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Inter-professional collaboration: The impact of serial versus merged treatment on the behavior of children with autism spectrum disorder

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Inter-Professional Collaboration: The Impact of Serial Versus Merged Treatment on the Behavior of Children with Autism Spectrum Disorder

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A thesis submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

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Table of Contents

List of figures.................................................................................................................... iv
Abstract ................................................................................................................................ v
Introduction .......................................................................................................................... 1
  Inter-Professional Education and Collaborative Practice
  Systematic Reviews of Research Evidence
  Collaborative Practice and Terminology
  Core Competencies of Collaborative Practice
  Autism Spectrum Disorder
  Treatments for ASD
Present Study ...................................................................................................................... 6
  Applied Behavior Analysis and Autism
  Speech Language Pathology and Autism
  Occupational Therapy and Autism
Purpose of Study
Methodology ..................................................................................................................... 9
  Participants
  Setting
  Activities
  Observers and Interobserver Reliability
  Procedures
    Baseline
    Serial Treatment
    Merged Treatment
Experimental Design
Independent Variables and Measurement for Clinician Behaviors
  Applied Behavior Analysis IVs
  Speech Language Pathology IVs
  Occupational Therapy IVs
Dependent Variables and Measurement for Child Outcomes
  Applied Behavior Analysis DVs
  Speech Language Pathology DVs
  Occupational Therapy DVs
Results .................................................................................................................................. 22
Discussion .......................................................................................................................... 28
Appendices ........................................................................................................................ 52
  Data Sheets
    General Clinician Behavior for Activities
    Visual Schedule and Prone Extension
References ......................................................................................................................... 61
List of Figures

Figure 1. Percentage of compliance across activities…………………………………….41
Figure 2. Percentage of compliance separated by activity…………………………………42
Figure 3. Frequency of pieces patterned correctly………………………………………43
Figure 4. Frequency of verbalizations across activities……………………………………44
Figure 5. Frequency of verbalizations separated by activity……………………………45
Figure 6. Percentage of intervals sitting correctly………………………………………46
Figure 7. Duration of prone extension……………………………………………………47
Figure 8. Duration of postural control……………………………………………………48
Figure 9. Average Duration of Escape…………………………………………………49
Figure 10. Mean Length of Utterance—Henry……………………………………………50
Figure 11. Mean Length of Utterance—James……………………………………………51
Abstract

Interdisciplinary collaboration is an innovative, resourceful approach to healthcare intended to positively affect patient outcomes. The purpose of the present study was to determine the efficacy of the serial exposure to three treatments, Applied Behavior Analysis, Speech Language Pathology, and Occupational Therapy, in comparison with an exposure to a merge of these treatments on child outcomes. During the serial treatment phases of intervention, three licensed professionals implemented core techniques from their respective disciplines. During merged treatment phases, a graduate clinician combined and implemented techniques from all three fields: differential attention, request sequences, sensory exposure, verbal/tactile cueing for postural alignment/control and motor planning, expansion of utterance, access for communication, and use of a visual schedule. Serial and merged treatment phases were implemented across participants within a multiple-baseline design. The child outcomes related to the core techniques include active listening, completion and sequence of activities, duration of postural control, postural alignment, and prone extension, motor planning abilities, frequency of verbalizations, and MLU. This research provides evidence to further support the claim that inter-professional collaboration is an effective approach to healthcare.
Introduction

Collaboration among professionals across different fields of healthcare is a complex and growing phenomenon. According to the World Health Organization’s 2010 report on inter-professional education and collaborative practice, these phenomena play an important role in addressing many of the challenges within health care systems. The WHO defines inter-professional education as occurring “when two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes,” and collaborative practice as occurring “when multiple health workers from different professional backgrounds provide comprehensive services by working with patients, their families, carers and communities to deliver the highest quality of care across settings” (2010, p. 13). The report also makes the claim that, based on adequate research evidence, inter-professional education is an important precursor to improved collaborative practice, and the combination of the two can lead to increased health outcomes (WHO, 2010).

The World Health Organization prepared a summary chart of systematic reviews of research evidence for collaborative practice, which highlighted the number of studies covered in each review, as well as their objectives and overall findings. The studies indicated that a collaborative approach to treatment resulted in shorter length of stay and reduced hospital charges (Zwarenstein, 2000; Simmonds, Coid, Joseph, Marriott, & Tyrer, 2001), a reduction in total costs associated with management of patients and incidence of total mechanical complications (Naylor, Griffiths, & Fernandez, 2004), and less dissatisfaction with care (Malone, Marriott, Newton-Howes, Simmonds, & Tyrer, 2007; Simmonds et al.). Similar findings discussed in a report by the Canadian Health
Services Research Foundation support these results and indicate that inter-professional models of care lead to improved patient outcomes and patient satisfaction, reduced health-care costs, as well as an increase in provider satisfaction through reduced workloads and staff shortages (2006). In a document summarizing the literature on inter-professional collaboration, the Health Professions Regulatory Advisory Council (HPRAC) noted that “Although there is a general sense that teamwork produces better patient outcomes, there are difficulties in demonstrating the relationship through research” (2008, p. 25). Despite the lack of compelling research evidence in relation to improved patient outcomes, the need for inter-professional collaboration and treatment is great, and complex health care systems should take advantage of the movement towards interdisciplinary collaboration by supporting this model through implementation across health fields (Bulletin of the World Health Organization, 2011).

Many terms synonymous with collaborative practice are referenced across research and reports concerning the merge of disciplines and collaboration between professionals from multiple fields, a few of these being interdisciplinary evidence-based practice, inter-professional teamwork, and interdisciplinary collaboration. The Association of University Centers on Disabilities defines interdisciplinary practice as

A team approach for providing services and supports to people with disabilities:

That supports shared decision-making by valuing and respecting the contributions of each individual, family, and professional discipline;

That demonstrates shared leadership, accountability, and responsibility for individualized planning of services and supports to improve the quality of life for everyone; and
That is comprehensive, holistic, and inclusive across communities and which generates synergistic problem-solving to meet the individual’s needs. (2007, p. 1)

The Inter-Professional Educational Collaborative report on core competencies of collaborative practice examines inter-professional education and practice, as well as inter-professional teamwork, which it defines as “The levels of cooperation, coordination, and collaboration characterizing the relationships between professions in delivering patient-centered care” (2011, p. 2). It discusses this teamwork as one of the four competency domains related to inter-professional collaborative practice: values/ethics for inter-professional practice, roles/responsibilities, inter-professional communication, and inter-professional teamwork (IPEC-Core Competencies, 2011). These domains, based on convergence between national and global literature regarding inter-professional collaboration, should be sought after and achieved by pre-licensure students according to the IPEC (2011). This report supports the notion that inter-professional education should precede collaborative practice, which helps ensure a greater foundation of knowledge of other professionals’ work prior to collaboration.

In addition to larger health organizations addressing the need for inter-professional collaboration, students at Virginia Commonwealth University created an organization known as the Inter Health Professionals Alliance (IHPA) in order to promote an interdisciplinary environment among students working to become health professionals. These students conducted a case study in which they identified four core benefits of the IHPA: the development of knowledge and skills, inter-professional networks, professional competence, and role clarity (VanderWielen, Do, Diallo, LaCoe,
Nguyen, Parikh, Rho, Enurah, Dumke, and Dow, 2014, p. 6). This organization is just one of many whose focus on inter-professional collaboration provides individuals with the tools they need to be successful clinicians and provide high-quality care to consumers of health care.

Inter-professional collaboration has the potential to be a beneficial treatment approach for addressing the needs of those suffering from one of the most prevalent disorders among children in the United States, autism spectrum disorder. According to the Centers for Disease Control and Prevention, this developmental disability has been diagnosed in about 1 in 68 children (2015), a rate that has increased by almost 30% since the 2012 press release estimating that 1 in 88 children were identified with the disorder. The inclusion of the new diagnosis and criteria of autism spectrum disorder in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) provides a more accurate method of diagnosing individuals suspected of having autism or a related disorder (American Psychiatric Association, 2013). Changes in the fifth edition include the development of an umbrella diagnosis, ASD, which encompasses autistic disorder, Asperger’s disorder, childhood disintegrative disorder, Rett’s disorder, and pervasive developmental disorder not otherwise specified, as outlined in the DSM-IV. The National Institute of Mental Health (NIMH) Neurodevelopmental Work Group believed that an umbrella term would better account for the range of symptoms and pathology, as well as provide a consistent method of diagnosing the disorder based on a certain set of criteria (2009).

