The Effects of Service Setting on Early Intensive Behavioural Intervention Program Delivery

by

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Abstract

Early intensive behavioural intervention (EIBI) is consistently acknowledged as an effective treatment for children diagnosed with autism spectrum disorder (ASD). More recently, these services are being delivered in a wider variety of service settings (e.g., classrooms, child care centres and preschools). Variations in service settings allow for more cost-effective treatment programs and may also widen the accessibility of services. However, it is unclear whether treatment can be delivered with high consistency and accuracy in settings where variations in program characteristics are expected (e.g., presence of peers, level of control, and staff training). The current study addressed the gap in the literature though comparing three aspects of EIBI that may be most affected by program variations as a function of setting: (a) perceptions of direct service providers regarding treatment quality, (b) the accuracy of discrete-trials teaching (DTT), and (c) service intensity and comprehensiveness. The current study has demonstrated that the delivery of EIBI varied as a function of service setting. Specifically, a difference in the treatment integrity of DTT, program comprehensiveness, and quality of team communication was observed. For each of these variables, results favored the delivery of services in ABA classrooms in comparison to integrated child care centres.

Keywords: treatment integrity, treatment quality, service setting, early intensive behavioural intervention, autism spectrum disorder

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Introduction

Autism spectrum disorder (ASD) is a complex neuro-developmental disorder that is characterized by varying degrees of impairments in social interactions, rigid and repetitive behaviours, and a restricted repertoire of interests (American Psychiatric Association, 2013). Manifestation of these characteristics typically occurs during the preschool years and will often persist throughout the lifespan. Early intensive behavioural intervention (EIBI) is an established treatment approach for children diagnosed with ASD that is based on principles from the field of applied behaviour analysis (ABA). EIBI programs are intense (i.e., 20-40 hrs per week) and comprehensive addressing a wide range of skill domains (e.g., communication, self-help, social skills). Outcome research investigating the effectiveness of EIBI continues to support the intervention approach as the most effective treatment for children with ASD (Peters-Scheffer et al., 2011).

Consistent evidence supporting the effectiveness of EIBI has contributed to the growing number of individuals requesting EIBI services. Despite its effectiveness, EIBI is consistently underfunded and as a result waitlists for services are growing (Jacobson & Mulick, 2000; Thomson et al., 2009; Rivard et al., 2014). Reports examining wait times for publicly funded EIBI treatment in North America estimate that children wait approximately 1-3 years from diagnoses to treatment onset (Dimian et al., 2020; Piccininni et al., 2017; Tsiplova et al., 2019; Yingling et al., 2018). It is noteworthy that these estimates do not reference wait times for publicly funded EIBI in Manitoba.

EIBI programs are delivered in a variety of settings (e.g., child care centres, children's homes, and treatment centres). Variations in service setting allow for more cost-effective treatment programs (e.g., lower teacher-to-child ratios), and may also widen the accessibility of

services (e.g., limited rural access to treatment locations). However, each setting also engenders variations in program characteristics, such that in some settings it can be more of a challenge to maintain the characteristics associated with quality driven EIBI programs. Further, service settings with low therapist control may negatively impact the number and breadth of learning opportunities in addition to the application of fundamental techniques used in EIBI programs, such as discrete-trials teaching (DTT). DTT is widely accepted as a valuable and effective teaching method for children with ASD (Lovaas, 1987, 2003; Smith, 2001), and child outcomes are strongly associated with the quality of implementation (Carroll et al., 2013). However, it is unknown whether the quality of DTT is at risk due to program variations across settings.

It is of particular concern whether procedural variations across settings are affecting the accuracy in which DTT is being delivered in addition to two central characteristics of EIBI: service intensity and comprehensiveness. Therefore, the purpose of this project was to understand whether the setting in which EIBI programming is delivered affects the accuracy of DTT, the number of teaching trials delivered, and the scope of skill domains targeted.

Autism Spectrum Disorder

According to the *Diagnostic and Statistical Manual of Mental Disorders, 5th edition*, an individual diagnosed with ASD must meet five criteria: (a) persistent deficits in social communication and social interaction; (b) restricted, repetitive patterns of behaviour, interests or activities; (c) symptoms must be present in the child's early developmental period; (d) symptoms must cause clinically significant impairment in social, occupational, or other critical areas of functioning; and (e) the disturbances cannot be better explained by intellectual disability or global development delay (DSM-5, American Psychiatric Association, 2013). The release of the DSM-5 was accompanied by significant changes in the diagnostic terminology of ASD. The term ASD now subsumes disorders that were previously categorized as distinct subtypes: Autistic

Disorder, Pervasive Developmental Disorder Not Otherwise Specified, Rett's Disorder, Asperger's Disorder, and Childhood Disintegrative Disorder. The purpose of this modification was to produce a clearer diagnostic system in order to improve the recognition and diagnoses for those affected with ASD across all ages and levels of functioning (Happe, 2011).

The literature on prevalence estimates of ASD has supported evidence of a dramatic increase in ASD identification over time, an estimated average annual percent increase in prevalence from 9.7% to 14.6% (e.g., Anagnostou et al., 2014; Manning-Courtney et al., 2013; Ouellette-Kuntz et al., 2014). Canadian prevalence estimates report that as of 2018 1 in 66 children in Canada have been diagnosed with ASD (Public Health Agency of Canada, National Autism Spectrum Disorder Surveillance System; www.canada.ca). Some studies report diagnostic stability in children as young as two years of age; however, the average age of ASD diagnoses has been reported at 5.7 years (Shattuck et al., 2009). A number of factors have been associated with early identification of autism; including being male, an IQ score of 70 or lower, and significant developmental regression (Shattuck et al., 2009). While there is currently no "cure" for individuals diagnosed with ASD, EIBI is an evidence-supported treatment approach that is consistently recognized as an effective treatment for symptoms and behaviours that are commonly associated with ASD (Department Health, 1999; Kuppens & Onghena, 2012; Peters-Scheffer et al., 2011).

Early Intensive Behavioural Intervention

EIBI is a comprehensive treatment program that is based on technologies and principles of ABA and is most commonly delivered for children diagnosed with ASD and other developmental delays. EIBI treatment is delivered though intensive programming (i.e., 20 to 40 hours of 1:1 training per week) that is individualized and comprehensive, addressing all skill domains. An individual implementing 1:1 programming for children with ASD may be described

differently such as an instructor, therapist, or teacher. The intervention goals and short-term objectives are identified based on the child's repertoire and are further guided by typical developmental sequences. Ideally, the location of treatment is based on the child's needs and would typically begin at home with gradual and systematic transition to the community and school settings (Green et al., 2002; Lovaas, 1987). Other common features of EIBI programs include the application of many behaviour analytic procedures (e.g., differential reinforcement, prompting, DTT), inclusion of staff who are experts in ABA, parental involvement in program delivery, duration of treatment for 2 or more years, and the onset of treatment before the age of 4 (Green et al., 2002).

A large body of literature has established the effectiveness of EIBI for children with ASD (Peters-Scheffer et al., 2011). Outcome studies comparing the effectiveness of EIBI with control groups have consistently shown that children receiving EIBI treatment make larger gains in a number of different domains including IQ, expressive and receptive language, and adaptive behaviour (e.g., Kuppens & Onghena, 2012; Makrygianni & Reed, 2010; Peters-Scheffer et al., 2011). EIBI is also a cost-effective approach to treating symptoms of ASD. According to an estimate of use and costs of direct medical (e.g., prescription medications, behaviour therapies, etc.) and nonmedical care (e.g., special education, respite, etc.) the costs associated with supporting an individual diagnosed with ASD is estimated to be more than $3 million U.S dollars greater than the costs for typically developing children (Ganz, 2007). Given the sizeable costs associated with supporting an individual with ASD, several published studies have performed cost-benefit analyses of EIBI (Chasson et al., 2007; Jacobson et al., 1998; Motiwala et al., 2006). Each of these has demonstrated that investing in effective treatment for ASD results in large societal net savings. The estimated net savings range from $55,000 to $1.1 million U.S dollars per child, to the age of 65.

Despite ABA treatments having been adopted and funded by the majority of Canadian provinces and territories (Madore & Paré, 2006), EIBI is consistently underfunded. As a consequence, waitlists for services are growing and more children are at risk of not receiving intervention prior to the age of four and thereby "aging out" of early intervention programs (Jacobson & Mulick, 2000; Thomson et al., 2009). In order to reduce these lengthy waitlists, service providers have explored variations in EIBI service models. Some variations that raise concerns include changes in service intensity, staff training requirements, the quality and quantity of supervision, and teacher-to-child ratios (Hayward et al., 2009). Services are also being delivered in a variety of settings (e.g., daycares, schools, homes). This often results in treatment models that sacrifice defining characteristics of EIBI programs (e.g., teacher to child ratios, frequency and quality of supervision, staff training). While it is imperative that agencies continue to adapt EIBI services to meet changing needs, the accuracy and consistency of EIBI treatment must be preserved in order to maximize child outcomes.

Treatment Quality and Integrity in EIBI

Several characteristics are essential in delivering an efficacious EIBI program. These include early intervention (before the age of four), treatment intensity (minimum of 20 hours per week), 1:1 teacher to child ratios, accurate and consistent application of discrete-trials teaching (DTT), continuous data collection and measurement, and a teaching curriculum developed by experts in ABA that is structured, comprehensive, and skills-acquisition oriented (Downs & Downs, 2013; Foxx, 2008; Kazdin, 2011; LeBlanc & Gillis, 2012; Reichow et al., 2012; Virués-Ortega, 2010). Previous research has demonstrated that EIBI programs that do not include these characteristics have resulted in less promising child outcomes (Hayward et al., 2009).

For EIBI program models that do include the efficacious characteristics, treatment integrity remains a challenge. Treatment integrity refers to the degree to which a procedure is

implemented as intended on a consistent basis across time and individuals (Martin & Pear, 2015). Previous research has emphasized that the quality of EIBI treatment is heavily reliant on administering interventions with high treatment integrity (DiGennaro Reed & Codding, 2014; Green, 1996; Perry et al., 2006). Without achieving such a standard, statements regarding the effectiveness of an EIBI program are severely restricted. Challenges to achieving high treatment integrity in EIBI programs include a lack of supervision, services for children who demonstrate more challenging behaviours, staff who are not adequately trained in ABA, and treatment delivered in settings where therapist control is difficult to achieve (Eikeseth et al., 2011; Jacobson & Mulick, 2000; Perry et al., 2008; Symes et al., 2006). Low treatment integrity can have profound effects on intervention outcomes. For example, integrity failures may result in reinforcing problem behaviours while failing to teach appropriate replacement behaviours in addition to slower rates of skill acquisition (e.g., Carrol et al., 2013; DiGennaro Reed et al., 2011; St. Peter Pipkin et al., 2010). However, despite the evidence supporting negative outcomes associated with low treatment integrity, the majority of research focusing on effectiveness and efficacy of EIBI has largely neglected to evaluate whether teaching methods used in EIBI programs are being delivered according to best practice (Langh et al., 2017; Penn et al., 2007).

EIBI Across Service Settings

Traditionally, EIBI treatment models involve a gradual and systematic transition from home services to services delivered in the community such as centre-based models (i.e., ABA classroom models, treatment centres), and integrated child care centres (i.e., child care centres and preschools) (Green et al., 2002). Today, many children are receiving services in a number of different settings and often do not follow the typical and recommended progression of

community integration. Despite this, there has been little research examining how treatment may differ as a function of location.

Even fewer studies have attempted to define the core characteristics that are typically associated with each setting. There are a number of discrepancies in how EIBI treatment settings are labeled (e.g., home-based, community-based, centre-based) and structured (e.g., teacher-to-child ratios, physical space, presence of peers) across the literature. For this reason it is essential that the characteristics associated with the given label be explicitly described in order to help define why treatment outcomes may differ across settings. A study comparing outcomes across three services settings (i.e., homes, treatment centres, integrated child care settings) provided a comprehensive review integrating descriptions of service setting across the literature (Pedreira, 2017). This paper will draw upon Pedreira (2017) to identify the program characteristics that make each setting distinct from one another.

EIBI services delivered at home are characterized by a physical space that is familiar to the child where the privacy and control over the environment may vary significantly from one home to the next. The teaching environment also includes the presence of caregivers who may observe teaching sessions and may have access to programming, data, and notes outside of treatment hours. Other program characteristics often include direct 1:1 teacher to child ratios, limited opportunities to practice social interactions and group instruction, high intensity (i.e., more than 20 hours per week), variations in the quantity and quality of staff supervision, and limited access to novel stimuli in comparison to other service settings.

Services delivered in centre-based programs are delivered outside of the child's home without direct parental supervision, typically in a dedicated facility or institution. Treatment is often delivered in a classroom model in which the structure of the classroom and the daily routine is planned and supervised by individuals trained in ABA. Centre-based services allow for

a high degree of therapist control over the learning environment where the proximity of supervisors often allows for convenient and ongoing staff supervision. There is often access to novel stimuli and naturalistic learning opportunities that are integrated with other peers with ASD, other developmental disabilities, and typically developing children. Centre-based models may be delivered with smaller teacher-to-child ratios that offer both high and low intensity models.

