DOCTOR OF PHILOSOPHY

Bridging the gap between research and practice for interventions based on applied behaviour analysis

Foran Conn, Denise

Award date:
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Summary

Interventions based on applied behaviour analysis (ABA) have been demonstrated to be effective in teaching a range of skills to children with autism spectrum disorder (ASD) (Brett, Warnell, McConachie, Parr, 2016; Leaf et al., 2016). Interventions based on ABA can be comprehensive in that they target multiple areas of development; this type of intervention, known as a comprehensive model of education, is designed to have broad impact on the core deficits of ASD (National Research Council, 2001). Other interventions are more focused and address discrete behaviours; these are sometimes known as focused intervention practices (Dixon et al., 2016; Odom, Boyd, Hall, & Hume, 2010).

Educational interventions for young children with ASD that are underpinned by the principles of ABA are related to best outcomes and considered 'treatment as usual' in Northern America (Keenan & Dillenburger, 2011). ABA is covered by medical insurance in at least fifty states in the USA and state educational and disabilities departments implement and fund interventions based on ABA (Autism Speaks, 2019). Early intensive behavioural intervention (EIBI) is also publicly funded in Norway (Eldevik, Titlestad, Aarlie & Tønnesen, 2019) and Canada. Conversely, intervention based on ABA are not typically delivered in maintained schools and other government funded settings in the United Kingdom (UK); instead, provision of this type of intervention is inadequate and uneven (North-Bates, 2016).

The purpose of this thesis was to identify if interventions based on the science of ABA could be feasibly implemented in a maintained special educational needs (SEN) school in the UK. A comprehensive model of educational that delivered low intensity one-to-one teaching hours was developed with key stakeholders; this was evaluated with children with ASD. A number of focused intervention practices were adapted to make them more suitable for a SEN setting: a bespoke prompting procedure that is used during discrete trial training

and interventions to decrease behaviours that are barriers to learning were also evaluated. All of the interventions were designed with contextual variables, such as typical SEN teacher to child ratios and limited resources in mind; it was essential that all of the interventions could the feasibly implemented in the setting.

Chapter 1 begins with an introduction to the literature on comprehensive models of education for children with ASD. This overview will begin with traditional EIBI before reviewing some of the advancements to these models.

Chapter 2 describes the formulation phase on the British Early Special Schools Teaching (BESST) model of education. This was a collaboration between university researchers, BCBA's, teachers and other professionals to develop a comprehensive model of education that could be implemented in a special educational needs setting.

Chapter 3 describes the BESST model and presents data from an initial evaluation of the model. Children made significant gains on standardised measures of intelligence quotient (IQ) and adaptive behaviour, and on a range of skills measured by Assessment of Basic Learning and Language Skills – Revised® (ABLLS-R; Partington, 2006).

Chapter 5 describes a bespoke prompting procedure, responsive prompt delay prompting procedure, that was implemented during discrete trial training (DTT) in the BESST model. This procedure was designed for this setting because we observed prior to conducting the research that commonly used procedures were difficult to implement with fidelity. The responsive prompt delay procedure was compared to simultaneous prompting and no-no prompting, two commonly used procedures. Results show that the responsive prompt delay procedure was as effective as the other procedures for three participants; efficiency data were variable.

Chapter 7 describes focused intervention practices that were developed for a SEN setting; SEN schools are busy clinical settings where many staff work with each child and as

a result it can be difficult to control certain aspects of the environment. Data from two studies are presented. In the first study, an adapted functional analysis was conducted with two participants to verify that problem behaviour was maintained by a novel form of attention - predictable, repetitive statements. In the second study, data were presented from a treatment analysis that compared three function based interventions that were intended to be implemented without extinction. Extinction was not feasible because it was not possible to reduce predictable attention to zero levels in this setting. Functional communication training and non-contingent reinforcement reduced problem behaviour to near zero levels for both participants. Pre-session satiation did not decrease problem behaviour consistently.

This thesis evaluated a comprehensive model of education and a number of focused intervention practices in a SEN school. All of the interventions were developed for this setting; a number of adaptations were necessary due to a range of contextual variables that presented challenges related to implementation. The comprehensive model of education based on ABA had a significant positive impact on a number of child outcomes. A bespoke prompting procedure that suited this setting was at least as effective as commonly used prompting procedures; and two interventions implemented reduced problem behaviours maintained by predictable repetitive statements. Interventions based on ABA were effectively adapted for this setting and resulted in positive outcomes for learners with ASD and other IDs.