The treatments available for those with ASD span a wide range of disciplines, but the Centers for Disease Control and Prevention provide a summary of these treatments,
including Applied Behavior Analysis, Occupational Therapy, and Speech Therapy within behavior and communication approaches to treatment (2015). These disciplines have at their core a client-centered approach to treatment, making inter-professional education and collaborative practice among the three a natural blend, as collaboration works best when “it is organized around the needs of the population being served” (WHO, 2010, p. 28). Additionally, the World Health Organization conducted an environmental scan to assess the global status of inter-professional education; the results of the scan recognized that professionals within the fields of Applied Behavior Analysis, Occupational Therapy, and Speech Language Pathology make up about 20% of individuals receiving inter-professional education within institutions that responded to the scan (2010). Respondents cited both educational benefits and health policy benefits stemming from the implementation of inter-professional education, including:

- Improved workplace practices and productivity
- Improved patient outcomes
- Raised staff morale
- Improved patient safety
- Better access to health-care (WHO, 2010, p. 17).

The merge of these three disciplines provides an example of inter-professional education and collaborative practice based on client-centered care with a focus on behavioral and communicative outcomes. The National Research Council reviewed ten models of ASD treatment that began as programs created to address empirically validated strategies and to incorporate these strategies into clinical models of treatment (2001). All of these models individualize programming based on the specific children’s needs, and
the majority are behaviorally oriented with elements of speech and occupational therapy. Some of the common goals across programs include a focus on increasing communication, engagement, social interaction, play skills, self-help, cognitive and academic skills, and motor skills (The National Research Council, 2001).

A breakdown of the disciplines is necessary in order to assess their contribution to the inter-professional model and the way they fit within it. Applied behavior analysis is the science of behavior that seeks to understand and improve socially significant behavior (Cooper, 2007). It emphasizes the application of behavioral principles to these socially significant behaviors, as well as the evaluation of the changes produced in relation to the environmental manipulations in place (Baer, Wolf & Risley, 1968). ABA has an immense and compelling research evidence base supporting its effectiveness in the treatment of behaviors related to autism spectrum disorder (Lovaas, 1987; McEachin, Smith, & Lovaas, 1993). The book Educating Children with Autism cites a review of approximately 19,000 published journal articles that revealed 500 papers on applied behavior analysis and ASD, 90 of which were single-case experiments conducted to evaluate the effectiveness of ABA interventions on the behavior of children with ASD (Lord & McGee, 2001; Palmieri, Valluripalli, Arnstein, & Romanczyk, 1998). The consistency and strength of arguments within the abundance of research evidence has led to autism mandates requiring certain insurers to provide coverage for ASD services across 39 states; 26 of these states plus the District of Columbia “require insurance carriers to sell ACA policies that cover autism treatments, including ABA” (Autism Health Insurance Project, 2014).
Speech language pathology addresses clients’ needs related to communication and swallowing disorders, and practitioners within the field work across many research, education, and health settings. Speech language pathologists “work to prevent, assess, diagnose, and treat speech, language, social communication, cognitive-communication, and swallowing disorders in children and adults” (American Speech-Language Hearing Association (ASHA), 2015). Regarding the SLP’s role in relation to autism, functional, spontaneous communication is often one of the main goals of treatment, as individuals with autism frequently have deficits in this area. Treatment modalities used in conjunction with speech therapy to increase communication may include augmentative and alternative communication, activity schedules/visual supports, facilitated communication, and computer/video-based instruction (ASHA, 2015). In addition to assessment and treatment of speech and language disorders, SLPs provide information and support to parents/caregivers and collaborate with other professionals as part of an interdisciplinary team of individuals working with individuals with ASD (ASHA, 2015).

Occupational therapy seeks to help individuals across the lifespan with everyday activities (occupations) that are important to them (American Occupational Therapy Association (AOTA), 2015). According to the Occupational Therapy Practice Framework: Domain and Process, OTs work on developing and increasing motor skills, play skills, process skills, activities of daily living, social participation, and activities related to work and education (2002). Occupational therapists play an integral role on teams of practitioners providing treatment to those with autism spectrum disorder, and despite the effectiveness of OT across the many challenging domains listed above, therapists in this discipline are often called upon for their expertise in sensory and motor
issues as well (Kuhaneck & Watling, 2015). A review of the literature discussing occupational therapy and ASD revealed 333 records in the occupational-therapy specific database, OT Search; 133 of these publications concerned sensory issues, while 50 related to motor concerns. (Kuhaneck & Watling, 2015). A report by the AOTA discussing the scope of OT services for individuals with autism cites that “occupational therapy ranks second to speech language pathology as the most frequently provided services for people with autism throughout the United States” (Tomcheck, LaVesser, & Watling, 2010). The report also recognizes that OT service delivery includes three components: evaluation, intervention, and assessment of outcomes; because this approach to treatment is similar to those of ABA and SLP, the merge of the three disciplines should provide a rational, coherent model of inter-professional collaboration.

Previous research conducted in an inter-professional setting demonstrated that graduate clinicians from three disciplines—ABA, SLP, and OT—can be taught to implement core procedures from said disciplines in a merged fashion while maintaining the fidelity of procedures from their respective disciplines. The current study takes the implications of the previous research a step further and continues that line of inquiry with a more systematic analysis of the effects of a merged approach.

The purpose of the present study was to determine the impact of providing serial treatments of ABA, SLP, and OT in comparison to merging the three disciplines on child outcomes. It used the model of inter-professional collaborative practice to deliver core techniques from three disciplines in a merged fashion as a preferred approach to providing separate, individual treatment in each of the disciplines. Because each discipline has its own relationship with autism and approach to treatment of this disorder,
the merge of core techniques from the disciplines for the purpose of addressing the needs of individuals with ASD appears to be a logical product. This interdisciplinary approach provides clinicians with the opportunity to communicate with and learn from other professionals in a manner consistent with best practice that allows for effective collaboration.

**Method**

**Participants**

Two male children participated in this study, aged 5 years and 7 years respectively, both of whom have been diagnosed with Autism Spectrum Disorder. The participants were recruited from the Inter-professional Autism Clinic on the campus of James Madison University. Selection for participation in the study was based on current enrollment in the IPAC program with considerations given to availability and scheduling considerations. IRB-approved informed consent was obtained from each participant and their parents.

**Setting**

This study was conducted in the Inter-professional Autism Clinic (IPAC) at James Madison University. Observers coded the child’s behavior during a structured work time involving a pattern activity and during a sensory motor time involving an obstacle course in two of the building’s therapy rooms. The dimensions of the speech room where the pattern activity was held are 11’5” L x 6’4” W, and it contained a table, chairs, and a file cabinet available for clinic use. The dimensions of the open clinic area where the obstacle course was held are 24’2” L x 13’9” W, and it contained items used for the obstacle course, a tent, table and chairs, and bikes, along with miscellaneous items used as part of
the occupational therapy clinic (OTCES) housed within the same building as IPAC. A second-year graduate clinician in the Applied Behavior Analysis concentration of JMU’s Psychological Sciences M.A. program conducted sessions with both participants during the baseline and merged treatment phases. Three licensed professionals, a behavior analyst, speech language pathologist, and occupational therapist, delivered treatment to the participants during the serial phases of treatment. Each clinician worked with both participants across repeated sessions in order to allow for a comparative assessment of skills across children.