Services delivered in integrated child care settings (i.e., child care centres and preschools) tend to encompass more variations in program characteristics in comparison to EIBI models delivered in other settings. Integrated child care refers to an inclusive program allowing children diagnosed with disabilities to receive care alongside other peers (Early Childhood Education and Care in Canada, 2010). Services delivered in integrated child care settings will often include smaller teacher-to-child ratios, daily routines and instruction that are planned and supervised by individuals who are not trained in ABA, and an environment that is difficult to achieve high treatment control. Most integrated child care centres provide access to many inclusion activities and novel stimuli that allow for many opportunities to practice and generalize skills in a more natural and uncontrolled environment. The ease of delivering basic language (e.g., requesting, labeling, receptive language, intraverbals) and academic (e.g., math, writing) programming may vary from each child care centre.

Effect of Service Setting on Treatment Outcomes

While EIBI is effective in a variety of settings, it is unknown whether comparable outcomes and intervention quality are achieved across settings (Nahmias et al., 2012; Pedreira, 2017; Parsons et al., 2011; Roberts et al., 2011). A recent study comparing retrospective outcome data for children receiving EIBI treatment in three different settings (i.e., home, treatment centre, and integrated child care centres) demonstrated that outcomes were not be equivalent,

particularly with respect to cognitive functioning, autism severity, adaptive behaviour, and skill acquisition (Pedreira, 2017). More specifically, results suggested that service hours delivered at home predicted gains in cognitive functioning, and adaptive behaviour. Service hours delivered in integrated child care centres predicted a reduction in autism severity. Service hours delivered in the centre-based model predicted lower scores in adaptive behaviour, increase in autism severity, and a lower proportion of skill gains. However, significant limitations were acknowledged by the author when examining children receiving services in the centre-based model. These included the small number of children exposed to services in this setting and notable differences in child characteristics (e.g., lower socio-economic status, children with higher needs, children with unsuitable homes for treatment) in comparison with other settings.

In contrast, a recent program evaluation compared learning rates for children with ASD who were receiving ABA services offered through a home and centre-based program. The results indicated that centre-based programming may produce favorable outcomes (Dixon et al., 2017). The comparison included an assessment of skill mastery over the course of three months including a total of 313 children between the ages of 3 and 12 years. From the 313 children, 72 children received ABA services delivered in a centre-based program, 241 received home-based services. A secondary analysis was conducted for the 44 children who received services in both service settings.

Each setting of service delivery followed the same treatment program based on the Centre for Autism Related Disorders (CARD) model of treatment (Granpeesheh et al., 2014). This model of treatment included a number of program features that are characteristic of EIBI, such as direct 1:1 treatment delivered by individuals trained in ABA, individualized and comprehensive treatment plans, the use of many behaviour analytic procedures (e.g., DTT, naturalistic teaching, prompting and shaping), function-based treatments for challenging

behaviour, parental involvement, and direct supervision that is routinely delivered. However, both home and centre-based treatments were non-intensive with children in the home-based group receiving on average 13.46 weekly treatment hours in comparison to the centre-based group who received on average 16.97 treatment hours per week. For children who received services in both settings, the average weekly treatment hours delivered was 16.74.

The results indicated that children receiving services in a treatment centre mastered significantly more learning objectives per hour in comparison to those receiving services at home. Furthermore, a secondary analysis controlling for individual differences by performing a comparison within children who received services in both settings revealed consistent results. These children mastered 100% more learning objectives per hour when sessions were delivered in a centre compared to at home. Overall, the results revealed that centre-based services were characterized by higher rates of learning in comparison to home-based services. These results were also consistent with a study by Roberts et al., (2011) in which gains were compared between two non-intensive behavioural intervention programs delivered either at a home or in a centre. Results indicated that while both groups made gains over the intervention period, overall outcomes favored the centre-based group.

Although the current literature suggests that the setting of service may influence the quality of treatment delivered, it remains unclear why these differences in outcomes exist. It is apparent that each treatment setting typically produces a number of variations that can shape how programming is developed and delivered. Clinicians are often forced to develop programming that may be better defined by the limitations accompanied by the service setting rather than by the child's direct needs. Examples of how program development and delivery may be shaped contingent on service setting include the domains that are targeted (e.g., social interactions,

academics), expectations for the number of teaching trials delivered, and expectations for procedural integrity.

Scope and Quantity of Programming

The applications of behavioural teaching methods (e.g., DTT, chaining) are effective means of teaching new behaviours by successive approximation in learn-units (i.e., trials). Each highly structured learn-unit is representative of a learning opportunity for a target behaviour where each treatment session involves the presentation of multiple learn-units. According to Greer and McDonough (1999), the learn-unit is a fundamental measure of teaching that describes the interaction between teachers and students including both the behaviour of the teacher and of the student. It is further suggested that the analysis of learn-units in frequency and quality is the strongest predictor of effective teaching and skill acquisition. For this reason, previous research suggests that the "amount" of treatment provided should be evaluated by examining the rate of teaching trials presented per hour, for example, rather than the number of hours the child was present for treatment (Lechago & Carr, 2008).

The literature does not identify an "optimal" number of teaching trials that should be delivered per hour in order to produce promising outcomes. This may be due to a number of foreseeable obstacles in quantifying a standard recommended number of trials, including a child's level of functioning, variety of teaching methods used (e.g., incidental teaching, chaining), or the complexity of programming. Despite this, comparing the number of teaching trials delivered across service settings provides useful information on whether setting has an effect on the amount or intensity of service being delivered. Some settings may limit the number of teaching trials that can be presented. For example, staff that provided services offered in integrated child care centres are required to take advantage of opportunities to run programming during classroom routines that are not tailored to the child's programming.

A child diagnosed with ASD may be affected in many or all areas of development, thereby making it crucial that treatments are both individualized and comprehensive (Gould et al., 2011). However, some service settings may offer only limited opportunities to target a range of skill domains. For example, staff delivering services in a home setting may need to contrive or plan for scenarios to practice group instruction, or social interactions. Staff providing service in a child care setting may have ample opportunities to practice such skills in the natural environment; however, prioritizing table work an academic programming may be more difficult. For these reasons, a comparison of the scope of skill domains targeted and also the frequency of trials delivered across settings is necessary.

Furthermore, some of the variations identified across settings present a basis for concerns about program delivery accuracy, such as the level of therapist control that can be achieved, number of likely distractors, presence of staff with and without ABA training, and staff supervision. An effective technique routinely used in EIBI treatment that may be particularly at risk for integrity failures is the application of DTT.

Discrete-Trials Teaching (DTT)

The DTT method of teaching utilizes a number of components fundamental to ABA, including reinforcement procedures, prompt delays and fading, breaking tasks into smaller parts, and requiring mastery of each task (Fazzio & Martin, 2011). The application of a single discrete-trial or "learn-unit" involves a 3-term behavioural contingency: an antecedent stimulus, behaviour response, and the consequence (Greer & McDonough, 1999). Teaching new behaviours with this behavioural contingency is further broken down into five components: a cue, prompt, response, consequence, and inter-trial interval. For example, a teacher delivers a cue (e.g., "point to red") with a prompt (e.g., physically guiding child's hand) and follows the

child's response (e.g., pointing) with an immediate consequence (e.g., praise and edible) that is followed by a brief pause before presenting the next cue (i.e., inter-trial interval) (Smith, 2001).

Treatment Integrity and DTT

While the application of DTT has consistently shown to produce meaningful gains in children with ASD (Lovaas, 1987, 2003; Smith, 2001), fewer studies have focused on teacher's behaviour in implementing DTT programming (Wightman, 2016). Previous research suggests that integrity failures in DTT applications have profound effects on treatment quality that may be contributing to the variability in EIBI outcomes (Carroll et al., 2013; Holcombe et al., 1994). A study by Carroll and colleagues identified three common integrity issues in DTT, namely failures to: (a) present a controlling prompt, (b) present the correct instruction, and (c) deliver reinforcement following correct responses. Children receiving instruction issued with one or more integrity failures displayed a slower rate of skill acquisition. This result is consistent with other studies evaluating the effect of DTT integrity failures on skill acquisition suggesting that even a moderate number of errors (i.e., 50% of trials) may produce negative effects on skill acquisition (Jenkins et al., 2015).

This is of particular concern as DTT implementation requires consistent, accurate application and record keeping that may be more of a challenge when being delivered in settings with low treatment control (e.g., child care centres and preschools; Denne et al., 2015). However, the long-term impact of integrity failures on skill acquisition remains unclear. A number of studies have demonstrated that high-quality instruction can reverse the negative effects of integrity failures (e.g., Hirst, & DiGennaro Reed, 2014; Leon et al., 2014; St. Peter Pipkin et al., 2010).

Fortunately, an integrity assessment for DTT has been developed to assess the quality of DTT application—the Discrete-Trials Teaching Evaluation Form (DTTEF; Fazzio et al., 2007).

The scoring manual consists of 21 components of DTT that are categorized into five subsections: (a) preparing for teaching session, (b) managing antecedents, (c) managing consequences for responses and recording data, (d) error correction following errors, and (e) prompt fading. Each of the 21 components are defined and information on correct and incorrect responses are provided.

The DTTEF has shown to be a reliable and valid tool for evaluating accuracy in administering DTT to children with ASD (Babel et al., 2008; Jeanson at al., 2010). This result has been replicated through video scoring and live observations of DTT (e.g., Babel et al., 2008, Jeanson et al., 2010, Wightman, 2016). However, previous studies evaluating the use of DTTEF during live observations have only replicated the results when DTT is administered in a structured teaching setting to a confederate playing the role of a child with ASD. It is unclear whether the DTTEF would require modifications in order to use it effectively during live observations when administered to a child with ASD, particularly in service settings where limited control over the environment is achieved (e.g., child care centres and preschools).

Statement of the Problem

The important clinical outcomes associated with EIBI treatment have resulted in the intervention being the most highly requested treatment approach for children with ASD (Green et al., 2006). The high demand for such treatment has resulted in service providers adapting program models in order to manage lengthy waitlists. One adaptation that often incorporates a number of program variations is to deliver EIBI in a variety of settings. Though it is unclear how variations from standard EIBI treatment models affect treatment quality. Therefore, the purpose of this research is to determine how three aspects of EIBI are affected by program variations as a function of setting: (a) the accuracy and consistency of DTT implementation, (b) the number of teaching trials delivered, and (c) the scope of

domains targeted.

General Method

An assessment was conducted to examine the effect of service setting on treatment quality. EIBI treatment was delivered in two different settings: ABA classrooms (i.e., centre-based model) and integrated child care centres. The project included three experiments: (1) indirect assessments evaluating the effect of service setting on treatment quality, (2) direct assessment of DTT integrity, and (3) measurement of service intensity comprehensiveness (i.e., number of teaching trials delivered and skill domains targeted). The service model and independent variables remain consistent across each experiment.

Service Program

The St.Amant Autism Program is a government-funded EIBI program that delivers services to preschool and school-aged children diagnosed with ASD. The St.Amant Autism Program follows a prescribed service model encompassing fundamental EIBI characteristics (Green et al., 2002) based on best-practice guidelines (Behaviour Analyst Certification Board, 2014). The St.Amant Autism Program has also shown to produce clinically and statistically significant gains in children enrolled in their program (Wright, 2012). The current study collected data on services being delivered in the Early Learning Program (ELP) for children between the ages of 2 and 6. Core components of the Autism ELP service model include 20 hours of direct teaching per week, 8 hours of tutor supervision per month, approximately 18-25 teaching goals across a variety of skill domains at any given time, 5 hours per week of parental program implementation, and ABA training requirements for both supervisors and tutor roles.

Each child receiving services in the ELP works with a treatment team consisting of an Autism Consultant, Senior Tutor, and Autism Tutor. The Autism Consultants are behaviour analysts who are working towards either a Master's or Doctoral degree in Applied Behavioural

Analysis. They are required to become Board Certified Behaviour Analysts upon completion of their degree. Autism Consultants are responsible for assessing skills, developing individualized behavioural programs, and supervising team members. Senior Tutors must have a minimum of 1000 hours of experience working with children with ASD and have completed at least two courses on principles and applications of behaviour analysis. Their responsibilities include assisting consultants with a variety of tasks such as data entry, graphing, skill probing, supervising and training tutors, parents, and other team members (e.g., school team, other caregivers, etc.). Autism Tutors must hold a high school degree and are provided with *"Discrete-Trial Teaching with Children with Autism – A Self-Instructional Manual"* (Fazzio & Martin, 2011) upon being hired. They are responsible for providing each client with 20 weekly hours of one-to-one behavioural intervention as developed by consultants. Autism Tutors receive ongoing supervision from Senior Tutors and Autism Consultant, with a minimum of 8 hours per month. Parents are trained and expected to implement a minimum of 5 hours per week working with their child on behaviour programming. Team meetings are held on a monthly basis for 2 hours and include the treatment team, parents, and the client. The purposes of the team meeting are to assess the client's progress, address any problem behaviours, review successes, develop and prioritize new goals, conduct direct observations of program implementation, and provide on-going training to tutors and parents.

Independent Variable – Service Setting

The current ELP model of service offers treatment in two settings: ABA classrooms located at four different locations across the city of Winnipeg, and integrated child care centres in Winnipeg as well as across the province of Manitoba. The structure of the treatment team and service model remain the same across settings; it is the characteristics within these settings that vary in program implementation. Caregivers may select the treatment location of their choice. A

previous study evaluating the effect of service setting on child outcomes has defined the following characteristics of service delivery in each location (Pedreira, 2017).