Chapter 1: An introduction to comprehensive model of educations based on applied behaviour analysis

Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterised by impairments in social interaction and communicative behaviours, restricted and repetitive patterns of behaviour and excessive sensitivity to environmental stimuli (American Psychiatric Association, 2019). ASD is a heterogeneous developmental disability that can impact many areas of development (Healy & Lydon, 2013; Petterson, Ollson, & Ala'I – Rosales, 2016). The prevalence of ASD is increasing in the USA, where rates of prevalence have increased from 1 in 100 to 1 in 68 (Centre for Disease Control, 2019). It is not known if this increase is a result of better detection or an actual rise in prevalence (Smith & Iadarola, 2015). The prevalence of ASD in the United Kingdom (UK) remains steady; affecting approximately 1% of the population (Kendall, Megnin-Viggars, Gould, Taylor, Burt, & Baird, 2013). It is estimated that each individual with ASD costs the health service between £3.1 million and £4.6 million depending on the severity of the disability. This is more than the cost of cancer, heart disease and stroke combined (Burscher et al., 2014). A residential school placement can cost up to £156, 360 per year in the UK (Smith, Hayward, Gale, Eikeseth & Klintwall, 2019); this is a huge financial burden for local education authorities (LEA) and costs significantly more than educating children in their local maintained SEN school; for example, educating a child in a maintained SEN schools in Wales costs on average £21, 947 per pupil per year (£15,451 – £40,821) (Welsh Government, 2019). Therefore, it is crucial that high quality teaching is delivered to all children in their local SEN school. If SEN schools adopted an evidenced based approach to education and behaviour management based on applied behaviour analysis (ABA), LEA's may make significant savings by keeping more children in their local schools.

The Importance of Early Intervention for Children with Autism Spectrum Disorder

There is a growing body of evidence to support the use of early intervention with children with ASD (Brett et al., 2016). For many, ASD is no longer considered a non-modifiable permanent disability; early intervention, ideally starting in infancy, can help to decrease the severity of symptoms associated with the disability (Lazaratou, Economou, & Dikeos, 2017). Early intervention is optimal because there is a greater potential for neural and behavioural plasticity in younger children (McGarrell, et al., 2009; Dawson, 2008). Neural plasticity refers to the shaping of the brain that occurs as a result of repeated learning experiences (Petterson, Ollson, & Ala'I – Rosasles, 2016). Early intervention may help a young child with ASD to become more receptive to the social world, which as a result may help them develop skills necessary to prevent or reduce the severity of symptoms associated with ASD (Dawson, 2010; Wallace & Rogers, 2010).

Early intervention may also be beneficial because behavioural delays may be less pronounced in a younger child and the gap between them and those of their peers without ASD may not be so great, given that the child would not have had much time to fall behind. For example, a child that begins intervention at three will have fewer skills to learn in order to catch up than a child who starts at seven years of age (Klintwall, Eldevik, Eikeseth, 2015). Therefore, if intervention starts early, it is more likely that the child will catch up to his peers (Eikeseth, Smith, Jahr, & Eldevik, 2002).

Applied Behaviour Analysis

The application of interventions based on the principles of ABA have been widely documented with children with ASD (Leaf et al., 2016; McMahon & Cullinan, 2016; Reichow, Barton, Boyd, & Hume, 2012; Smith et al., 2019). In general terms, intervention derived from these principles are applied in order to improve socially significant behaviours. These are behaviours that will make a meaningful difference to the individual and those

around him. Interventions based on ABA are highly individualised, and based on detailed assessment of the individual and his or her environment. Examples of interventions include comprehensive education models aimed at targeting multiple areas of functioning (BACB, 2019) and focused intervention practices that are used to teach specific academic and functional skills and to reduce problem behaviours whilst simultaneously increasing appropriate replacement behaviours (Dixon et al., 2016).

Comprehensive models of education based on applied behaviour analysis

The aim of a comprehensive model of education is to target multiple affected developmental domains such as cognitive skills, communication, social and emotional skills and adaptive behaviours, as well as problem behaviours. Comprehensive models of education aim to broadly impact on the core deficits of ASD (BACB, 2019). Skills such as attending to others, imitation, joint attention, social skills, communication, and academic skills are be targeted over the duration of the intervention. Basic skills, such as attending to others, imitation, and basic communication, are taught before targeting more complex skills. Each learner has an individualised learning programme (ILP) that specifies skills to be targeted. An ILP is based on skills assessments such as the assessment of basic language and learning skills-revised (ABLLS-R; Partington, 2006) or the verbal behaviour milestones assessment and placement programme (VB-MAPP) (Sundberg, 2008). Problem behaviours that may impede learning and quality of life are also targeted. Operant principles, such as reinforcement, extinction, stimulus control, and generalisation are integral to teaching the wide range of skills targeted in these comprehensive models. Early intensive behavioural intervention (EIBI) is the most researched comprehensive educational model for children with ASD (Reichow, Barton, Boyd & Hume, 2012).