**Activities**

Two activities were used exclusively for the purpose of research: a pattern activity and obstacle course. The pattern activity, Discovery Toys Playful Patterns Heirloom Edition, is an early-childhood pre-math and pre-reading tool consisting of 132 wooden geometric shapes and 20 two-sided cards with 34 progressively challenging designs. The children were instructed to match the shapes and complete the pattern. The therapist behavior changed across sessions, but the general instructions remained the same. The obstacle course was made up of four main items: a balance beam, 8’1” L x 10” W x 9” H, a large UCS Rainbow Barrel, 3’6” W x 2’9” H with a circumference of 103.67 inches, a Bosu ball 2’1/2” W x 8” H, and an extended tunnel, 15’9” L x 2’1” W with a circumference of 65.97 inches. The children were instructed to use each of the items as intended. Again, the therapist behavior changed across sessions, but the general instructions provided were consistent.
Data Collection

Three undergraduate clinicians involved in the IPAC program coded observations. Two were the primary observers for the study, and the third was used for assessing interobserver reliability. Observers were trained by the graduate clinician running baseline and merged treatment sessions. Each observer was given a list of the independent and dependent variables and was trained on the topography of the variables in the two activities. They were also trained on the types of data collection used in this study and were given opportunities to practice taking live data prior to the start of the study. For verbalization data training, observers were given a list of dos and don’ts for coding frequency of verbalizations. They practiced coding verbalizations from videos of the sessions. Interobserver reliability was calculated during practice sessions for both live data and data collected from video recordings, and this reliability ranged from 84-100% across all of the variables. Data taken during practice sessions were not included in the study. Observers were consulted following each weekly research session for questions or concerns regarding data collection. Observers coded data during all live sessions and video recordings. One of the primary observers listened via ear buds to voice-recording stating 15-second intervals for the pattern activity during each session using an iPhone 6. A headphone splitter was used for taking interobserver reliability data during some of the sessions. This primary observer also took duration data during the obstacle course activity on prone extension, postural control, and escape and completed checklists for correct sequence of obstacle course items. The second primary observer took frequency and opportunity data during both activities, took duration data on escape during the obstacle course activity, used permanent product recording for the pattern activity based
on correct completion of pieces and patterns, and completed treatment fidelity checklists following each session. Observers also coded the number of verbalizations per activity for each session by watching videotapes of the sessions.

**Interobserver Reliability**

Interobserver agreement was calculated for at least 38% of every variable in each phase of the study: baseline, ABA, SLP, OT, and merge. Reliability data was taken more often for some variables than others. IOA was taken from both live sessions and video recordings and was distributed randomly across baseline and merged treatment sessions, as well as the ABA phase for Henry, as he received two sessions of ABA. A variation of total count IOA was calculated for agreements on compliance with commands and responses to questions out of the total number of opportunities. Because the total number of opportunities varied between the primary and secondary observer, IOA was calculated as the smaller percent of compliance by opportunity divided by the larger multiplied by 100. This IOA ranged from 77-99% with an overall average of 89%. Total count IOA was calculated for percent of pieces patterned correctly and verbalizations as the smaller frequency divided by the larger multiplied by 100. Pieces patterned IOA was 100% for each reliability session across all phases for both participants. Verbalization IOA ranged from 50-95% with an average of 81%. Interval-by-interval IOA was calculated for correct sitting as the number of agreements divided by the total number of intervals multiplied by 100. This IOA ranged from 95-100% with an overall average of 99%. IOA was calculated for the obstacle course and treatment fidelity checklists as the number of agreements divided by the number of agreements plus disagreements multiplied by 100. This IOA was 100% for each reliability session across all phases for both participants. A
variation of total duration IOA was calculated for prone extension and postural control as the smaller duration divided by the larger multiplied by 100. Only the highest duration out of all the opportunities scored by each of the data collectors was used, as this was the graphed duration. Prone extension IOA ranged from 79-100% with an average of 96%. Postural control IOA ranged from 0-100% with an average of 86%. Average duration IOA was calculated for escape data as the smaller average duration divided by the larger multiplied by 100. This IOA ranged from 0-100% with an overall average of 74%. Reliability observers collected data independently of the primary observer during live sessions and video recordings.

**Procedures**

**Baseline.** Baseline sessions were conducted by a second-year graduate clinician involved as an ABA therapist in the Interprofessional Autism Clinic. She did not implement any of the core techniques from the three disciplines but instead provided reinforcement noncontingently and gave simple commands with minimal prompting and no follow-through or reinforcement for compliance with the commands. Although the clinician had been trained in the independent variable procedures to be used during the merged sessions, she was instructed not to perform them during baseline sessions. The first participant received four sessions in baseline, and the second participant received six sessions in baseline.

**Serial Treatment.** A behavior analyst, speech language pathologist, and occupational therapist supervising the regular workings of the clinic conducted serial treatment sessions as part of this research study. Clinicians were instructed not only to adhere to procedures related to their respective disciplines but also to run the activities as
they normally would. Following a stable baseline, the first participant received two sessions of ABA treatment from the behavior analyst who implemented core techniques from ABA: differential attention and request sequences. Following these two treatment sessions, the first participant received one session of SLP treatment from the speech language pathologist who implemented core techniques from this field: expansion of utterance, access for communication, and use of a visual schedule. The final treatment in the serial phase of the study consisted of one session of OT treatment from the occupational therapist who implemented core techniques from OT: sensory exposure, verbal and tactile cueing for postural alignment/control, and use of a visual schedule/verbal and tactile cueing for motor planning. The second participant remained in baseline during the first participant’s exposure to the serial treatment sessions and began serial treatment on the same day as the first participant’s second merged session. The second participant received one session for each of the three disciplines during the serial treatment phases in the same order as the first participant. Decisions regarding the order of the phases were based on clinician availability.

**Merged Treatment.** Merged treatment sessions were conducted by the same graduate clinician who conducted the baseline sessions. Prior to the initial merged treatment session, the clinician collaborated with each of the licensed professionals and learned the core techniques from each discipline: differential attention, request sequences, sensory exposure, use of a visual schedule, verbal and/or tactile cueing for postural alignment/control and motor planning, expansion of utterance, and access for communication. She also watched the clinicians run their respective research phases. The graduate clinician implemented the SLP and OT procedures she learned during training
and continued to implement the ABA procedures she had been previously trained to perform. The three licensed professionals watched the merged sessions live and provided feedback to the graduate clinician based on her performance following the first merged session for each participant. The first participant received six sessions in the merged treatment phase, and the second participant received two.

**Experimental Design**

A concurrent multiple baseline across participants design was used in this study. ABA, SLP, and OT procedures were implemented serially across two participants. The procedures were then merged across the same participants, and a comparison was made between baseline and the serial and merged treatment conditions.

**Independent Variables and Measurement for Clinicians**

This study was one in a series of studies related to inter-professional collaboration between clinicians practicing within the fields of ABA, SLP, and OT. Therefore, the independent variables used were either based on or directly related to the dependent variables in previous studies. These dependent variables were skills taught to and used by graduate clinicians within treatment sessions. Techniques from each field were chosen based on research literature as well as the expertise of three licensed professionals: a behavior analyst, a speech language pathologist, and an occupational therapist.

As indicated in the “Procedures” subsection above, the licensed professionals conducted serial treatment sessions and implemented procedures from their respective fields. For Applied Behavior Analysis and Speech Language Pathology, the procedures remained the same as the dependent variables used in previous studies. For ABA, these procedures included request sequences and differential attention, and for SLP, they
included expansion of utterance and access for verbalization. Use of a visual schedule was also added as an independent variable in this study. For Occupational Therapy, the procedures were slightly altered from those used in previous studies based on collaboration with the licensed occupational therapist involved in the study. The new procedures for this field included sensory exposure, use of a visual schedule/verbal and/or tactile cueing for motor planning, and verbal and/or tactile cueing for postural alignment and postural control.

**ABA IV 1: Request Sequences.** A clinician gives a direct command or asks a question, pauses, repeats the command or question if the child does not comply, pauses again, and provides either physical or verbal follow-through in the case of noncompliance or labeled praise and positive touch in the case of compliance. In her Parent-Child Interaction Therapy coding system, Eyberg defined direct commands as “Declarative statements that contain an order or direction for a vocal or motor behavior to be performed and indicate that the child is to perform this behavior” (Eyberg, 2009, p. 33) and questions as “Verbal inquiries from one person to another that are distinguishable from declarative statements by having a rising inflection at the end and/or by having the sentence structure of a question” (Eyberg, 2009, p. 59). The pause between commands or questions is five seconds, and no prompting or reinforcement should occur during those five seconds. The follow-through for noncompliance should also occur without reinforcement.

**ABA IV 2: Differential Attention.** The clinician delivers reinforcement, labeled praise or positive touch (Eyberg, 2010), when the child engages or attempts to engage in active listening or another positive, appropriate behavior that the clinician wants to
differentially reinforce. Differential attention is a form of differential reinforcement, which entails “reinforcing one response class and withholding reinforcement for another response class” (Cooper, 2007, p. 470). It is the least intrusive behavior intervention, as it does not involve time-out, response cost, or presentation of aversive stimuli (Cowdery, Iwata, and Pace, 1990).