ABA Classrooms

The St.Amant Autism Program offers EIBI treatment in four ABA classrooms (i.e., centre-based treatment model) across Winnipeg. Children receiving services in this setting receive one-to-one instruction with their ABA trained tutor in a controlled setting; 1-2 Senior Tutors are present in the classroom at all times and 1-2 Autism Consultants are responsible for the program development of every client in the classroom (approximately 8-15 children with ASD). All treatment materials are kept in a secure space in the classroom. Children have access to stimuli during treatment hours that are initially novel, though may become increasingly familiar over the course of treatment. Throughout the day there are many inclusion opportunities to interact with other children with ASD (e.g., recess, lunch). Monthly clinic meetings with the treatment team and parents are held at the ABA classroom location.

Integrated Child Care

Treatment is delivered in a child care centre or preschool setting of the parent's choice. For the purpose of this study, child care centres and preschools will be both categorized as an integrated child care setting. In Manitoba, both are required to follow the same licensing and accreditation requirements (The Community Child Care Standards Act, 2016), and children receiving treatment in either settings will likely encounter a similar environment. Although some differences may exist between child care centres and preschool models (e.g., age of children, staff education, daily activities), factors that may influence the treatment environment are also likely to vary among child care locations, and among preschool locations. There is therefore little basis for treating them as distinct settings in the context of this study.

Children receive one-to-one instruction with their ABA-trained tutor amongst other typically developing peers; in some cases the Autism Consultant and Senior Tutor train the child's inclusion support worker in lieu of an Autism Tutor. The client follows the same routine as their peers deemed by the child care centre or preschool providers, such that it can be difficult to control the environment and other external influences. It is the responsibility of the treatment team, in consultation with the child care centre staff, to ensure that the child's programming is prioritized in the child care centre. In most cases, individuals who are not trained in ABA also provide supervision. All treatment materials are kept in a secure space at the child care centre or preschool. During child care hours there is access to stimuli that are initially novel, and many inclusion opportunities are accessible. Monthly clinic meetings with the treatment team and parents will be held at the child care centre.

Experiment 1: Indirect Assessment of Setting and Service Delivery

In this experiment, treatment quality was indirectly examined by asking Autism Tutors to rate the extent to which setting affected various aspects of EIBI programming. This included the effect of setting on accuracy of DTT, team communication, and service intensity and comprehensiveness.

Method

Participants

45 Autism Tutors employed by the St.Amant Autism Program submitted the online questionnaire. There were three participants who did not complete all questions included in the questionnaire. This sample included only tutors who had completed all of their training requirements and were currently providing direct one-to-one behavioural intervention for children receiving services from the St.Amant ELP. Among these tutors, 18 had 3-12 months of experience working as an Autism Tutor, 16 had 1-2 years of experience, and 11 had over two

years of experience. They ranged in age categories from 18-24 years (N = 17), 25-29 years (N = 23), and 30 years and older (N = 5). Participants also varied in their highest level of education, including high school diplomas (N = 11), undergraduate degrees (N= 30), and graduate degrees (N = 4). All participants who completed the survey were females.

Materials and Procedures

The questionnaire was distributed via email to all Autism Tutors at two time points, in order to increase the overall response rate. Tutors were instructed not to complete the survey more than once. The questionnaire (Appendix A) was anonymous and voluntary, and consisted of 33 questions broken down into two main sections: (a) participant characteristics, and (b) an assessment of the effect of service setting on treatment delivery. Questions included in section one (i.e., participant characteristics) collected information on the tutor's level of experience in addition to the setting(s) in which they had gained experience (e.g., length of employment as an Autism Tutor, settings in which they had provided services). Questions in section two included Likert scale and open-ended questions that assessed the effect of service setting on treatment delivery. Section two included one sub-section for each service setting (i.e., integrated child care centres, and ABA classrooms). Tutors were asked to respond to only the sub-section(s) in which they had provided services in that setting in the past six months. For example, a tutor who had provided services at a daycare and in an ABA classroom in the past six months could respond to both sub-sections.

Each sub-section surveyed tutors on five service aspects. First, the effect of setting characteristics on treatment delivery was assessed (e.g., "Providing service in an ABA classroom means that there are other peers who are receiving ABA treatment nearby. How does this feature affect the quality of service you provide?", 1 = *negatively* and 5 = *positively*). Second, the ease of delivering programming across curriculum domains was assessed (e.g., "How does working in

an ABA classroom affect your ability to deliver programs targeting social skills", 1 = *negatively* and 5 = *positively*). Third, confidence in implementing components critical to DTT was assessed (e.g., "Please indicate how working in a child care facility affects your ability to secure the child's attention before presenting the instruction", 1 = *negatively* and 5 = *positively*). Fourth, the effect of setting on communication and training was assessed (e.g., "Please indicate how working in a child care facility affects your ability to obtain feedback from your supervisor". 1 = *negatively* and 5 = *positively*). Finally, an open-ended question was also included in each sub-section in an effort to identify other characteristics associated with each setting that may have an effect on treatment delivery.

Data Analysis

Tutors who had provided services in only one setting responded to questions pertaining only to that setting. These responses were grouped according to service setting (i.e., integrated child care centres, and ABA classrooms). Mean ratings for questions that allowed for direct comparisons across settings (i.e., sections: "running teaching trials" and "communication and training") were compared using an independent samples *t*-test. Responses from tutors who had provided services in more than one setting and have therefore responded to questions pertaining to both settings, were analyzed using a dependent samples *t*-test. Mean ratings were computed and compared within groups.

To minimize the risk of type 1 error, responses to some questions in the survey were averaged together to reduce the number of direct comparisons that were made. Four questions pertaining to the delivery of programming across skill domains were averaged together, and two questions pertaining to communication and feedback were averaged together. In total, 7 comparisons were made in both inferential statistical tests. To adjust for multiple comparisons, the Bonferonni correction was applied by dividing the original alpha level by the total number of

comparisons (.05/7 = .007). The adjusted *p* value (2-tailed, α = .007) was used to determine statistical significance across all inferential tests for this experiment. Questions that did not allow for a direct comparison across groups (i.e., core characteristics associated with setting) were analyzed descriptively for all participants.

Results

Descriptive Statistics

The following statistics are summarized in Table 1. Tutors rated the extent to which they agreed with statements indicating that service setting had an effect on service quality and training (1 = *strongly disagree,* 5 = *strongly agree)*. On average, tutors reported that treatment setting affects service quality (M = 4.33, SD = .77). Tutors also reported that the setting in which they were trained affected the quality of training that was received (M = 4.24, SD = .86).

Tutors also responded to questions pertaining to specific features unique to each setting (i.e., "how does the following feature affect the quality of service you provide?" 1 = *negatively,* 5 = *positively*). For questions associated with services delivered in an integrated child care setting, tutors reported the following averaged responses regarding the effect of (a) providing services with typically developing peers nearby (M = 4.04, SD = 1.11), and (b) following daily routines planned by daycare and preschool providers that are not trained in ABA (M = 3.68, SD = .99). For questions associated with services delivered in ABA classrooms, tutors reported the following averaged responses regarding the effect of (a) having peers nearby that are receiving ABA treatment (M = 4.61, SD = .78), and (b) having continuous access to support from the Senior Tutor (M = 4.77, SD = .62).

Between-group Comparisons

An independent samples *t*-test was used to compare mean responses across settings for tutors who have provided service in only one setting (see Table 2; α = .007). Tutors reported how

a specified setting (i.e., either ABA classroom or integrated child care) affected their ability to adhere to various aspects of service delivery (1 = *negatively*, 5 = *positively*). Tutors who provided service in an ABA Classroom provided significantly higher ratings regarding their ability to deliver programs on a daily basis or as prescribed by their Autism Consultant (M = 4.74, SD = .73), compared to tutors who provided service in an integrated child care centre (M = 3.0, SD = 1.0, $t(28) = -5.47$, $p = .0001$). However, self-reported ability to deliver programming across various curriculum domains (i.e., basic learner, academic, group instruction, social skills) was not significantly different between tutors who provided service in ABA classrooms (M = 4.69, SD = .37) or in an integrated child care centre (M = 4.45, SD = .41, $t(28) = -1.66$, $p = .11$). It is noteworthy that both groups reported that the setting where they provided service had a positive effect on this variable.

Multiple items inquired about adherence to various components of DTT programing. Tutors who provided service in ABA Classrooms compared to those in integrated child care centres reported that the former setting had a significantly more positive effect on their ability to deliver the following components of DTT programming: Arranging the teaching setting (M_{int} = 2.55, SD = 1.44, M_{Clrm} = 4.05, SD = 1.03, $t(28) = -3.34$, p =.002), securing the child's attention (M_{int} = 2.45 , SD = .93 , M_{Clrm} = 3.79, SD = 1.23, t(28) = -3.11, p =.004), presenting the correct antecedent (M_{int} = 3.18, SD = .87, M_{Clrm} = 4.32, SD = 1.0, t(28) = -3.12, $p = .004$), and presenting the correct consequence (M_{int} = 3.09 , SD = .70, M_{Clrm} = 4.32 , SD = 1.0, $t(28) = -3.92$, $p = .001$). Regarding the effect of service setting on communicating and receiving feedback from team members, tutors who provided service in the ABA classrooms (M = 4.79, SD = .42) compared to integrated child care settings (M = 3.09, SD = 1.14), reported that setting had a significantly more positive effect on this variable ($t(28) = -5.57$, $p < .007$).

Within-group Comparisons

A dependent samples *t*-test was used to compare mean responses within subjects (i.e., see Table 2; $\alpha = .007$). Tutors reported that working in an ABA classroom ($M = 4.92$, $SD = .29$) compared to integrated child care centres ($M = 3.42$, $SD = 1.24$) had a significantly more positive effect on their ability to deliver programming on a daily basis or as prescribed by the Autism Consultant ($t(11) = -4.18$, $p = .002$). However, tutors reported that settings did not significantly differ with regards to the ease of delivering programming across various curriculum domains ($M_{\text{int}} = 3.92$, $SD = .72$, $M_{\text{Clrm}} = 4.52$, $SD = .52$, $t(11) = -3.01$, $p = .012$).

Tutors who have provided service in both settings also reported that ABA classrooms had a significantly stronger positive effect on their ability to deliver various components in DTT programming. This includes: arranging the teaching setting ($M_{\text{int}} = 2.92$, $SD = 1.08$, $M_{Clrm} = 4.83$, $SD = .58$, $t(11) = -4.81$, $p = .001$), securing the child's attention ($M_{\text{int}} = 2.67$, $SD = 1.07$, $M_{\text{Clrm}} = 4.0$, $SD = .95$, $t(11) = -3.55$, $p = .005$), and presenting the correct antecedent ($M_{\text{int}} = 3.45$, $SD = 1.13$, $M_{Clrm} = 4.73$, $SD = .47$, $t(11) = -3.82$, $p = .003$). However, tutors did not report a significant difference between settings with regards to their ability to deliver the correct consequence ($M_{\text{int}} = 3.25$, $SD = 1.21$, $M_{\text{Clrm}} = 4.58$, $SD = .90$, $t(11) = -3.22$, $p = .008$). Tutors reported that providing service in an ABA Classroom ($M = 4.75$, $SD = .62$) compared to an integrated child care centre *(*$M = 3.25$, $SD = 1.40$) had a significantly stronger positive effect on their ability to communicate and receive feedback ($t(11) = -3.35$, $p = .006$).

Open-ended Questions

A total of 20 tutors responded to the question "Are there any other features of this service setting that you think have an effect on the quality of service you provide? If so, what are they?" Among these tutors, nine provided service in only the ABA classroom, five provided service in only integrated child care setting, and six provided service in both settings.

Regarding features associated with the ABA classrooms. Four tutors indicated that classroom settings were an overall positive environment to work in. Four tutors reported that a positive feature of this setting includes the ease of communicating with other tutors and receiving feedback from Senior Tutors. Three tutors indicated that ABA classrooms facilitate peer play, group instruction, and social skills. Finally, one tutor commented on the benefit of having access to various reinforcing and leisure items. In regards to disadvantageous features associated with the ABA classroom, three tutors reported that the presence of other children with ASD creates opportunities for children to imitate inappropriate or challenging behaviours. Three tutors commented on the increased noise level of the classrooms, resulting in distraction. Three tutors indicated that without the presence of typically developing peers, children have limited opportunities to imitate appropriate play skills, requesting, and language. Finally, one tutor reported that the ongoing presence of supervisors can be uncomfortable.

Regarding features associated with integrated child care centres. Six tutors indicated that when following the child care centres schedule, it can be a challenge to deliver programming at the prescribed intensity in addition to targeting all skill domains. Five tutors commented that a the lack of communication between the treatment team and child care staff services as a barrier. Two tutors indicated that policies of child care centres can interfere with incorporating programming stimuli and reinforcers. Finally, one tutor described that a positive feature of child care settings is that it allows for skill generalization to a natural environment.

Discussion

The purpose of this experiment was to indirectly evaluate the effect of service setting on treatment quality by surveying Autism Tutors. This survey evaluated various aspects of service including accuracy of DTT, communication and training, frequency and comprehensiveness of program, and finally the effect of features associated with each setting. Overall, results suggest

that according to tutors, service setting affects the quality of service that is delivered in addition to the quality of training that is received. When directly comparing ratings across settings, these findings suggest that delivery of EIBI treatment in an ABA classroom is superior compared to delivery in integrated child care centres for the majority of variables that were assessed. While this provides important information on which setting is more favorable, the next logical question is: *how* does each setting impact each of these aspects of service?

Therefore, it is also important to examine the mean ratings (see Table 2) for each setting in order to distinguish how, if at all, these aspects of service affected treatment quality in each setting (i.e., negatively, positively, or no effect). Specifically, these results indicate that when services are delivered in ABA classrooms, this has a positive impact on (a) the delivery of programming at the intended frequency, (b) tutor adherence to components of DTT, and (c) team communication. Integrated child care centres appear to have little effect on these variables, or a negative effect. Both settings appear to positively support the delivery of programming that is comprehensive.

Previous research suggests that comparable outcomes and treatment quality may not be achieved across settings (Nahmias et al., 2012; Pedreira, 2017; Parsons et al., 2011; Roberts et al., 2011). Despite this, there is a scarcity of literature that has examined how treatment may differ as a function of location. These findings provide valuable information in developing a better understanding of *why* differences in outcomes and treatment quality may be observed across service settings. More specifically, previous research has emphasized that EIBI treatment quality is challenged when service includes integrity failures in DTT applications, lack of direct-support supervision, and in settings with limited therapist control. The current study has demonstrated that ABA classrooms are perceived to be superior in supporting these critical components of EIBI treatment.

Limitations

Limitations of this study should be noted. First, participants were not randomly assigned across settings. It is possible that some tutors may have developed a preference bias that influenced their responses to the questionnaire in some way. It is also possible that experience in both settings versus one setting influenced their responses to the questionnaire. However, the threat of this bias may be reduced by the fact that the results for both within and between-subject comparisons were comparable.

Second, it is difficult to determine whether these results would generalize to other comparable service settings or treatment models. While the current study has explicitly described the characteristics of both settings, many other studies fail to do so. Although this issue has persisted across the literature examining EIBI outcomes, it has been largely unrecognized. Without this information, it is difficult to determine whether other locations of service such as child care centres, and ABA classrooms incorporate similar features.

Third, given the indirect nature of this experiment, the causality of these results cannot be inferred. Though these results demonstrated that Autism Tutors perceived differences in treatment quality across settings, it remains unclear whether setting *causes* disparities in perceived treatment quality.

Experiment 2: Direct Assessment of DTT Integrity

The accuracy of DTT was also measured through direct assessment. A revised DTTEF scoring manual (see Appendix B) was used to directly compare DTT integrity across both service settings.

Method

Participants

A direct assessment of DTT integrity was conducted on four Autism Tutors, two in each service setting. From these tutors, two had 1-2 years of experience working as an Autism Tutor, one had 2-3 years of experience, and the fourth participant had over three years of experience. They ranged in age categories from 18-20 years ($N = 1$), 21-25 years ($N = 2$), and older than 25 years ($N = 1$). Participants also varied in their highest level of education, including high school diplomas ($N = 3$), and an undergraduate degree ($N = 1$). All tutors who participated were females. Tutors met the same inclusion criteria as in Experiment 1. Tutors providing service in the ABA classrooms, had over three and 1-2 years of experience. Tutors working in integrated child care settings had 1-2 and 2-3 years of experience. Participants were recruited and informed of the study requirements during a presentation held at a tutor meeting at St.Amant. Additionally, recruitment letters including a detailed project description were sent to all Autism Tutors though surface mail and to their staff email. Participants were informed that taking part in this study would not affect their employment with the St.Amant Autism Program and that their individual performance scores would not be added to their employee file.

Materials and Procedure

Only programs delivered in DTT format were observed. A revised version of the DTTEF scoring manual and score form was created in order to evaluate the critical components of DTT (see Appendix B). Although the current version of the DTTEF is a reliable and valid tool for examining DTT integrity (Babel et al., 2008), the current project required that some adaptations be made for the following reasons. First, in order to minimize obtrusion in the service setting, live observations were not supplemented with video recordings. Therefore the DTTEF was condensed in order to facilitate accuracy in real-time observations. Second, the researchers had

limited information on the specific trial being delivered (e.g., whether it was baseline vs. maintenance, or which fading step was employed) and also on slight variations that may exist across programming (e.g., fading and time delay procedures). Therefore, the DTTEF was adapted and simplified to evaluate prompt fading within trials (see component 4 in the revised DTTEF), as this procedure should remain consistent across program variations. Third, descriptions of correct and incorrect responses for each component were adapted to meet expectations in how DTT is usually delivered within the program. For example, component 1 in the DTTEF (i.e., arrange the teaching setting) does not require that the tutor arrange a table and two chairs for the teaching session. Trials may be appropriately delivered on a carpeted floor, for example. Fourth, the researcher observed trials at various points throughout the day, therefore, the current project did not evaluate a number of components associated with preparing the teaching session (e.g., determining the teaching task).

The adapted DTTEF manual and score form included 13 components broken down into 4 sections: set up, antecedent, consequence, and error correction following an error. For each scoring component, the item was scored as correct, incorrect, or non-applicable. This facilitated the assessment of procedural errors that are common within a setting while also acknowledging differences in how DTT programs may be developed for children receiving services in a specified setting. Percent accuracy was calculated for each trial by dividing the number of components that were delivered correctly by the number of components delivered correctly plus the number of components that were delivered incorrectly and then multiplying by 100.

Data Analysis

For each service setting, average percent accuracy was calculated for all trials and also for each DTTEF component across trials (see Table 3). These results were analyzed descriptively.

Results

Average DTT Accuracy

Table 3 reports averages of DTT trial accuracy in both settings. For the two participants who were observed in the ABA Classroom, procedural integrity was evaluated for 78 DTT trials. On average, 6.63 (*SD* = 1.5) components were scored per trial. The mean percent accuracy across trials was 86.91% (*SD* = 9.53), with an average of 5.75 (*SD* = 1.47) components scored correctly per trial, and an average of .87(*SD* = .76) components scored incorrectly per trial. For the two participants who were observed in an integrated child care setting, procedural integrity was evaluated for 68 DTT trials. On average, 6.56 (*SD* = 1.2) components were scored per trial. The mean percent accuracy across trials was 82.80% (*SD* = 17.12), with an average of 5.32 (*SD* = 1.43) components scored correctly per trial, and an average of 1.23 (*SD* = 1.43) components scored incorrectly per trial.

Accuracy Across DTTEF Components

Table 3 reports mean percent accuracy in both settings for each DTTEF component. The 13 components evaluated in the project were categorized in four different sections (i.e., Set up, Antecedents, Consequences, and Error Corrections). The first category, Set Up, includes one DTTEF component (i.e., arranging the teaching setting). Tutors in the ABA classroom scored 100% across all trials (*N* = 78), whereas tutors delivering service in integrated child care centres scored correctly on 52.94% (*N* = 68) of trials.

In the second category, Antecedents, tutors in the ABA classroom scored above 90% on all three components: Securing attention (*N* = 78), presenting the correct instruction (*N* = 78), and prompt fading (*N* = 14). Tutors in child care settings scored above 90% for two components: Securing attention (*N* = 68), and presenting the correct instruction (*N* = 68). The third component, prompt fading, was scored correct for 32.35% of trials (*N* = 34).

For the third category, Consequence, tutors in the ABA classroom scored above 90% for two of four components: Correct consequence following a correct response ($N = 71$), and inter-trial intervals ($N = 78$). Tutors responded correctly in response to an error for 87.5% of trials ($N = 7$), and the child's response was recorded correctly for 51.06% of trials ($N = 78$). Tutors being observed in child care centres scored above 90% for one of four components: Correct consequence following a correct response ($N = 64$). In response to child errors, they responded correctly for 0% of trials ($N = 4$). For 89.70% of trials ($N = 68$), tutors correctly administered an inter-trial interval. (N = 68). Finally, for 82.45% of trials ($N = 68$), tutors correctly recorded the child's response.

For the fourth category, Error Correction, tutors observed in the ABA classroom scored 100% across all trials ($N = 7$) for four of five components: Securing attention, re-presenting the correct instruction with a prompt, delivery of praise only, and inter-trial interval. The child's response was recorded correctly for 57.15% of trials. Tutors observed in child care settings scored 100% across all trials ($N = 4$) for one component: Inter-trial interval. The child's response was recorded correctly for 75% of trials. Finally, for the remaining three of four components they scored correctly for 50% of trials: Securing attention, re-representing the instruction with a prompt, and providing praise only.

Inter-observer Agreement

Inter-observer agreement (IOA) was conducted on 34% of trials ($N = 48$). On average, IOA was 95.1% for all trials observed. For each setting, IOA was conducted on 24 trials. Average IOA was 94.12% in ABA classrooms and 96% in integrated child care centres.

Discussion

The purpose of this experiment was to evaluate whether the delivery of DTT varies as a function of setting. Overall, these results suggest that the application of DTT is more accurate

when delivered in an ABA classroom compared to an integrated child care centre. Results favored ABA classrooms for overall trial accuracy and also across each of the four categories of the DTTEF scoring manual. For each DTTEF component separately, results favored ABA classrooms for each component aside from two: recording the child's response in standard and in error correction trials. Overall, this is consistent with findings from Experiment 1. On average, tutors reported that working in an ABA classroom had a more positive effect on their ability to deliver DTT accurately compared to in an integrated child care setting.

DTTEF components with the most notable difference between service settings included arranging the teaching setting, prompt fading, recording the child's response, and responding to errors. Due to the limited number of child errors that were observed, results for DTTEF components within the delivery of error corrections should be interpreted with caution. Despite this, these results suggest that a tutor's ability to adequately deliver these components of DTT may differ as a function of setting. More specifically, it appears that the learning environment in integrated child care centres may not sufficiently support a tutors ability to consistently arrange the teaching setting or fade teaching prompts following a child's response. Further, it appears that ABA classrooms may not adequately support the tutor's ability to consistently record the child's behaviour. Though these differences have been observed across service settings, we cannot assume that all differences can be attributed to errors made by the tutor. Some differences may be represented by differences in how DTT programming is developed across settings. For example, tutors may be instructed to record the child's response for the first and last trial delivered rather than on a trial-by-trial basis.

Whether differences in DTT application are attributed to tutor error or DTT programming, it remains unclear how these variations in DTT application may, if at all, affect outcomes. While it is well understood that integrity failures in DTT have a negative impact on

outcomes (e.g., Jenkins et al., 2015), DTT components may not be equivalent in this regard. It is nevertheless plausible that, for example, inaccurately arranging the teaching setting or fading out teaching prompts could negatively affect child outcomes.

Previous research suggests that child outcomes may differ according to the setting in which services are provided (Nahmias et al., 2012; Pedreira, 2017; Parsons et al., 2011; Roberts et al., 2011). Yet, there remains a scarcity of literature that examines how EIBI treatment differs as a function of setting. Therefore, it remains largely unclear why these differences in outcomes exist. The current study has contributed to the literature by identifying areas in which the application of DTT may vary as a function of setting.

Limitations

Limitations of this experiment should be noted. First, due to the COVID-19 pandemic, recruitment was interrupted and therefore only two participants were observed in each setting. Although over 65 trials were observed for each participant, it remains unclear whether differences observed across settings vary as a function of setting or by participant. Despite this, these findings highlight the importance of further exploration of this topic.

Second, tutors were aware that researchers were observing the accuracy in which DTT was implemented. As a result, it is possible that DTT accuracy was higher than would be observed when evaluations aren't being conducted. However, tutors may be a population that is less reactive to this form of bias due to the frequency in which they are evaluated and observed on a day-to-day basis.

Finally, it is difficult to determine whether these results would generalize to programs that offer EIBI treatment in similar settings. However, the current study provided extensive details when describing the characteristics of each setting. This will allow service providers and

researchers to consider the generality of these findings with respect to a service setting in which they have observed.

Experiment 3: Measures of Service Intensity and Comprehensiveness

The purpose of this experiment was to examine two aspects of service as a function of setting: intensity and comprehensiveness. First, the numbers of learning opportunities created in each setting (i.e., intensity) were compared by analyzing the number of teaching trials delivered. Second, the proportions of total trials delivered in each ABLLS-R curriculum domain (i.e., comprehensiveness) was compared across settings.

Information regarding the child's response type (i.e., independent, prompted, error) was also available and was therefore collected and compared across settings. While this data does not relate to the effect of setting on service intensity or comprehensiveness, it is possible that service setting may also impact the child's response. For example, programming targets may be less challenging in a learning environment with limited therapist control or supervision. As a result, a child may be more likely to make more independent than error responses. A comparison of response type across settings may indirectly provide information regarding the difficulty of instructions provided across settings. Therefore, response type was evaluated and compared across settings.