**SLP IV 1: Expansion of Utterance.** Expansion of utterance is defined as the act of verbally echoing what the child says while adding words to give additional meaning to the utterance (Scherer & Olswang, 1989).

**SLP IV 2: Access for Verbalization.** The clinician presents a reinforcer, either a verbal praise or the item being withheld, so that the student has tactile or auditory access to it in the presence of a communication response (verbally or receptively). The clinician also provides a reinforcer based on the participants’ preferences contingent upon their completion of the activity without aggression. For Henry, this reinforcer was one of two apps played on an iPhone 5, Cut the Rope or Angry Birds, depending on what he requested at the beginning of the session(s) and during the session(s). For James, this reinforcer was either pictures of planes at night displayed on an iPhone 5 or access to the camera used to record the research sessions.

**SLP IV 3: Use of a Visual Schedule.** The clinician provides a visual schedule during the obstacle course for increased in-context verbalizations.

**OT IV 1 for Pattern Activity: Sensory Exposure.** The clinician provides a therapy ball (Body Sport Studio Series) for the child to sit on at the table for vestibular input (Schilling & Schwartz, 2004). Dimensions of the therapy ball are 16.9” W x 16.9” H.
OT IV 2 for Pattern Activity: Verbal/Tactile Cueing for Postural Alignment.
The clinician provides verbal and/or tactile cues (prompts) in order for the child’s body to be properly aligned while sitting on the ball. For example, a verbal cue might be “put your feet on the floor,” or “sit up.” A tactile cue consists of the clinician touching the child and physically bringing their body back into a position of alignment. The Occupational Therapy Practice Framework defines postural alignment as maintenance of an “upright sitting or standing position, without evidence of a need to persistently prop during the task performance” (2002, p. 621).

OT IV 1 for Obstacle Course: Verbal/Tactile Cueing for Motor Planning.
The clinician provides a visual schedule and verbal and/or tactile cues for correct use of the items in the obstacle course and completion of the correct sequence. A verbal cue may be an instruction to the child to complete the sequence in the correct order, while a tactile cue may involve the clinician physically moving the child through the correct sequence. A minimum amount of this type of prompting must occur across all sessions in order to provide the child with general instructions for the activity.

OT IV 2 for Obstacle Course: Verbal/Tactile Cueing for Prone Extension and Postural Control.
The clinician provides a picture of a child performing prone extension and verbal and/or tactile cues in order for the child to maintain prone extension and postural control. For example, a verbal cue might be “stand up straight” or “hold your arms up in front of you.” A tactile cue occurs when the clinician touches the child and physically aligns or holds their body in the correct position on the barrel or Bosu ball. The Occupational Therapy Practice Framework defines postural stability as the maintenance of “trunk control and balance while interacting with task objects such that
there is no evidence of transient (i.e., quickly passing) propping or loss of balance that affects task performance” (2002, p. 621). A minimum amount of this type of prompting must occur across all sessions in order to provide the child with general instructions for the activity.

**Dependent Variables and Measurement for Child Outcomes**

Some of the children’s behaviors were scored as response per opportunity measures based on the clinicians’ behaviors. For example, a clinician using an ABA request sequence would have to give a command or ask a question in order for a child to be able to comply with the command or respond to the question. Other behaviors were observed by their frequency or duration.

**ABA DV 1: Active Listening.** This is defined by the percentage of answers to questions and compliance to commands. Occurrence or non-occurrence of these behaviors was scored based on opportunity. An attempt to comply with a command or to answer a question occurring within five seconds of the command/question was recorded based on whether it was a correct (C) or incorrect (I) attempt. If the child did not comply/answer within five seconds or if the clinician provided a verbal/physical prompt, (N) was recorded for noncompliance. If the clinician gave any combination of commands or questions without waiting five seconds between each command/question, (NO) was recorded for no opportunity to comply.

**ABA DV 2: Frequency of Pattern Pieces Correctly Completed.** The total number of pieces patterned correctly was recorded after each five-minute session. Patterns were set aside as the child completed them.
ABA DV 3: Average Duration of Escape. Escape was counted when the participant engaged in behaviors that were incompatible with and/or prohibited the activities of the research sessions (i.e. aggression (hitting, kicking, pinching, clawing, grabbing) throwing research materials, getting out of the chair/off the ball, standing up in the chair, falling to the floor, looking out the window, running away from the therapist/table/obstacle course items). These behaviors may have occurred alone or in any combination with one another. Recording the duration of the escape occurrence stopped after three seconds passed without the participant engaging in any of the above behaviors. If the participant engaged in any of the above behaviors after three seconds, recording a new occurrence of escape began. This data was only collected for Henry, as James’s escape behaviors did not impede the research sessions beyond an extent viewed as typical by the researchers.

SLP DV 1: Frequency of Verbalizations. This is defined as the total number of words spoken by the child per activity. Observers coded the number of verbalizations per activity for each session by watching videotapes of the sessions taken using a Cisco flip video camera for the first ten data points and a Sony Digital HD Video Camera Recorder for the remaining four. Verbalizations that occurred either in context, directed towards the therapist or other individual, or in response to the therapist were coded, including mands, tacts, intraverbals, and echoics. Verbalizations that occurred when the child was engaging in repetitive statements, statements out of context, or delayed echolalia were not coded.

SLP DV 2: Mean Length of Utterance. This is defined as the average number of morphemes a child uses in a phrase or utterance. MLU is more useful when measured in
terms of morphemes rather than average number of words (Brown, 1973). It is also necessary to examine MLU versus only one utterance due to variations in utterances (Williamson, 2014). MLU was probed by two SLP graduate clinicians working in the Inter-Professional Autism Clinic by watching videos from the first two baseline sessions and the last merged session for each participant. They also calculated the upper morpheme boundary for each participant in the same sessions.

**OT DV 1: Sitting Correctly on Chair or Ball.** This is defined as occurring when the child is sitting symmetrically with feet flat on the floor or supported on box and hip width apart with hips, knees, and ankles bent to approximately 90° (East Kent Hospitals University, 2010; Green & Nelham, 1991). A 15-second whole-interval recording system was used; an occurrence of correct sitting was counted if the child maintained the correct position throughout the 15-second interval.

**OT DV 2: Duration of Prone Extension.** This is defined as the ability to simultaneously lift the head, arms, upper trunk, and extended legs up against gravity when lying on stomach; observed as duration of prone extension on rocking barrel (Blanche, 2002). Duration began after the therapist gave the command to “lift your arms, head, and legs for as long as you can,” and the child complied with correct form; it ended when the child dropped his head, arms, and/or feet. If the child did not respond within 10 seconds of command or responds incorrectly, the duration was counted as zero. Mastery criteria for Henry was 10 seconds, and mastery criteria for James was 15 based on a review of previous literature and consultation with the clinic’s licensed occupational therapist (Gregory-Flock & Yerxa, 1984).
OT DV 3: Duration of Postural Control. The ability to regulate the body’s position in space for the dual purposes of stability and orientation (Blanche, 2002); observed as duration of independent balancing on Bosu ball. Duration began after the therapist gave the command to “stand still by yourself for as long as you can” and released the child’s hands and the child complied correctly; it ended when the child grabbed the therapist for support or stepped off of the Bosu ball. Mastery criteria for both participants was 25 seconds (Atwater, Crowe, Deitz, & Richardson, 1990). An increased requirement to throw a ball back and forth to the therapist was added for James beginning in the second merge session.

Results

The results of all three participants are represented in Figures 1 through 11. Figure 1 shows the percentage of compliance across activities. Henry’s overall compliance indicates a decreasing trend in baseline from the second data point at 72% to the fourth data point at 35%, which increased in the first ABA treatment session to 42% and further increased to 86% during the second implementation of the ABA treatment. Compliance increased to 90% during the SLP phase and decreased to 63% during the OT phase. Following implementation of the merge, total compliance increased to 79% and remained in the range of 61-76%. Henry increased his average compliance from 50% in baseline to 70% in the merge. James’s overall compliance indicates a decreasing trend in baseline from the first data point at 83% to the last in baseline at 42%. Compliance increased to 65% in the ABA phase, remained at this percentage in the SLP phase, and increased to 75% in the OT phase. Following implementation of the merge, total compliance
increased to 91% and 85% in the two respective merged sessions. James increased his average compliance from 56% in baseline to 88% in the merge.