Method

Participants

Service intensity and comprehensiveness were analyzed by accessing scanned service data sheets for teaching trials delivered to children enrolled in the St.Amant ELP. All data sheets were collected for 10 service days spanning from May 1 to 14, 2019. Data sheets were collected only for children who received services in Winnipeg from a tutor with at least 3 months of experience in their role with St.Amant. This sample included a total of 64 children. From the 64

children, 11 were excluded from this experiment because their scanned data sheets were not dated or the printing was illegible. The final sample included datasheets for 53 children. Of these children, 24 received services in an integrated child care setting during the 10-day service period, and 29 received services in an ABA classroom. Regarding differences in child characteristics across settings, children were compared on age and a scored of Autism Severity (PDDBI). Date of birth was available for 62% of children receiving service in integrated child care and 93% of children in classrooms. The average age of children in integrated child care was 52.6 months (SD = 9.38) and 58.9 months (SD = 8.25) in the classroom. Scores of autism severity were available for 42% of children receiving service in integrated child care settings and 52% of children in classrooms. The average PDDBI score for children in integrated child care settings was 42 (SD = 14.49) and 46.48 (SD = 12.85) in the classroom. Given that both age and scores of autism severity did not differ significantly across settings ($p > .05$), these variables were not controlled for.

The average number of months of tutor (N = 53) experience working with the St.Amant ELP was calculated for each setting. Tutors providing service in integrated child care centres had an average of 16 (SD = 13.31) months of experience ranging from 3-55 months. Those working in ABA classrooms had an average of 28.7 (SD = 23) months of experience, ranging from 3-79 months. Months of experience working with St.Amant did not differ significantly across settings ($p > .05$). It is noteworthy that the group of tutors working in ABA classrooms included five individuals with over 66 months of experience each. These outliers significantly increased the average experience for tutors in the ABA classroom. Without these outliers the ABA classroom mean experience was more comparable at 21.5 months of experience (SD = 15.3), ranging from 3-56. These outliers were not excluded from the analysis. Regarding Autism Consultants who were responsible for developing the child's programming. There were approximately 7

consultants responsible for programming in the ABA classroom and approximately 18 consultants assigned to children receiving service in the community.

Materials and Procedure

Service data sheets provided trial-by-trial information regarding the child's response to the tutor's instruction in addition to the targeted ABLLS-R curriculum domain (e.g., group instruction, imitation). See appendix C for an example of a standard service datasheet including mock data. Trials included in the present analysis included those delivered as a baseline assessment, standard trials for skills currently in teaching, error correction trials, and generalization trials. Each client was grouped according to service setting and the numbers of teaching trials delivered were tallied for each client. Each trial was coded as either a correct independent response, prompted response, or incorrect response. Each trial was also coded according to its ABBLS-R curriculum domain (e.g., imitation, reading, etc.). If the child had programming that did not fall directly under an ABLLS-R skill domain, it was coded as "other". The ABLLS-R has 26 distinct curriculum domains. For the purpose of this study, each curriculum domain was placed in one of six categories: Basic learner skills, academic, self-help, motor skills, classroom skills, and other. See Table 4 for the categorization of these domains. Note that the number of curriculum domains sorted under each category were not equivalent.

Maintenance trials were not analyzed. Tutors recorded maintenance data on distinct datasheets. Maintenance datasheets may be collected by the Senior Tutor at considerably longer intervals (e.g., bi-monthly, annually) than the sample period. Therefore, for any given child there would be an unknown number of maintenance datasheets that wouldn't be scanned into the electronic database unless the sample period were much longer.

The number of service days on which the child was present during the data collection period (i.e., May 1 to 14, 2019) was also recorded. A child was considered "present" on a service

day if there was at least one trial recorded for that service date. The final database included the following information for each child: client ID, service setting, total days of service, the number of trials delivered in each domain and the response type for each trial (i.e., independent, prompt, error).

Data Analysis

The average number of teaching trials delivered per day was calculated for each child by dividing the total number of trials delivered across the sample period by the number of service days for which the child was present. An independent-sample *t*-test was then used to compare the mean number of teaching trials delivered on average per day across both settings (2-tailed, $\alpha = .05$). Next, descriptive statistics were used to analyze and compare across settings, (a) the proportions of total trials that were delivered in each curriculum domain, and (b) the proportions of total trials that were recorded as an independent, prompted, or erred response. The mean numbers of trials delivered per day for each curriculum domain and for each response type are also reported for each setting.

In order to minimize the risk of reducing power and sample size, tutor experience was not controlled for. To evaluate tutor experience as a possible confounding variable, a Pearson correlation was used to determine whether a relationship existed between experience and the average number of trials delivered per day. Pearson correlations revealed that there was no statistically significant relationship between experience and the average number of trials delivered per day for all tutors ($r(53) = -.16$, $p = .26$). Correlations run separately for tutors working ABA classrooms ($r(32) = .12$, $p = .51$) and in integrated child care centres ($r(24) = -.34$. $p = .10$) were also not significant.

Results

Average Number of Trials Delivered Per Day

Over the 10 day data collection period, children who received service in an integrated child care setting ($N = 24$) were present for an average of 7.58 days ($SD = 2.10$), and children who received service in an ABA classroom ($N = 29$) were present for an average of 7.65 days ($SD = 1.79$). The average numbers of trials delivered per day in integrated child care settings ($M = 43.93$, $SD = 20.01$) and in ABA classrooms ($M = 44.16$, $SD = 25.15$) did not differ significantly, $t(51) = .04$, $p = .97$.

Trials Across Curriculum Domains

The mean number of trials delivered per day for each curriculum domain was calculated (see Table 5): Basic learner skills ($M_{IntC} = 32.98$, $SD = 20.79$, $M_{Clrm} = 27.76$, $SD = 13.15$), academic ($M_{IntC} = 5.68$, $SD = 7.95$, $M_{Clrm} = 4.65$, $SD = 5.21$), self-help ($M_{IntC} = .70$, $SD = 1.46$, $M_{Clrm} = 4.0$, $SD = 11.13$), fine and gross motor skills ($M_{IntC} = .52$, $SD = .99$, $M_{Clrm} = 2.01$, $SD = 4.17$), classroom skills ($M_{IntC} = 3.97$, $SD = 4.06$, $M_{Clrm} = 4.61$, $SD = 5.8$), and other ($M_{IntC} = .08$, $SD = .35$, $M_{Clrm} = 1.2$, $SD = 3.88$). In order to reduce the risk of type 1 error, inferential statistics were not used to analyze this data.

Trials Across Response Type

The mean number of trials per day for each response type was also calculated (see Table 5): Independent ($M_{IntC} = 17.66$, $SD = 9.89$, $M_{Clrm} = 20.30$, $SD = 12.31$), prompted ($M_{IntC} = 21.29$, $SD = 17.07$, $M_{Clrm} = 19.77$, $SD = 14.34$), and error ($M_{IntC} = 4.34$, $SD = 3.54$, $M_{Clrm} = 4.08$, $SD = 3.11$). Given the high variability of the data, inferential statistics were not used to compare these means.

Data Entry and Reliability

Reliability checks were conducted in two ways. First, to ensure the accuracy of coding scanned datasheets, an independent reliability check was conducted for records of 38% of children include in the study. Therefore records for a total of 20 children (10 in each setting) were re-coded by an independent research assistant. The research assistant was blind to the settings of service and did not have access to any identifying information regarding the children or the tutors providing service. Agreement was calculated at an average of 93%. Second, to ensure the accuracy in which the data was entered into the project database, 100% of the records were verified. Data entry accuracy was reported at 100%.

Discussion

These results suggest that service setting does not impact numbers of learning opportunities created and recorded in each setting (i.e., intensity). However, these results demonstrate that children receiving service in ABA classrooms received more comprehensive programming (see Table 5). While in both settings the large majority of programming targets basic learner skills, the distribution across the remaining curriculum domains were more equally dispersed in ABA Classrooms. More specifically, programming targeting self-help, fine and gross motor skills, and skills outside of the ABLLS-R curriculum (i.e., other), were lacking in integrated child care centres (i.e., less than one teaching trial per day).

This finding contradicts a result described in Experiment 1. According to tutors, their ability to deliver programming at the intended frequency was superior in ABA classroom; however, setting did not impact their ability to deliver programming across various curriculum domains. While these results are inconsistent, it is possible that Autism Consultants select programming and their intended frequency according to a structure and routine that is specific to that setting. For example, if there are limited opportunities to teach self-help skills in a daycare,

programming for this skill may not be provided to the tutor or the expectations regarding the frequency that the program may be adjusted appropriately. Therefore, tutors in Experiment 1 may have responded to the survey concerning their ability to deliver programs that were provided to them, rather than the total opportunities available to target various domains.

Notwithstanding the present findings regarding the effect of setting on curriculum delivery and planning, it remains difficult to define whether each setting meets the criteria of being "comprehensive." EIBI programming is highly individualized and therefore the breadth of domains targeted at any given time will vary significantly between children. There is no standard number of trials that should be delivered across each domain in order to be considered comprehensive. Nevertheless, these results suggest that the ability of the service team to create opportunities in each domain may be superior in ABA classrooms.

Service setting did not appear to affect the average number trials delivered across response type (see Table 5). Results in both settings appear to be consistent with errorless learning procedures that are standard to DTT application: error responses account for approximately 10% of total responses in both settings. Independent and prompted responses account for the remaining proportions of responses at a relatively even split. This further suggests that setting may not impact the relative difficulty of instructions delivered and also consistent application of prompt fading procedures—a finding inconsistent with that of Experiment 2. According to direct observations of DTT conducted in each setting, tutors' accuracy of prompt fading was superior in ABA classrooms.

In summary, this experiment provided three important findings. First, the amount of service delivered does not differ as a function of setting. Second, the ability of the treatment team to develop and deliver a comprehensive program plan may be superior in ABA classrooms. Third, the proportions of responses across response types do not differ as a function of setting,

suggesting that the use of prompt fading techniques in addition to the difficulty of programming, relative to the child, does not vary across settings.

Limitations

Despite the important contribution of these results to the literature examining the effect of service setting on EIBI treatment quality, a number of limitations should be noted. First, this data may not account for all teaching trials delivered on a service day. As described above, data from maintenance trials were excluded from the analysis. There are reasons to suspect that the number of maintenance trials delivered may be variable across children. The frequency in which maintenance trials are delivered may vary based on instructions provided by the consultant and also based on the child's level of functioning. For example, a higher functioning child may be more likely to have more skills assessed for maintenance compared to a lower functioning child. Furthermore, it was determined that during the data collection period, two children had a behavioural intervention plan (BIP) in place (ABA classroom = 1, Integrated child care = 1). A BIP is a detailed individualized treatment plan based on functional assessment of specified problem behaviour. A BIP may take considerable time to implement and thereby less programmed teaching trials may be in effect. It is important to note that a BIP would likely contain targets for developing new skills which may or may not be tracked on daily data sheets. However, given that only 2 of 53 children had a BIP in place at that time, the effect of this is likely limited.

Finally, the data does not reflect any skill probes that may have been conducted by a Senior Tutor or Autism Tutor during the data collection period. Skill probes are typically collected twice per year, which may take approximately one to three full days. Any data from skill probes were not included in this analysis. Efforts were made to select a data collection period that would be less likely affected by this process; however, it is difficult to determine

whether or not this may have occurred for some children throughout the data collection period. Although these factors that may contribute to variability across children and tutors, there is little reason to believe that these variables would vary based on service setting.

Second, a significant amount of variability across children was observed. This is not surprising given the variability across levels of functioning of children with ASD in addition to the importance of individualized programming in EIBI and ABA treatments. However, this makes it difficult to analyze the data using inferential statistics, thereby making it difficult to make strong inferences when comparing two populations. While it is important to note that variability in children may affect programing, variability may also exist across consultants who develop the programming. There are more consultants who are assigned to children in the integrated child care settings compared the ABA classrooms. Each ABA classroom has 1-2 consultants (7 in total) that are responsible for developing programming for each child in the classroom. This leaves approximately 18 consultants assigned to children receiving service in the community. Therefore, it is difficult to determine whether the consultants who develop the programming and data collection procedures may affect the results observed.

Third, due to the abundance of data entry required, the data collection period spans only 10 service days. It is difficult to determine whether the results provided would generalize to a much larger sample of service days. Finally, this data is retrospective and therefore the researcher had no control on how the data was collected and the accuracy of this behaviour. Furthermore, it is difficult to determine whether all datasheets were included in the child's electronic folder. The scanning of data sheets is a systematic task included in the role as a Senior Tutor. Although it is expected that Senior Tutors follow through with this task on a regular basis, St.Amant staff provided a prompt to all Senior Tutors requesting that all data sheets were scanned appropriately for the data collection period.

General Discussion

Though the effectiveness of EIBI has been demonstrated across a number of meta-analysis and reviews (Reichow et al., 2012), the literature also demonstrates that not all EIBI programs produce equivalent child outcomes (e.g., Hayward et al., 2009, Magiati et al., 2007). For this reason, it is imperative that researchers continue to acknowledge variations in program features and how this may contribute to variability in outcomes. Therefore, the current study aimed to explore whether the delivery of EIBI services varied as a function of service setting. Two service settings were examined as an independent variable: ABA classrooms and integrated child care settings. As dependent variables, DTT integrity, program comprehensiveness, quantity of teaching trials, and the perceptions of Autism Tutors regarding treatment quality were compared across settings. The current study has demonstrated that the delivery of EIBI does vary as a function of service setting. Specifically, differences in the treatment integrity of DTT, program comprehensiveness, and quality of team communication were observed.

Across all three experiments, results favored the delivery of services in ABA classrooms in comparison to integrated child care centres. According to Autism Tutors, treatment integrity, team communication and training, and the delivery of programming at the intended frequency is better supported through the ABA classroom environment. Additionally, higher treatment integrity was also observed in ABA classrooms through direct observations. Finally, a retrospective analysis of service data revealed that programming was more comprehensive in ABA classrooms though the numbers of teaching trials delivered did not differ across setting.

Previous research has demonstrated that EIBI treatment integrity is at risk when the learning environment allows for minimal therapist control and staff supervision, and the inclusion of staff who are not adequately trained in ABA (Eikeseth et al., 2011; Jacobson & Mulick, 2000; Perry et al. 2008; Symes et al., 2006). The two settings defined in the present

study differed substantially with respect to each of these important features. The finding that treatment integrity was superior in ABA classrooms is therefore consistent with previous literature.

Furthermore, high quality EIBI treatments models are characterized by treatment that is comprehensive and delivered with high intensity (Green et al., 2002). A child with ASD often requires skill development across several curriculum domains, therefore programming that is comprehensive is key to the delivery of an effective EIBI treatment model (Gould et al., 2011; Hayward et al., 2009). While both settings appear to offer a comparable number of teaching trials, the ability to develop and deliver programming that is comprehensive may be more successful when the client is receiving services in an ABA classroom.

Future research should prioritize examining both the effect that service setting has on the characteristics of program models, and also effects on treatment outcomes. Most importantly a direct assessment of DTT across settings should be replicated with a larger sample size. The current study has also identified other variables that should be directly examined. This includes the effect of setting on parent training, staff supervision, and skill generalization to the natural environment. Future research also should conduct a prospective analysis that examines the number of teaching trials that are delivered in addition to number of learning opportunities that are available. Finally, future research should provide a detailed description of characteristics that accompany the setting in which treatment is delivered. This will allow for the reader to make stronger inferences regarding the generalizability of these results.

The current study has a number of important implications for future research, service providers, and individuals receiving treatment. First, this project highlights the importance of examining service setting as an independent variable. This will facilitate the understanding of how setting impacts EIBI programming and thereby child outcomes. Second, these findings may

prompt service providers to evaluate whether the characteristics associated with their service setting are impacting the quality of EIBI treatment. Third, when options are available, these findings will allow for a more informed decision when caregivers are selecting the child's location of service. Finally, the current study has important policy implications—the prioritization of funds can be better informed through examining both program and cost effectiveness of treatment across settings.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

Anagnostou, E., Zwaigenbaum, L., Szatmari, P., Fombonne, E., Fernandez, B. A., Woodbury-Smith, M., Brian, J., Bryon, S., Smith, I., Drmic, J., & Buchanan, J. A., Roberts, W., & Scherer, S.W. (2014). Autism spectrum disorder: Advances in evidence-based practice. *Canadian Medical Association Journal*, *186*(7), 509-519.

Babel, D., Martin, G., Fazzio, D., Arnal, L., & Thomson, K. (2008). Assessment of the reliability and validity of the discrete-trials teaching evaluation form. *Developmental Disabilities Bulletin, 36*, 67-80.

Carroll, R., Kodak, T., & Fisher, W. (2013). An evaluation of programmed treatment- integrity errors during discrete-trials instruction. *Journal of Applied Behavior Analysis, 46*(2), 379-394.

Chasson, G.S., Harris, G. E., & Neely, W. J., (2007). Cost comparison of early intensive behavioral intervention and special education for children with autism. *Journal of Child and Family Studies, 16,* 401-413.

Denne, T., Thomas, E., Hastings, R., & Hughes. J. C. (2015). Assessing competencies in applied behavior analysis for tutors working with children with autism in a school-based setting. *Research in Autism Spectrum Disorders, 20*, 67-77.

Department of Health. (1999). *Clinical practice guideline: The guideline technical report – autism/pervasive developmental disabilities, assessment and intervention*. Albany, NY: New York State Department of Health.

DiGennaro Reed, F., & Codding, R. (2014). Introduction: Advancements in procedural fidelity assessment and intervention: Introduction to the special issue. *Journal of Behavioral Education, 23*(1), 1-18.

DiGennaro Reed, F., Reed, D. D., Baez, C. N., & Maguire, H. (2011). A parametric analysis of errors of commission during discrete-trial training. *Journal of Applied Behavior Analysis, 44*, 611–615.

Dimian, A., Symons, F., & Wolff, J. (2020). Delay to Early Intensive Behavioral Intervention and Educational Outcomes for a Medicaid-Enrolled Cohort of Children with Autism. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-020-04586-1

Dixon, D., Burns, R., Granpeesheh, C., Amarasinghe, O., Powell, D., & Linstead, R. (2017). A program evaluation of home and center-based treatment for autism spectrum disorder. *Behavior Analysis in Practice, 10*(3), 307-312.

Downs, A., & Downs, R. C. (2013). Training new instructors to implement discrete trial teaching strategies with children with autism in a community-based intervention program. *Focus on Autism and Other Developmental Disabilities*, *28*(4), 212-221.

Eikeseth, S., Klintwall, L., Jahr, E., & Karlsson, P. (2011). Outcome for children with autism receiving early and intensive behavioural intervention in mainstream preschool and kindergarten settings. *Research in Autism Spectrum Disorders, 6,* 829-835.

Fazzio, D., Arnal, L., & Martin, G. (2007) Discrete-trials teaching evaluation form (DTTEF). Unpublished scoring form, University of Manitoba, Canada.

Fazzio, D., & Martin, G. L. (2011). Discrete-trials teaching with children with autism: A self-instructional manual. Winnipeg, Manitoba*: Hugo Science Press.*

Foxx, R. M. (2008). Applied behavior analysis treatment of autism: The state of the art. *Child*

and adolescent psychiatric clinics of North America, *17*(4), 821-834.

Ganz, M. L. (2007). The lifetime distribution of the incremental societal costs of autism. *Archives of pediatrics & adolescent medicine*, *161*(4), 343-349.

Gould, E., Dixon, D., Najdowski, A., Smith, M., & Tarbox, J. (2011). A review of assessments for determining the content of early intensive behavioral intervention programs for autism spectrum disorders. *Research in Autism Spectrum Disorders*, *5*(3), 990–1002. https://doi.org/10.1016/j.rasd.2011.01.012

Granpeesheh, D., Tarbox, J., Najdowski, A. C., & Kornack, J. (2014). Evidence-based treatment for children with autism: the CARD model. Waltham, MA: Elsevier.

Green, G. (1996). Early behavioral intervention for autism: What does the research tell us? In C. Maurice, G. Green, & S. C. Luce (Eds.), *Behavioral intervention for young children with autism: A manual for parents and professionals* (pp. 29–44). Austin, TX: Pro-Ed.

Green, G., Brennan, L. C., & Fein, D. (2002). Intensive behavioral treatment for a toddler at high risk for autism. *Behavior Modification, 26*, 69–102.

Green, V. A., Pituch, K. A., Itchon, J., Choi, A., O'Reilly, M., & Sigafoos, J. (2006). Internet survey of treatments used by parents of children with autism. *Research in Developmental Disabilities, 27*, 70–84.

Greer, R. D., & McDonough, S. H. (1999) 'Is the learn unit a fundamental measure of pedagogy?' *The Behavior Analyst*, *22*, 5-16.

Happe, F. (2011). Criteria, categories and continua: Autism and related disorders in DSM-5. *Journal of the American Academy of Child and Adolescent Psychiatry, 50*, 540–542.

Hayward, D., Gale, C., & Eikeseth, S. (2009). Intensive behavioural intervention for young children with autism: A research-based service model. *Research in Autism Spectrum Disorders, 3,* 571.580

Hirst, J. M., & DiGennaro Reed, F. D. (2014). An examination of the effects of feedback accuracy on academic task acquisition in analogue settings. *The Psychological Record, 65*(1), 49-65.

Holcombe, A., Wolery, M., & Snyder, E. (1994). Effects of two levels of procedural fidelity with constant time delay on children's learning. *Journal of Behavioral Education, 4*, 49-73.

Human Resources and Skills Development Canada. (2010). *Early childhood education and care in Canada.* Retrieved from: http://www.ecd-elcc.ca/eng/ecd/ececc/early_childhood_education-eng.pdf

Jacobson, J.W., & Mulick, J. A. (2000). System and cost research issues in treatments for people with autistic disorders. *Journal of Autism and Developmental Disorders, 30*, 585–593.

Jacobson, J.W, Mulick, J. A, & Green, G. (1998). Cost-benefit estimates for early intensive behavioral intervention for young children with autism – general model and single state case. *Behavioural Interventions, 13*(4), 201-226.

Jeanson, B., Thiessen, C., Thomson, K., Vermeulen, R., Martin G., & Yu, C. T. (2010). Field-testing of the discrete-trials teaching evaluation form. *Research in Autism Spectrum Disorders, 4*(4), 718-723.

Jenkins, S. R., Hirst, J. M., & DiGennaro Reed, D. (2015). The effects of discrete-trial training commission errors on learner outcomes: An extension. *Journal of Behavioral Education, 24*(2), 196-209.

Kazdin, A. E. (2011). Single-case research designs: Methods for clinical and applied settings. New York: Oxford University Press.

Kuppens, S. & Onghena, P. (2012). Sequential meta-analysis to determine the sufficiency of cumulative knowledge: The case of early intensive behavioral intervention for children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 6*, 168-176.

Langh, U., Cauvet, E., Hammar, M., & Bolte, S. (2017). Cross-cultural validation of the York Measure of Quality of Intensive Behavioral Intervention. *Behavior Modification, 41*(6), 808-828.

LeBlanc, L. A., & Gillis, J. M. (2012). Behavioral interventions for children with autism spectrum disorders. *Pediatric Clinics of North America*, *59*(1), 147-164.

Lechago, S. A., & Carr, J. E. (2008). Recommendations for reporting independent variables in outcome studies of early and intensive behavioral intervention for autism. *Behavior Modification, 32*(4), 489-503.

Leon, Y., Wilder, D. A., Majdalany, L., Myers, K., & Saini, V. (2014). Errors of omission and commission during alternative reinforcement of compliance: The effects of varying levels of treatment integrity. *Journal of Behavioral Education, 23*(1), 19-33.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology,* 55, 3–9.

Lovaas, O. I. (2003) *Teaching Individuals with Developmental Delays: Basic Intervention Techniques*. Austin, TX: PRO-ED Inc.

Madore, O., & Paré, J. R. (2006). *Provincial and territorial funding programs for autism therapy*. Ottawa, ON: Library of Parliament. Issue: PRB 06-22E.

Magiati, I., Charman, T., & Howlin, P. (2007). A two-year prospective follow-up study of community-based early intensive behavioural intervention and specialist nursery provision for children with autism spectrum disorders. *Journal of Child Psychology and Psychiatry*, *48*(8), 803–812. https://doi.org/10.1111/j.1469-7610.2007.01756.x

Makrygianni, M. K., & Reed, P. (2010). A meta-analytic review of the effectiveness of behavioural early intervention programs for children with autistic spectrum disorders.

Research in Autism Spectrum Disorders, 4, 577–593.

Manning-Courtney, P., Murray, D., Currans, K., Johnson, H., Bing. N., Kroeger-Geoppinger, K., Sorensen, R., Bass, J., Reinhold, J., Johnson, A., & Messerschmidt, T. (2013). Autism spectrum disorders. *Current problems in pediatric and adolescent health care*, *43*(1), 2-11

Martin, G., & Pear, J. (2015). *Behavior modification: What it is and how to do it?* (10th ed.). Upper Saddle River, NJ: Prentice Hall.

Motiwala, S. S., Gupta, S., Lily, M., Ungar, W., & Coyte, P. (2006). The cost-effectiveness of expanding intensive behavioural intervention to all autistic children in Ontario. *Healthcare Policy, 1*(2), 135-151.

Nahmias A. S., Kase, C., & Mandell, D. S. (2012). Comparing cognitive outcomes among children with autism spectrum disorders receiving community-based early intervention in one of three placements. *Autism, 18*(3), 311-320.

Ouellette-Kuntz, H., Coo, H., Lam, M., Breitenbach, M. M., Hennessey, P. E., Jackman, P. D., Lewis, M. E., Dewey, D., Bernier, F. P., & Chung, A. M. (2014). The changing prevalence of autism in three regions of Canada. *Journal of Autism and Developmental Disorders, 44*(1), 120-136.

Parsons, S., Guldberg, K., MacLeod, A., Jones, G., Prunty, A., & Balfe, T. (2011). International review of the evidence on best practice in educational provision for children on the autism spectrum. *European Journal of Special Needs Education, 26*(1), 47-63.

Pedreira, K. (2017). *Evaluating the impact of service setting on early intensive behavioural intervention outcomes for children with autism spectrum disorder.* (Masters thesis, University of Manitoba). Retrieved from http://hdl.handle.net/1993/32243

Penn, H. E., Prichard, E. A., & Perry, A. (2007). The reliability and validity of a pilot version of

the York Measure of Quality of Intensive Behavioural Intervention. *Journal on Developmental Disabilities*, *13*, 149-166

Perry, A., Cummings, A., Dunn Geier, J., Freeman, N., Hughes, S., LaRose, L., Managhan, T., Reitzel, J. A., & Williams, J. (2008). Effectiveness of intensive behavioral intervention in a large, community-based program. *Research in Autism Spectrum Disorders, 2*, 621–642.

Perry, A., Prichard, E. A., & Penn, H. E. (2006). Indicators of quality teaching in Intensive Behavioral Intervention: A survey of parents and professionals. *Behavioral Interventions, 21*, 85–96.