Figure 2 shows the percentage of compliance separated by activities. Henry’s compliance in both the pattern and obstacle course indicate similar decreasing trends from points two to four in baseline. Compliance in the pattern activity increased from the last data point in baseline at 17% to the first data point in the ABA phase at 42% and further increased to 90% during the second session of ABA. It remained at 90% in the SLP phase but decreased to 50% in the OT phase. Following implementation of the merge, compliance increased to 76% and remained in the range of 65-96%. Henry increased his average pattern activity compliance from 33% in baseline to 78% in the merge. Compliance in the obstacle course increased from the last data point in baseline at 41% to the first data point in the ABA phase at 42% and further increased to 83% during the second session of ABA. It increased to 89% in the SLP phase but decreased to 71% in the OT phase. Following implementation of the merge, compliance increased to 80% and remained in the range of 39-80%. Henry decreased his average obstacle course compliance from 72% in baseline to 61% in the merge. James’s compliance in both the pattern and obstacle course indicate similar decreasing trends from the first data point at 91% (pattern) and 75% (obstacle course) to the last in baseline at 33% (pattern) and 46% (obstacle course). Pattern activity compliance increased to 64% during the ABA phase, decreased to 52% during the SLP phase, and increased to 84% during the OT phase. Obstacle course compliance increased to 65% during the ABA phase, remained at this percentage in the SLP phase, and increased to 75% during the OT phase. James increased his average pattern activity compliance from 63% in baseline to 95% in the merge. He
increased his average obstacle course compliance from 51% in baseline to 79% in the merge.

Figure 3 shows the frequency of pattern pieces independently and correctly placed. Henry’s frequency of pieces patterned decreased from 10 to 1 from sessions two to four in baseline. This number increased to 5 during the first ABA session and to 14 during the second. The frequency decreased to 13 during the SLP phase and increased back to 14 during the OT phase. Henry increased his average number of pieces placed from 5 in baseline to 12 in the merge. James’s pieces patterned data ranged from 15-18 pieces patterned for all data points in baseline except one in which he patterned 24 pieces. He increased his pieces patterned from the last point in baseline at 16 to the first point in the ABA phase at 19. James’s pieces patterned decreased to 11 during the SLP phase and increased to 14 during the OT phase. This number increased to 17 following implementation of the merge. James decreased his average number of pieces placed from 18 in baseline to 17 in the merge.

Figure 4 shows the frequency of verbalizations across activities. Henry’s total verbalizations graph displays a decreasing trend from 20 to 3 in baseline but an increase in frequency to 21 during the first ABA session. This number increased to 55 during the SLP phase and 64 during the OT phase. Henry increased his verbalizations from an average of 13 in baseline to 90 in the merge. James’s total verbalizations indicate a decreasing trend from the second baseline data point at 189 to the last data point in baseline at 76. This number increased to 108 during the ABA phase, 156 during the SLP phase, and 173 during the OT phase. James increased his verbalizations from an average of 119 in baseline to 216 in the merge.
Figure 5 shows the frequency of verbalizations separated by activity. Henry’s verbalizations decreased from 13 to 1 in the pattern activity and 7 to 2 in the obstacle course during baseline. Pattern activity verbalizations increased to 9 and 12 during the two ABA sessions, further increased to 44 in the SLP phase, and decreased to 25 in the OT phase. Following implementation of the merge, verbalizations increased to 32, and the frequency ranged from 42-89 for the remaining sessions. Henry increased his average verbalizations in the pattern activity from 8 to 63. Obstacle course verbalizations increased to 12 and decreased to 6 during the two ABA sessions, increased to 11 during the SLP phase, and further increased to 39 during the OT phase. Following implementation of the merge, verbalizations decreased to 30, and the frequency ranged from 9-50 for the remaining sessions. Henry increased his average verbalizations in the obstacle course from 4 to 26. James’s verbalizations began at 44 for both activities in baseline, increased to 112 during the pattern activity and 77 during the obstacle course, and decreased to 36 (pattern) and 40 (obstacle course) during the last data points in baseline. Pattern activity verbalizations decreased to 32 during the ABA phase, increased to 102 during the SLP phase, and decreased to 42 during the OT phase. James increased his average verbalizations in the pattern activity from 57 in baseline to 106 in the merge. Obstacle course verbalizations increased to 76 during the ABA phase, decreased to 54 during the SLP phase, and increased to 131 in the OT phase. James increased his average verbalizations in the obstacle course from 61 in baseline to 111 in the merge.

Figure 6 shows the percentage of intervals in which the participants sat on either a chair or ball correctly. Both participants’ sitting remained at zero throughout baseline, ABA, and SLP phases. Henry’s correct sitting increased to 35% of intervals during the
OT phase, and James’s correct sitting increased to 55% of intervals during the OT phase. Following implementation of the merge, Henry’s correct sitting decreased to 5%, but this data path indicates an increasing trend throughout the remaining phases of the merge. Henry increased the average percent of intervals sitting correctly from 0% in baseline to 37% in the merge, while James increased the average percent of intervals sitting correctly from 0% in baseline to 75% in the merge.

Figure 7 shows the duration of prone extension for each participant during the obstacle course. Both participants’ prone extension duration remained at zero throughout baseline, ABA, and SLP phases. Henry’s prone extension increased to two seconds during the OT phase, and James’s prone extension increased to three seconds during the OT phase. Following implementation of the merge, Henry’s prone extension decreased to zero, increased to two seconds during the fifth session, and decreased to zero again during the sixth session. James’s prone extension increased from 3 seconds in the OT phase to 6 seconds in both merged sessions.

Figure 8 shows the duration of postural control for each participant during the obstacle course. Henry’s postural control duration ranged from 0 to 6 during baseline, and increased to 4 and 8 during the ABA phase of treatment. This duration decreased to 2 seconds during the SLP phase and to 1 second during the OT phase. Following implementation of the merge, Henry’s postural control increased to 4 seconds and ranged from 0-9 during the remaining sessions of the merge. He increased his average duration from 3 seconds in baseline to 3.16 seconds in the merge. James’s postural control duration began at 24 seconds in the first baseline session, decreased to 0 during the fifth baseline session, and increased to 25 seconds during the last session in baseline. This
number decreased to 5 during the ABA phase, further decreased to 0 during the SLP phase, and increased to 12 during the OT phase. Following implementation of the merge, James’s postural control increased to 38 seconds during the first session and 41 seconds during the second. He increased his average duration from 11 seconds in baseline to 40 seconds in the merge.

Figure 9 shows the average duration of escape for Henry. Escape increased in the pattern activity from 0 to 148 seconds in baseline and decreased to 5 and 8 seconds in the two respective ABA sessions. It decreased to 4 seconds in the SLP phase and 0 in the OT phase but increased to 55 seconds following implementation of the merge. Escape during this activity decreased from an average of 73 seconds in baseline to 15 seconds in the merge. Escape ranged from 21 to 48 seconds during the obstacle course in baseline and decreased to 0 and 1 second during the two respective ABA sessions. It increased to 38 seconds in the SLP phase and decreased back to 0 seconds in the OT phase and then increased to 4 seconds following implementation of the merge. Escape during this activity decreased from an average of 32 seconds in baseline to 6 seconds in the merge.

Figure 10 displays the mean length of utterance for Henry probed from videos recorded at the beginning and end of the study. Henry increased his mean length of utterance from 1.9 morphemes per utterance to 2.36 morphemes per utterance. His upper morpheme boundary was calculated as 7 in baseline, but he only reached 5 morpheme utterances during the last merge session.

Figure 11 displays the mean length of utterance for James probed from videos recorded at the beginning and end of the study. James decreased his mean length of utterance from 4.14 morphemes per utterance to 2.86 morphemes per utterance. His
upper morpheme boundary was calculated as 11 in baseline, but he only reached 8 morpheme utterances during the last merge session.

Discussion

The current study sought to provide evidence to support the proposal that interprofessional collaboration is an effective approach to healthcare. This research concludes that variables related to specific disciplines—ABA, SLP, and OT—can be manipulated when the procedures of each discipline are implemented in isolation. The data also support the idea that a merged approach can result in a beneficial change across variables relevant to each discipline implemented as part of the merge, especially in comparison to baseline. Although some of the data from this study indicate superior levels of behavior in the serial phases of treatment, when all of the clinician procedures were combined in the merged phase, the majority of the behaviors in question experienced a beneficial change, unlike in the serial phases where a more limited number of variables experienced a similar change.

The data in figure 1 provide evidence to support the hypothesis that a merge of treatments is an effective approach. Although compliance is at a higher level for Henry in the second ABA session and the SLP phase than it is in the merge, there was an increase following implementation of the merge in comparison to the final serial treatment session, OT, as well as an overall increase of 20% between baseline and the merged phases. James’s merge data display the two highest compliance data points, 91% and 85%, and his data indicate an overall increase of 31% between baseline and the merged phases. Data from figure 2 indicate similar results but provide a picture of compliance in each separate activity. There was an increase in compliance following the implementation
of ABA across both participants, which was expected since compliance/responding (active listening) was one of the dependent variables related to ABA, but the continuation in the SLP and OT phases may indicate a sequence effect. There was also an increase in compliance across both activities for Henry following implementation of the merge, as well as a 45% increase in the pattern activity from baseline to merge. Following implementation of the merge, there was an increase in pattern activity compliance for James and only a slight 3% decrease in his obstacle course compliance. There was an overall increase in compliance during both activities, 32% in the pattern and 28% in the obstacle course, between baseline and merge.

The data from figure 3 provide similar findings, as the frequency of pieces patterned increased for both Henry and James following the implementation of ABA. However, the general maintenance of the frequency of pieces patterned across the SLP and OT phases may indicate a sequence effect. There was also an increase in Henry’s average number of pieces patterned from 5 in baseline to 12 in the merge. James experienced a slight decrease in the average number of pieces patterned from 18 in baseline to 17 in the merge, but this may be explained by the increase in pattern activity difficulty and the number of additional variables manipulated during the merge. Because the patterns used in the pattern activity increased in difficulty across sessions, a flat or even decreasing trend was predicted at the outset of the study. Looking at the data, this was the case for certain data points, as there were decreases in pieces patterned during a few of the later phases. These decreases are likely due to a combination of the change in clinician behaviors/phases and the difficulty of the patterns. Additionally, the increase in pieces patterned following implementation of the serial phases of treatment for both
participants suggests that the contingencies in the phases had an effect on the participants’ behavior.

Verbalization data across activities in figure 4 provides evidence supporting the claim that merged treatment is an effective approach, particularly in comparison to serial treatment. There is an effect on verbalizations following implementation of the SLP phase for each of the participants, which maintains in the OT phase, indicating a possible sequence effect. Henry’s verbalization data path shows an increasing trend in the merge, and his highest verbalization data point (143) occurs in this phase. He increased his verbalizations from an average of 13 in baseline to 90 in the merge. James’s verbalization data path indicates increased levels of verbalizations in the merge, with his highest verbalization data point (234) occurring in this phase. He increased his verbalizations from an average of 119 in baseline to 216 in the merge.

The data in figure 5, verbalizations separated by activity, indicate a beneficial change in verbalizations, particularly in the pattern activity, following the implementation of the SLP phase. There is not, however, a beneficial change in verbalizations during this phase for the obstacle course; the OT phase indicates a greater change in obstacle course verbalizations across both participants. This is discussed further as a limitation in the subsequent section. Although obstacle course verbalizations decrease slightly from the OT phase to the merge phase for both participants, pattern activity verbalizations increase to SLP phase levels for James and indicate an increasing trend to higher levels than that of the SLP phase in four out of the six merge data points for Henry.

Data from figure 6, percent of intervals sitting correctly, are stable across all of the baseline, ABA, and SLP sessions but change in relation to the relevant phase,
occupational therapy. During the OT phase, Henry’s data increased from 0% to 35%, and James’s data increased from 0% to 55%. Although Henry’s data decreased in the first merged session, the data path indicates an increasing trend from 5-70% across the merged sessions. Support for the merge can be found in the comparison between merge and baseline, ABA, and SLP phases for Henry and between merge and every other phase for James. Henry increased his average percent of intervals sitting from 0% in baseline to 37% in the merge. James increased his average percent of intervals sitting by 20% between the OT and merged phases and by 75% between the baseline and merged phases.

Figure 7 shows the duration of prone extension for each participant during the obstacle course. Both participants’ prone extension duration remained at zero throughout baseline, ABA, and SLP phases but changed in relation to the relevant phase, occupational therapy. During this phase, Henry’s prone extension increased to two seconds, and James’s prone extension increased to three seconds. Following implementation of the merge, Henry’s prone extension decreased to zero. This may be attributed to the lack of training on the part of the clinician implementing the merge, the number of variables the clinician had to focus on changing during the merge, or the requirement that participants do this behavior without prompting; this limitation is discussed further in the subsequent section. During the fifth merged session, however, Henry’s prone extension increased to OT levels (two seconds). Additional support for the merged approach can be taken from James’s data, in which his prone extension increased from three seconds in the OT phase to six seconds in both merged sessions, indicating a positive outcome following implementation of the merge.
Figure 8 shows the duration of postural control for each participant during the obstacle course. This data is variable for both participants across all phases of the study. Henry’s postural control data path shows an increasing trend in baseline; this behavior was intervened on because of time constraints and the decrease in the fourth baseline data point. Henry’s highest postural control duration in baseline was 6 seconds, which increased to 8 seconds in the second ABA session; this may be attributed to the physical follow-through for compliance as part of the ABA request sequence procedure. This variable decreased to 2 seconds during the SLP phase and to 1 second during the OT phase, which was unexpected, as the behavior is most relevant to occupational therapy. There was, however, no physical follow through during this phase; the OT simply moved on to the next item in the obstacle course if the participant stepped off the Bosu ball. Following implementation of the merge, there was an increase in Henry’s postural control in comparison to the SLP and OT phases. Henry’s highest data point (9 seconds) occurred during the merge, and he increased his average duration from 3 seconds in baseline to 3.16 seconds in the merge. James’s postural control duration began at 24 seconds in the first baseline session, but because he did not reach mastery criteria (25 seconds), the difficulty of the task was not increased. His behavior decreased to 0 during the fifth baseline session and increased to 25 seconds during the last session in baseline, but the difficulty could not be changed because of the change in the phase of research. James’s postural control decreased during the ABA and SLP phases but increased to 12 seconds during the OT phase. His highest data points occurred during the two merge sessions (38 and 41 seconds respectively), even with the increased difficulty of the second merged session.
Escape data was not originally included as a dependent variable, but due to Henry’s increasing escape behavior during the research sessions, the researchers made a decision after the third session to rewatch the videos of previous sessions and collect escape data during future sessions. Escape was originally collected and graphed as frequency data, but after discussion among the researchers, the method of data collection for escape was changed to duration. This change arose from the discovery that frequency data was not providing a true picture of the behavior. Henry only escaped twice during the pattern activity in the fourth baseline session, but his average escape duration was much higher (148 seconds) in this session when compared to that of the first ABA session (5 seconds). The frequency of escape in the first ABA session, however, was eleven, so the graph depicted an increase in frequency of escape despite the fact that the time spent escaping from the activity was much lower in this phase. Therefore, the researchers concluded that the relevant dimension of the behavior was duration rather than frequency. Henry’s escape in the pattern activity increased from 0 to 148 seconds in baseline and decreased in both activities following implementation of the ABA phase, which was expected because of the therapist’s procedures and style of interaction. Escape decreased even further in the SLP and OT phases but saw an increase to baseline level in the first merge session. The topography of escape changed between sessions in baseline and the merge. In baseline, Henry escaped by getting out of his chair, running away, and/or singing songs, but in the merge, he escaped through aggression. Although the level of escape in the merge is higher than that of the serial treatment sessions, it decreased from an average of 73 seconds in baseline to 15 seconds in the merge for the pattern
activity and from 32 seconds in baseline to 6 seconds in the merge for the obstacle course.

Data in figures 10 and 11, MLU for Henry and James, display interesting results, especially in relation to verbalization frequency data. MLU decreased across the course of the study for James, a finding that contradicts his verbalization frequency data. Although MLU increased for Henry, this was only a slight increase between the data taken from the first two videos and the data taken from the last video. These results may be due to the fast pace of the sessions and the quick responding of the participants. Because the setting was contrived and the clinician asked a high number of questions that were appropriately answered in one-word utterances, MLU probed during the merge session for both participants did not accurately reflect the true MLU of the participants at the end of the study. When questions were not asked as frequently, as in the baseline sessions, James had more opportunities to comment upon the activity and other interests rather than answer simple questions. Additionally, MLU was probed across multiple baseline sessions but was calculated only from the last merged session for both participants, as there were not enough utterances to calculate MLU from just one baseline session.