Peters-Scheffer, N., Didden, R., Korzilius, H. & Sturmey, P. (2011). A meta-analytic study on the effectiveness of comprehensive ABA-based early intervention programs for children with Autism Spectrum Disorders. *Research in Autism Spectrum Disorders, 5*, 60-69.

Piccininni, C., Bisnaire, L., & Penner, M. (2017). Cost-effectiveness ofwait time reduction for intensive behavioral intervention services in Ontario, Canada. JAMA Pediatrics, 171(1), 23–30. https://doi.org/10.1001/jamapediatrics.2016.2695

Public Health Agency of Canada. (2018). *Autism Spectrum Disorder among Children and Youth in Canada 2018.* Retrieved from: https://www.canada.ca/en/public-health/services/publications/diseases-conditions/autism-spectrum-disorder-children-youth-canada-2018.html

Reichow, B., Barton, E. E., Boyd, B. A., & Hume, K. (2012). Early intensive behavioral intervention (EIBI) for young children with autism spectrum disorders (ASD). *Cochrane Database Syst Rev*, *10*(10).

Rivard, M., Terroux, A., & Mercier, C. (2014). Effectiveness of early behavioral intervention in public and mainstream settings: The case of preschool-age children with autism spectrum

disorders. *Research in Autism Spectrum Disorders*, *8*(9), 1031–1043. https://doi.org/10.1016/j.rasd.2014.05.010

Roberts, J., Williams, K., Carter, M., Evans, D., Parmenter, T., Sie, N., Clark, T., & Warren, T. (2011) A randomized controlled trial of two early intervention programs for young children with autism: Centre-Based with parent program and home-based. *Research in Autism Spectrum Disorder, 5,* 1553-1566.

Shattuck, P. T., Durkin, M., Maenner, M., Newschaffer, C., Mandell, D. S., Wiggins, L., Lee, L., Rice, C., Giarelli, E., Kirby, R., Baio, J., Pinto-Martin, J., & Cuniff, C. (2009). Timing of Identification among Children with an Autism Spectrum Disorder: Findings from a Population-Based Surveillance Study. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(5), 474-483.

Smith, T. (2001). Discrete trial training in the treatment of autism. *Focus on Autism and Other Developmental Disabilities, 16*, 86-92.

St. Peter Pipkin, C., Vollmer, T. R., & Sloman, K. N. (2010). Effects of treatment integrity failures during differential reinforcement of alternative behavior: A translational model. *Journal of Applied Behavior Analysis, 43*, 47–70.

Symes, M. D., Remington, B., Brown, T., & Hastings, R. P. (2006). Early intensive behavioral intervention for children with autism: Therapists' perspectives on achieving procedural fidelity. *Research in Developmental Disabilities*, *27*(1), 30-42.

The Community Child Care Standards Act. (2016). Manitoba Laws. Retrieved from http://web2.gov.mb.ca/laws/statutes/ccsm/c158e.php

Thomson, K., Martin, G., Arnal, L., Fazzio, D., & Yu, C.T. (2009). Instructing individuals to deliver discrete-trials teaching to children with autism spectrum disorders: A review. *Research in Autism Spectrum Disorders*, *3*, 590–606.

Tsiplova, K., Ungar, W., Flanagan, H., den Otter, J., Waddell, C., Murray, P., D'Entremont, B., Léger, N., Garon, N., Bryson, S., & Smith, I. (2019). Types of Services and Costs of Programs for Preschoolers with Autism Spectrum Disorder Across Sectors: A Comparison of Two Canadian Provinces. *Journal of Autism and Developmental Disorders*, *49*(6), 2492–2508. https://doi.org/10.1007/s10803-019-03993-3

Virués-Ortega, J. (2010). Applied behavior analytic intervention for autism in early childhood: Meta- analysis, meta-regression and dose–response meta-analysis of multiple outcomes. *Clinical psychology review*, *30*(4), 387-399.

Wightman, J. (2016). *Teaching Staff Who Work with Children with Autism Spectrum Disorders to Evaluate the Treatment Integrity of Discrete-Trials Teaching Sessions*. (Doctoral Dissertation, University of Manitoba). Retrieved from: http://hdl.handle.net/1993/31036

Wright, L .(2012). *Intensive Behavioral Intervention in a Community-based Program for Children with Autism: A Retrospective Effectiveness Study*. (Doctoral dissertation, University of Manitoba). Retrieved from http://hdl.handle.net/1993/8254

Yingling, M. E., Hock, R. M., & Bell, B. A. (2018). Time-lag between diagnosis of Autism spectrum disorder and onset of publicly-funded early intensive behavioral intervention: Do race–ethnicity and neighbourhood matter? *Journal of autism and developmental disorders, 48*(2), 561–571.

Appendix A

PART 1 – RESPONDENT CHARACTERISTICS

1. How long have you been working as a Tutor for the St.Amant Autism Program?

   - ☐ Under 3 months
   - ☐ 3-12 months
   - ☐ 1-2 years
   - ☐ Over 2 years

2. Please indicate your highest level of education (either completed or in progress).

   - ☐ High school
   - ☐ Undergraduate degree
   - ☐ Graduate degree

3. Please list the names of all post-secondary courses you have completed with a focus on applied/experimental analysis of behaviour, intellectual/developmental disabilities.

4. Please indicate the service setting(s) in which you have worked in the past 6 months:

   - ☐ Integrated Childcare settings (i.e., daycares and preschools)
   - ☐ ABA Classrooms

PART 2 – EFFECT OF SERVICE SETTING ON TREATMENT QUALITY

Questions 5-6: To what extent do you find the following statements to be true?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5. The setting where behaviour intervention services are delivered affects service quality.	☐	☐	☐	☐	☐
6. The setting where you were trained as an ABA tutor affects the quality of training you received.	☐	☐	☐	☐	☐

PART 2A – Complete Part 2A if you have provided services in a child care facility in the past 6 months. If not, please proceed to Part 2B.

Questions 7-8: ***Core Characteristics of Integrated Child Care Settings.***

How do the following features affect the quality of service you provide?

	Negatively	Somewhat Negatively	No Effect	Somewhat Positively	Positively
7. Providing service in a child care facility means that developing peers are nearby.	☐	☐	☐	☐	☐
8. Providing service in a child care facility typically means that daycare or preschool providers who are not trained in ABA plan the daily routine.	☐	☐	☐	☐	☐

Questions 9-17: ***Running Teaching Trials.***

Please indicate how working in a child care facility affects your ability to do the following.

	Negatively	Somewhat Negatively	No Effect	Somewhat Positively	Positively
9. Deliver programs on a daily basis or as prescribed by Autism Consultant.	☐	☐	☐	☐	☐
10. Deliver programs for basic learner skills (e.g., requesting, labeling, receptive language, intraverbals).	☐	☐	☐	☐	☐
11. Deliver programs for social skills (e.g., play skills, social interactions).	☐	☐	☐	☐	☐
12. Deliver programs for following group instructions and classroom routines.	☐	☐	☐	☐	☐
13. Deliver programs for academic skills (e.g., writing, math, reading).	☐	☐	☐	☐	☐

14. Arrange the teaching setting? (e.g., necessary materials within reach of the teacher, any unnecessary materials are out of reach of the child)	☐	☐	☐	☐	☐
15. Secure the child's attention prior to delivering an instruction?	☐	☐	☐	☐	☐
16. Present the correct antecedent (i.e., instruction, prompt, and or prompt fading procedures)?	☐	☐	☐	☐	☐
17. Present the correct consequence (i.e., praise, or error correction procedure)?	☐	☐	☐	☐	☐

Questions 18-19*: Communication and Training.*

Please indicate how working in a child care facility affects your ability to do the following.

	Negatively	**Somewhat Negatively**	**No Effect**	**Somewhat Positively**	**Positively**
18. Communicate with team members? (e.g., Autism Consultant, Senior Tutors)	☐	☐	☐	☐	☐
19. Obtain feedback from your supervisor?	☐	☐	☐	☐	☐

20. Are there any other features of child care facility service settings that you think affects the quality of service you provide? If so, what are they?

Part 2B – Complete Part 2B if you have provided services in Autism Program ABA classrooms in the past 6 months. If not, please skip this section.

Questions 21-22: *Core Characteristics of ABA Classrooms.*

How do the following features affect the quality of service you provide?

	Negatively	Somewhat Negatively	No Effect	Somewhat Positively	Positively
20. Providing service in an ABA classroom means that there are other peers who are receiving ABA treatment nearby.	☐	☐	☐	☐	☐
21. Providing service in an ABA classroom means that tutors have continuous access to support from the classroom Senior Tutor.	☐	☐	☐	☐	☐

Questions 22-30: ***Running Teaching Trials.***

Please indicate how working in an ABA classroom affects your ability to do the following.

	Negatively	Somewhat Negatively	No Effect	Somewhat Positively	Positively
22. Deliver programs on a daily basis or as prescribed by Autism Consultant.	☐	☐	☐	☐	☐
23. Deliver programs for basic learner skills (e.g., requesting, labeling, receptive language, intraverbals).	☐	☐	☐	☐	☐
24. Deliver programs for social skills (e.g., play skills, social interactions).	☐	☐	☐	☐	☐
25. Deliver programs for following group instructions and classroom routines.	☐	☐	☐	☐	☐
26. Deliver programs for academic skills (e.g., writing, math, reading).	☐	☐	☐	☐	☐
27. Arrange the teaching setting? (e.g., necessary materials within reach of the teacher, any unnecessary materials are out of reach of the child)	☐	☐	☐	☐	☐

28. Secure the child's attention prior to delivering an instruction?	☐	☐	☐	☐	☐
29. Present the correct antecedent (i.e., instruction, prompt, and or prompt fading procedures)?	☐	☐	☐	☐	☐
30. Present the correct consequence (i.e., praise, or error correction procedure)?	☐	☐	☐	☐	☐

Questions 31-33: ***Communication and Training.***

Please indicate how working in an ABA classroom affects your ability to do the following.

	Negatively	**Somewhat Negatively**	**No Effect**	**Somewhat Positively**	**Positively**
31. Communicate with team members? (e.g., Autism Consultant, Senior Tutors)	☐	☐	☐	☐	☐
32. Obtain feedback from your supervisor?	☐	☐	☐	☐	☐

33. Are there any other features of the ABA classrooms settings that you think affects the quality of service you provide? If so, what are they?

Appendix B

Revised Discrete-Trials Teaching Evaluation Form (DTTEF)[1]

Part 1: Set up

Component 1: Arrange the Teaching Setting

The teacher should arrange the teaching setting.

Correct response:
- The teacher arranges the data sheets, materials, and reinforcers so that they are: (a) convenient for the teacher to reach; and (b) as out-of-reach of the child as is feasible.

Incorrect response:
- One or more of the data sheet, materials, and reinforcers are not in arms reach of the tutor.
- One or more of the data sheet, materials, and reinforcers in arms reach of the child.

Part 2: Antecedents

Component 2: Secure the child's attention

If the child is not attending, the teacher secures the child's attention prior to presenting the instruction.

Correct Response:
- If the child is not attending (i.e., child is looking at the teacher or materials), the teacher secures the child's attention appropriately prior to presenting the instruction.
- Examples of appropriate ways to get the child's attention: the teacher calls the child's name, says "eyes over here", or says "look", or says "ready" or "get ready", or makes gestures to effectively prompt the child to look at teacher or teaching materials, or just waits (no more than 3-4 seconds for the child to attend).

Incorrect Response:
- The teacher presents the instruction when the child is not attending.
- The teacher uses forceful physical guidance to get the child to attend.
- The teacher waves a reinforcer in front of the child.
- The teacher just waits, more than 6 seconds before attempting to get the child's attention to start a trial.

Not Applicable:
- The child is already attending to the teacher/material.

Examples of the child not attending include:
- Fidgeting

[1] The original DTTEF (Fazzio et al., 2007) has been modified for the purpose of this project.

- Dazing
- Leaving the seat
- Making vocalizations that are not directed to teacher or relevant to task
- Attending to a reinforcer from a previous trial

Component 3: Present the correct instruction

The teacher presents the correct instruction for the task in each trial.

A correct instruction has these characteristics:

1. It is simple (i.e., typically no more than 3 or 4 words).
2. It is not interrogative.
3. It is repeated only after 3-5 seconds without a response having elapsed.

Correct Responses:

- The teacher presents a single, simple, non-interrogative instruction that is appropriate to the task, and if applicable, to the specific trial/task item.

Incorrect Responses:

- The teacher presents an extra auditory cue that might prompt a correct response (e.g., "Match the cat" during matching pictures of common items; "Put your arms up" during imitation of hand movements).
- The teacher presents a long instruction, adding several words to the relevant parts of the instruction (e.g., "I would like you to show me one of the pictures on the table, the one that shows a ball").
- The teacher presents an interrogative instruction (e.g., can you match?)
- The teacher repeats the instruction before 3 seconds have elapsed without a response.

Component 4: Fade Prompts Within Trial

If the child does not respond within 4 seconds, the teacher should repeat the instruction and provide an immediate prompt at one step higher (e.g., NP → No response → P2). These two steps are repeated until the child makes a correct response.

For example: In teaching a child to imitate simple actions. The teacher says "Do this" while touching her nose (NP). The child does not respond so then the teacher continues with the same trial and repeats the instruction while gesturing towards the child's hand and nose (P2). The child still does not respond, so the teacher proceeds with the same trial and repeats the instruction while lightly touching the child´s arm raising it slightly towards the child´s nose (P1). The child again does not respond, so while continuing with the same trial, the teacher finally provides full physical guidance (F).

Correct Responses:

- If a child does not respond for 4 seconds, the teacher repeats the instruction and provides and immediate additional prompt at the appropriate level (i.e., 1 step higher than the prompt level that preceded it)

- Both steps are repeated until child makes a correct response.

Incorrect Responses:
- The teacher waits longer than 4 seconds to deliver an additional prompt
- The teacher does not repeat the instruction prior to delivering an additional prompt
- The teacher does not prompt at the appropriate level.

Not Applicable:
- If the child makes an immediate error such that the teacher has less than 1 second to deliver a prompt
- The child responds correctly following the first prompt.
- The first prompt delivered is a full prompt

Component 4a: Record Prompt Level

For observers reference:
- Record the *last* prompt delivered (i.e., prompt delivered that was followed by error or correct response). Note. In some cases only one prompt and/or instruction may be given.
  - Full (F): Hand over hand guidance
  - Partial (P1): Light physical touch
  - Gesture (P2): Pointing/modeling
  - No prompt (NP): No prompt

Part 3: Consequence

Component 5: Following a correct response, praise and present additional reinforcer

The teacher immediately praises the student and presents an additional reinforcer (e.g., token, edible, access to item, access to social interaction).

Correct Responses:
- The teacher presents praise within 1-sec of the correct response and an additional reinforcer within 2-sec of the correct response

Incorrect Responses:
- The teacher does not praise.
- The teacher does not present an additional reinforcer
- The teacher provides reinforcement immediately following the response.

Not Applicable:
- The child's response was incorrect.
- There was no response.

Component 6: Following an incorrect response, block gently, remove materials, show neutral expression for 2-3 seconds.

The teacher interrupts the child's completion of an incorrect response (if possible), removes the materials (if possible), and shows a neutral expression for 2-3 seconds. Note: The teacher doesn't need to make eye contact while performing the neutral expression.

Correct Responses:
- The teacher completes these three steps successfully.
- The teacher attempts to block the response but is unsuccessful and the child completes the response, but the teacher completes the other two steps successfully.
- Vocal Responses: blocking is not applicable. This occurs when the child's response is a vocalization; the teacher cannot block or interrupt vocalizations, but applies the other 2 steps.
- No-material tasks (e.g., motor imitation): removing materials is not applicable. The teacher applies the other 2 steps.

Incorrect Responses:
- The teacher misses one of the three steps if they are all applicable, or one of the last two steps if only they are applicable.

Not Applicable:
- The child's response was correct.
- There was no response.

Component 7: Record response accurately and immediately

The teacher immediately records the response and prompt level on the data sheet.
To score this item you should review the teacher's data sheet. Note: Does not require delivery of the correct prompt level according to the fading procedure in order to be scored as correct.

Correct Response:
- The teacher records the response and prompt level that was delivered before the next trial.

Incorrect Responses:
- The teacher does not record the response and prompt level before the next trial (e.g. she/he does so after two trials, or at the end of the session).
- The teacher does not record either the response or prompt level delivered (or both).

Component 8: Inter-trial interval

The teacher waits at least 3 seconds before presenting the next trial (i.e., presenting instruction)

Correct Response:
- The teacher waits at least 3 seconds before presenting the next trial (i.e., presenting instruction).

Incorrect Responses:
- The teacher presents a new trial immediately without a pause.

Part 4: Error Correction

Component 9: Secure the child's attention

The teacher ensures that the child is attending to him/her and or the teaching materials before starting the trial (i.e., presenting the instruction).

Note: Score this component exactly the same as Component 2

Component 10: Re-present the instruction and prompt immediately to guarantee a correct response.

The teacher (1) re-presents the *same* instruction that was followed by an error (scored exactly the same as component 3) and (2) immediately prompts a correct response, by prompting at one level higher than when the error occurred (e.g., if the child made an error following a partial-1 prompt, a full prompt should be used).
- To be scored as correct, BOTH parts (1 + 2) must be done. If either one is wrong, the whole item is wrong.

Correct Response:
- The teacher re-presents the *same* instruction that was followed by an error (e.g., "Match") and immediately prompts a correct response by prompting at the next highest level as compared to before the error.

Incorrect Response:
- The teacher re-presents the instruction and does not immediately prompt a correct response, or prompts at the same level as before the error.
- The teacher re-presents part of the instruction that is not appropriate (see component 3), does not present the same instruction, or does not re-present the instruction and moves to a new trial.

Not Applicable:
- The child responded correctly prior to re-presenting instruction.

Component 11: Praise only

The teacher praises the correct prompted response.

Correct Response:
- The teacher praises the correct prompted response and does NOT present the additional reinforcer.

Incorrect Response:
- The teacher praises the correct prompted response and presents the additional reinforcer.

- The teacher does not provide verbal praise following the correct prompted response.

Not Applicable:
- The child's response was incorrect.

Component 12: Record response immediately and accurately

The teacher immediately records the response and prompt level.

This component is scored exactly the same as Component 7.

Component 13: Inter-trial interval
This component is scored exactly the same as described previously for Component 8.

DTTEF Score Form

SCORING: ✓= performed correctly; **X** = performed incorrectly; **n/a** = not applicable

COMPONENTS		**TRIALS**									
Set up		1	2	3	4	5	6	7	8	9	10
1. Arrange the Teaching setting											
Antecedent											
2. Secure the child's attention before proceeding											
3. Present the correct instruction.											
4. Fade prompts within trial											
4a. Record *last* prompt level (F/P1/P2/NP):											
Consequence											
Score #5 **OR** #6 -	4. Following a **correct** response, praise & present an additional reinforcer.										
Not both!	5. Following an **incorrect** response, block gently if possible, remove materials or stop gesturing & show a neutral expression for 2-3 s.										
6. Record the response immediately AND accurately.											
7. Allow brief inter-trial interval of 3-10 s.											
Error Correction Trial Following an Error											
8. Secure the child's attention											
9. Re-present the instruction & prompt immediately to guarantee correct response											
10. Praise only											
11. Record the response immediately AND accurately											
12. Allow brief inter-trial interval of 3-10 s.											
Total: ✓											
Total: **X**											
Total: **N/A**											
Percent Accurate = **✓ / (✓ + X)**											

Appendix C

Mock Datasheet

St.Amant	5-Trial Block Data Sheet	Child Initials	St.Amant Autism Programs

Label Body Parts — PROGRAM

"Whats this?" — SD

Q5 — CODE

Date, Initials	Exemplar	Step	Error	Full Prompt	Partial Prompt	Independent
01-May-19	Fingers				✓	
						✓
					✓	
					✓	
					✓	
01-May-19	Fingers				✓	
						✓
						✓
					✓	
01-May-19	Fingers					✓
						✓
						✓
						✓
						✓
01-May-19	Toes			✓		
				✓		
					✓	
					✓	
					✓	
01-May-19	Toes				✓	
						✓
					✓	
						✓
						✓
02-May-19	Toes					✓
						✓
						✓

Date, Initials	Exemplar	Step	Error	Full Prompt	Partial Prompt	Independent
04-May-19	Eyes			✓		
				✓		
			✓			
				✓		
				✓		
04-May-19	Eyes				✓	
					✓	
						✓
						✓
						✓
04-May-19	Eyes					✓
04-May-19	Nose				✓	
					✓	
					✓	
				✓		
					✓	
04-May-19	Nose				✓	
						✓
					✓	
						✓
						✓
04-May-19	Nose					✓

Table 1

Experiment 1 – Descriptive Statistics

Question	*N*	*M*	*SD*
To what extent do you find the following statements to be true? 1 = Strongly disagree, 5 = Strongly agree			
The setting where behaviour intervention services are delivered affects service quality.	45	4.33	.77
The setting where you were trained as an ABA tutor affects the quality of training you received.	45	4.24	.86
How do the following features affect the quality of service you provide? 1 = Negatively, 5 = Positively			
Providing service in a child care facility means that typically developing peers are nearby.	23	4.04	1.11
Providing service in a child care facility typically means that daycare or preschool providers who are not trained in ABA plan the daily routine.	22	3.68	.99
Providing service in an ABA classroom means that there are other peers who are receiving ABA treatment nearby.	31	4.61	.78
Providing service in an ABA classroom means that tutors have continuous access to support from the classroom Senior Tutor.	31	4.77	.62

Table 2

Experiment 1: Comparison of Means – Between and Within Subjects

	Between Subjects Comparison				Within Subjects Comparison			
	Integrated Child Care	ABA Classroom			Integrated Child Care	ABA Classroom		
	N = 11	*N* = 19			*N* = 12			
How does working in (setting) affect your ability to do the following? 1 = Negatively, 5 = Positively	*M (SD)*	*M (SD)*	*t*	*p*	*M (SD)*	*M (SD)*	*t*	*p*
Deliver programs on a daily basis or as prescribed by Autism Consultant.	3.0 (1.0)	4.74 (.73)	-5.47	.0001*	3.42 (1.24)	4.92 (.29)	-4.18	.002*
Delivering programs across various skill domains. [a]	4.45 (.41)	4.69 (.37)	-1.66	.11	3.92 (.72)	4.52 (.52)	-3.01	.012
Arrange the teaching setting?	2.55 (1.44)	4.05 (1.03)	-3.34	.002*	2.92 (1.08)	4.83 (.58)	-4.81	.001*
Secure the child's attention prior to delivering an instruction?	2.45 (.93)	3.79 (1.23)	-3.11	.004*	2.67 (1.07)	4.0 (.95)	-3.55	.005*
Present the correct antecedent?	3.18 (.87)	4.32 (1.0)	-3.12	.004*	3.45 (1.13)	4.73 (.47)	-3.82	.003*
Present the correct consequence?	3.09 (.70)	4.32 (1.0)	-3.92	.001*	3.25 (1.21)	4.58 (.90)	-3.22	.008
Communication and feedback.[b]	3.09 (1.14)	4.79 (.42)	-5.57	.000*	3.25 (1.40)	4.75 (.62)	-3.35	.006*

Note. [a]Four questions related to the delivery of programs across curriculum domains have been collapsed into one variable. [b] Two questions related to team communication and feedback have been collapsed into one variable.
*$p < .007$

Table 3

Experiment 2: Accuracy of Direct Observations on DTT

		Classroom		Integrated Child Care	
Trials (*N*)		78		68	
Tutors (*N*)		2		2	
DTT Accuracy		*M (SD)*		*M (SD)*	
DTTEF components observed per trial		6.63 (1.5)		6.56 (1.2)	
Percent Accuracy		86.91% (9.53)		82.80% (17.12)	
Correct per trial		5.75 (1.47)		5.32 (.93)	
Incorrect per trial		.87 (.76)		1.23 (1.43)	
DTTEF Components		***N***	**Accuracy (%)**	***N***	**Accuracy (%)**
PART 1: SET UP	1. Arrange teaching setting	78	100%	68	52.94%
PART 2: ANTECEDENT	2. Secure attention	78	100%	68	94.12%
	3.Present correct instruction	78	97.87%	68	91.18%
	4. Prompt fading	14	90%	34	32.35%
PART 3: CONSEQUENCE	5. Correct consequence: Correct	71	90%	64	92.19%
	6. Correct Consequence: Error	7	87.5%	4	0%
	7. Record Response	78	51.06%	68	82.35%
	8. Inter-trial Interval	78	100%	68	89.70%
PART 3: ERROR CORRECTION	9. Secure attention	7	100%	4	50%
	10. Re-present instruction/prompt	7	100%	4	50%
	11. Praise only	7	100%	4	50%
	12. Record response	7	57.15%	4	75%
	13. Inter-Trial Interval	7	100%	4	100%

Table 4

Experiment 3 – Categorization of ABLLS-R Domains

ABLLS-R Categories					
Basic Learner Skills	Academic	Self-Help	Motor Skills	Classroom Skills	Other
A – Cooperation B – Visual C – Receptive D – Imitation E –Vocal Imitation F – Requests G – Labeling H – Intraverbal I – Spontaneous Requests J – Syntax/Grammar P – Generalized Responding	Q – Reading R – Math S – Writing T – Spelling	U – Dressing V – Eating W– Grooming X – Toileting	Y – Gross Motor Z – Fine Motor	K – Play L – Social Skills M – Group Instruction N – Classroom Routines	O – Other

Table 5

Experiment 3 – Descriptive Statistics

	Integrated Child Care *N* = 24	ABA Classroom *N* = 29
	M (SD)	*M (SD)*
Days of service	7.58 (2.1)	7.65 (1.79)
Trials delivered per day	43.93 (20.01)	44.16 (23.15)
Trials across curriculum domains per day		
Basic learner skills	32.98 (20.79)	27.76 (13.15)
Academic	5.68 (7.95)	4.65 (5.21)
Self-help	.70 (1.46)	4.0 (11.13)
Fine and gross motor skills	.52(.99)	2.01 (4.17)
Classroom skills	3.97 (4.06)	4.61 (5.8)
Other	.08 (.35)	1.2 (3.88)
Trials across response types per day		
Independent	17.66 (9.89)	20.30 (12.31)
Prompted	21.29 (17.07)	19.77 (14.34)
Error	4.34 (3.54)	4.08 (3.11)