Several limitations arose throughout the course of the study that should be taken into consideration for subsequent research, the most significant of which is the definition of a true merge. Future studies may adjust this definition in relation to both the clinician procedures and the individual(s) implementing these procedures. In this study, a graduate clinician trained in Applied Behavior Analysis conducted the merged sessions, but other possibilities exist with regards to what constitutes a true merge. From a practical
standpoint, having individuals from each discipline implement the merged procedures rather than just one individual from one discipline may address issues related to the physical demand of the procedures. This type of merge would also ensure a more strict procedural fidelity, as clinicians trained in each discipline would implement the procedures related to their respective fields.

The use of the pattern activity and obstacle course and the relevance of these activities to the three disciplines encompass another limitation of this research design. As mentioned above, the increase in verbalizations during the pattern activity across both participants when the SLP phase was implemented is not unusual, but the increase in verbalizations during the obstacle course across both participants when the OT phase was implemented is unexpected. This may be related to the relevance of the activities to the disciplines or the familiarity of the clinicians with each of the activities. The occupational therapist prompted verbalizations in the obstacle course more frequently than the speech language pathologist, but the speech language pathologist prompted verbalizations more often than the occupational therapist during the pattern activity. Because each clinician was instructed to run the activities as they normally would, this led to each clinician prompting for verbalizations in different activities, SLP in the pattern and OT in the obstacle course. The different types of prompting used are not listed specifically under use of the visual schedule, therefore, the procedural fidelity was kept intact, but the verbalization data changed according to the prompting. Future studies may adjust the type of activities based on their relevance to specific disciplines, as well as the specific requirements within each activity.
Time constraints also presented a challenge to the experimental design, as decisions to move from one phase to the next depended more upon the amount of time available to collect data rather than the actual data itself. For example, each participant was only exposed to one session of each serial phase of treatment, with the exception of Henry in the ABA phase. Henry received two points in this phase due to issues with scheduling. Although this was not the plan at the outset of the study, time constraints dictated the rate at which the participants moved through each phase, rather than the stability of the data across multiple sessions. Additionally, James met mastery criteria for postural control duration on the Bosu ball during the last baseline session, indicating that he should have been kept in baseline longer with an increase in difficulty before moving on to the ABA treatment session. Because of the study’s time limitations, the researchers made an executive decision to move on to the ABA phase since all of the other variables were stable and James needed to begin moving through the serial phases in order to ensure exposure to all of the study’s phases.

Sequence effects are always a possibility in research implementing consecutive treatment phases. In this study, continuation of the high level of verbalizations in the OT phase of research may be due to the participants’ exposure to the SLP phase of treatment. Continuation of the high level of compliance in the SLP phase for Henry and both the SLP and OT phases for James may be due to the participants’ exposure to the ABA phase of treatment. Additionally, high levels of any of the variables in the merge could indicate a sequence effect following the serial phases. Future studies may address this issue by adjusting the order of the phases and presenting the phases in varying combinations with one another to conduct a type of component analysis. Replication of the phases would
also provide a stronger level of experimental control if the relevant variables changed in relation to the type of treatment administered.

Although the procedures were strictly adhered to across all phases of the study, the licensed professionals implementing the serial conditions noted that their prior collaboration with one another over the course of several years made it somewhat difficult for them to focus solely on procedures from their own discipline. Future studies may require a better form of treatment fidelity that extends beyond training undergraduate clinicians from one discipline. Graduate clinicians or even licensed professionals from each respective discipline could be recruited to determine the level of procedural fidelity across the individual phases, as well as the merged phase of treatment. This may resolve some of the issues with the confounding nature of prior collaboration among the professionals involved in this study.

In addition to collecting data on child outcomes, data was also collected on cueing for postural control, prone extension, and motor planning. The definition of cueing for postural control and prone extension needed to be separated into two separate definitions midway through the study, so the researchers made a decision to eliminate this variable, considering it was clinician behavior, which was not the focus of the research. Additionally, data regarding the frequency of cueing for motor planning was taken across the length of the study, but because the topography of this behavior changed within and across phases, the data was unclear, and a comparison could not be made. This, in turn, affected the obstacle course sequence data, as a relationship between the frequency of cueing for motor planning and performance of the steps in the correct sequence was also unclear. Although increased motor planning abilities was identified as a goal for the
participants at the outset of the study, data taken on the sequence of the obstacle course indicated completion of the correct sequence by both participants from the first baseline session across all sessions of the study. This may have not been the case had the obstacle course increased in difficulty across sessions, with the exception of the last merged session for James, or if the level of prompting had been limited prior to the OT phase. This data was not displayed graphically, as there were no specific patterns that emerged, especially in relation to the frequency of cueing for motor planning.

Another limitation in the procedural design relates to the frequency of commands given and questions asked. Because this frequency varied greatly between sessions and clinicians, future studies may seek to provide more consistency within and across phases in order to provide a better comparison of compliance/responding. Additionally, the opportunities available for prone extension on the barrel and postural control on the Bosu ball varied within and across phases. This may have affected the participants’ performance, as the highest duration out of all the opportunities within each session was graphed for the two variables.

There are several increasing trends seen in Henry’s pattern compliance, sitting, verbalization, and pieces patterned data in the merged phase. One possible explanation is that the clinician implementing the merged procedures became more proficient in implementing these procedures over time. Although there was strict adherence to the procedures, repeated practice across sessions may have lead to a greater competency in applying the procedures. This may be why Henry’s escape data in the first merge session is relatively high and some of the other variables listed above are relatively low in comparison to data from the serial treatment sessions.
Issues related to interobserver agreement arose in relation to low-frequency behaviors, such as Henry’s verbalization and escape data, as well as postural control duration for both participants. For example, total count IOA was only 50% for one verbalization data point, as one observer scored a frequency of one and the other scored a frequency of two. Average duration IOA for escape behaviors was zero for one data point, as one observer scored zero occurrences of escape and the other scored one occurrence. This also presented an issue when both observers scored one instance of escape with varying durations. The same issue occurred for postural control duration, as one observer scored zero seconds on the Bosu ball and the other scored a duration higher than zero.

Technological issues related to use of the video camera arose during the course of the study, as the first verbalization data point for both participants on 12/10 was lost due to the camera batteries losing their charge. Additional issues arose with the flip camera at the beginning of the ninth research session, so verbalization data was taken on two iPhones with no connection to the Internet. This data was transferred to a computer without an Internet connection and put on a hard drive to be stored with verbalization data from previous sessions. During the eleventh research session, specifically the pattern activity with James in the SLP phase, the flip camera stopped working, so the session had to be completed again with a backup Cannon camera used to record verbalizations.

Previous research within the Inter-Professional Autism Clinic provided evidence to show that graduate clinicians can be trained to implement procedures from all three disciplines, but this study took the implications of the previous research a step further and sought to demonstrate how this information could be used to positively affect child
outcomes. It provides a pertinent addition to the limited body of research on inter-professional education and collaborative practice. Although some of the data are variable across and within the figures, there is a general theme that indicates a positive change in variables associated with their relevant conditions. Compliance, pieces patterned, and escape all changed in relation to the implementation of ABA; postural alignment, postural control, and prone extension changed in relation to implementation of OT; and verbalizations changed in relation to implementation of SLP. This study demonstrated that variables can change in accordance with their related clinician procedures and be maintained at a level above baseline in the merged phase. The current literature on inter-professional collaboration is sparse and consists almost entirely of subjective information, making studies such as this one important in providing objective evidence to support the claim that collaboration is an effective approach to healthcare.
Figure 1. Percentage of compliance/responses across activities. Percentage of compliance with commands/answers to questions by opportunity during pattern activity and obstacle course.
Figure 2. Percentage of compliance/responses separated by activity. Percentage of compliance with commands/answers to questions by opportunity during pattern activity and obstacle course.
Figure 3. Frequency of pieces patterned correctly. Frequency of pieces patterned during pattern activity across participants.
Figure 4. Frequency of verbalizations across activities. Frequency of verbalizations during pattern activity and obstacle course across participants.
Figure 5. Frequency of verbalizations separated by activity. Frequency of verbalizations during pattern activity and obstacle course across participants.
Figure 6. Percentage of intervals sitting correctly. Percentage of intervals sitting correctly on chair or ball during pattern activity across participants.
Figure 7. Duration of prone extension. Highest duration of prone extension in seconds during obstacle course across participants.
Figure 8. Duration of postural control. Highest duration of prone extension in seconds during obstacle course across participants.
Figure 9. Average duration of escape. Average duration of escape in seconds during obstacle course for one participant.
Figure 10. Mean Length of Utterance—Henry. Mean length of utterance from probes at beginning and end of study for Henry.
Figure 11. Mean Length of Utterance—James. Mean length of utterance from probes at beginning and end of study for James.
Appendix A

Date: ______________  Participant: __________  Observer: __________  Primary or Secondary  IOA: Yes or No

Pattern activity 5 minutes

<table>
<thead>
<tr>
<th>Child Behavior</th>
<th>Record [C] for correct attempt, [I] for incorrect attempt, [N] for noncompliance/no answer, [NO] for no opportunity; score N if no attempt made within 5 seconds</th>
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<tbody>
<tr>
<td>Compliance</td>
<td></td>
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<tr>
<td>w/commands</td>
<td></td>
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<tr>
<td>Answers to questions</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinician Behavior</th>
<th>Record a [V] (verbal) or [T] (tactile) for occurrence by frequency</th>
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<tbody>
<tr>
<td>Cueing for postural alignment</td>
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<th>Escape—record timed duration of min/sec with two decimals</th>
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<table>
<thead>
<tr>
<th>Child Behavior</th>
<th>Record [C] for correct attempt, [I] for incorrect attempt, [N] for noncompliance/no answer, [NO] for no opportunity; score N if no attempt made within 5 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance</td>
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<tr>
<td>w/commands</td>
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<tr>
<td>Answers to questions</td>
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<thead>
<tr>
<th>Clinician Behavior</th>
<th>Record a [V] (verbal) or [T] (tactile) for occurrence by frequency</th>
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<tbody>
<tr>
<td>Cueing for motor planning</td>
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</table>
Date: ______________  Participant: ___________ Observer: ___________  Primary or Secondary  IOA: Yes or No

Correct sitting: Child is sitting symmetrically with feet flat on the floor or supported on box and hip width apart with hips, knees, and ankles bent to approximately 90°.

Record a [+] for occurrence and a [-] for non-occurrence

**Pattern activity—whole interval recording**

<table>
<thead>
<tr>
<th>Minute</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td>1</td>
<td>2</td>
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<td>1</td>
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<tr>
<td>Sitting correctly on chair or ball</td>
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</table>

Pieces patterned correctly: ________ out of ________

---

Date: ______________  Participant: ___________ Observer: ___________  Primary or Secondary  IOA: Yes or No

Record a [+] for occurrence and a [-] for non-occurrence

**Pattern activity—whole interval recording**

<table>
<thead>
<tr>
<th>Minute</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td>2</td>
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Pieces patterned correctly: ________ out of ________
Permanent Product Check

Participant: ___________  Observer: ___________  Primary or Secondary

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<th>Date</th>
<th>Clinician</th>
<th>IOA</th>
<th># pieces patterned correctly</th>
<th>Total # possible</th>
<th>Pattern #s attempted</th>
<th>Pattern #s completed correctly</th>
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<tbody>
<tr>
<td>Y</td>
<td>N</td>
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Number of verbalizations

Participant: ________

P=Pattern Activity  OC=Obstacle Course

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</tbody>
</table>
**Obstacle Course**

Date: _______________  Participant: _______________  Observer: _______________

Number sequence 1-4 for each completion of sequence

Escape—record timed duration of min/sec with two decimals

<table>
<thead>
<tr>
<th>Items</th>
<th>Sequence/Timed duration</th>
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<tbody>
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<td>Escape</td>
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</tr>
<tr>
<td><strong>Barrel</strong></td>
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</tr>
<tr>
<td>Escape</td>
<td></td>
</tr>
<tr>
<td><strong>Bosu ball</strong></td>
<td></td>
</tr>
<tr>
<td>Escape</td>
<td></td>
</tr>
<tr>
<td><strong>Connecting tunnel</strong></td>
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<tr>
<td>Escape</td>
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</table>
# Treatment fidelity checklist

Date: ____________________  Participant: _______________  Clinician: ________________  Observer: ________________  Primary or Secondary

**Pattern Activity:**

<table>
<thead>
<tr>
<th>Clinician Procedures</th>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
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<tbody>
<tr>
<td>ABA-Request sequences</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ABA-Differential attention</td>
<td></td>
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<tr>
<td>SLP-Expansion of utterance</td>
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<tr>
<td>SLP-Access for verbalization</td>
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<tr>
<td>OT-Sensory exposure</td>
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<td></td>
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<tr>
<td>OT-Postural alignment</td>
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**Obstacle course:**

<table>
<thead>
<tr>
<th>Clinician Procedures</th>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
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<tr>
<td>ABA-Request sequences</td>
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<td>ABA-Differential attention</td>
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<tr>
<td>SLP-Expansion of utterance</td>
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<tr>
<td>SLP-Access for verbalization</td>
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<tr>
<td>SLP-Visual schedule</td>
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<tr>
<td>OT-Motor planning</td>
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<tr>
<td>OT-Prone extension and postural control</td>
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Appendix B

General Clinician Behavior for Activities

Pattern activity:
Both the child and clinician sit at the table. The clinician provides one pattern (specific to the child’s current progress) and an assortment of pattern pieces including all of the pieces needed to complete the pattern correctly as well as distractors. A student timing the activity will prompt the clinician to begin, and the clinician will give the command “match the pieces.” The clinician will give additional commands to complete the activity/ask questions related to the activity throughout the five-minute session. If the child completes a pattern, the clinician will set it aside for data collection (a picture to be taken of the product) and provide the next numerically successive pattern (if child completes pattern #14, provide them with pattern #15). The student timing the activity will inform the clinician when the activity has reached five minutes.

Transition between activities:
The clinician transitions from the pattern activity to the obstacle course using verbal and/or physical prompts as needed.

Obstacle course:
The clinician will provide verbal and/or physical prompts as needed to guide the child through the obstacle course sequence: balance beam, barrel, bosu ball, and extended tunnel. A student timing the activity will prompt the clinician to begin, and the clinician will give the command “walk across the balance beam.” After the child walks across the balance beam, either independently or with prompting, or does not comply, the clinician will prompt the child to walk to the barrel if the child does not begin to do so independently. The clinician will roll the child onto the barrel, holding the child by the waist, and give the command to “lift your arms, legs, and head for as long as you can.” Clinicians not prompting for prone extension (baseline and SLP) will hold the child on the barrel for 10 seconds after giving the command, regardless of the child’s behavior. After ten seconds, the clinician will roll the child off the barrel then prompt the child to walk to the bosu ball if the child does not begin to do so independently. The clinician will then prompt the child to stand on the bosu ball if not initiated independently and give the command to “stand still by yourself for as long as you can.” The clinician will let go of the child’s hands, and if the child complies, the clinician will wait by the ball until the child steps off or grabs the clinician for support. If the child does not comply (or after stepping off/grabbing clinician), the clinician will prompt to move on to the tunnel if the child does not begin to do so independently. The clinician will give the command “crawl through the tunnel.” If the child does not comply, repeat the command until the child crawls through either end of the tunnel. Once the child crawls through the tunnel, begin the sequence again with the balance beam, prompting as necessary based on the child’s behavior. The student timing the activity will inform the clinician when the activity has reached five minutes.
Appendix C

Visual Schedule
References


Centers for Disease Control and Prevention (2012). *CDC estimates 1 in 88 children in United States has been identified as having an autism spectrum disorder.* Retrieved from http://www.cdc.gov/media/releases/2012/p0329_autism_disorder.html


497-506. Retrieved from

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1286265/pdf/jaba00090-0108.pdf


Youngstrom, M., Brayman, S., Anthony, P., Brinson, M., Brownrigg, S., Clark, G., Roley, S., Sellers, J., Van Slyke, N., Desnarausm S., Oldham, J., Radomski, M. &