Early Intensive Behavioural Intervention

Components of Early Intensive Behavioural intervention

Early intensive behavioural intervention is a comprehensive model of education that utilises principles and procedures from ABA to teach a wide range of skills to children with ASD (Rivard, Morin, Mello Terroux, & Mercier, 2018). Developmental assessments are conducted prior to intervention; absent skills are targeted in developmental sequence. The principles of ABA are used to teach a range of adaptive and functional skills that typically developing children acquire. Children make gains in many areas because many areas of development are targeted in the intervention. The intervention is delivered to young children between the ages of two to seven years (Eikeseth et al., 2002; Granpeesheh et al., 2009). Guidelines set out by the Behavior Analyst Certification Board (BACB) defines comprehensive models of ABA as consisting of 30-40 hours of intervention per week (BACB, 2019). A cut off of 20 hours per week has been used to classify a programme as "low" or "high" intensity (Rivard et al., 2018); others suggest that "low" intensity treatment is less that 15 hours of one-to-one treatment per week (e.g. Smith et al., 2019). As such, intensity refers to the number of one-to-one teaching hours, but does not consider what happens when children are not in one-to-one teaching. Staff must be trained to implement procedures with high treatment integrity (Leaf et al., 2016). To begin, treatment is primarily delivered in a structured one-to-one teaching format, often at home, before gradually extending to small and then increasingly larger group formats in pre-school or other educational settings (Eikeseth et al., 2002; Green, Brennan & Fein, 2002; Peters-Scheffer et al., 2010; Reichow et al., 2012). In intensive programmes, this transition typically occurs when the child has developed the skills necessary to learn in in a group (Peters-Scheffer et al., 2010).

EIBI is considered to be an effective intervention for children with ASD; however, there can be considerable variation in child outcomes following treatment (Klintwall, Eldevik, & Eikeseth, 2015; Linstead et al., 2017). Child specific and treatment specific variables have been explored in relation this variability. Child specific variables include: age at the beginning of treatment (Vietze, & Lax, 2018; Blacklock, Perry, & Geier, 2014; Granspeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009; Smith, Klorman, & Mruzek, 2015), cognitive functioning, language skills, and adaptive functioning (Eikeseth et al., 2002; Hayward, Eikeseth, Gale, & Morgan, 2009) Treatment specific variables include: intensity of treatment (Eldevik, et al., 2019; Lovaas, 1987), duration of treatment (Linstead et al; Lovaas, 1987; Virués-Ortega, 2010), treatment quality (Magiati et al., 2007), staff training, programme supervision, qualifications and experience of supervisors (Eikeseth et al., 2009; Eikeseth, 2010) and location of treatment (Linstead et al., 2017).

The following sections will provide an overview of the literature for EIBI; it will consider clinic, university and parent managed EIBI. Following this, the research to practise gap for EIBI will be explored. An overview of the research on lower intensity comprehensive models of education will then be provided before discussing how the literature on lower intensity one-to-one teaching models is calling for a new conception of comprehensive models of education based on ABA.

A review of the literature for early intensive behavioural intervention

The benefits of EIBI for children with ASD have been well documented in the literature (Lovaas, 1987; Eldevik et al., 2009; Eikeseth, 2009; Eldevik et al., 2010). Research includes a randomised control trial (RCT) (e.g. Smith, Green, Wynn, 2000) which was conducted with children with a diagnosis of ASD and pervasive developmental disorder (PDD-NOS); efficacy studies; and effectiveness studies (e.g. Eikeseth et al., 2002; Grindle et al., 2012; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005). Makrygianni and

colleagues (2018) conducted a meta-analysis of 29 studies that evaluated the effectiveness of interventions based on ABA. Comparisons of pre-and post- intervention data on standardised assessments of IQ (verbal and non-verbal), adaptive behaviour, and receptive and expressive language were used to measure the effectiveness of interventions. ABA based interventions were very effective in improving IQ scores; moderately to very effective in improving communication skills; and moderately effective in improving overall adaptive behaviour, socialisation skills and receptive language. Smaller gains were made in daily living skills. Previous meta-analysis also reported positive results with large and moderate effect size changes for IQ and adaptive functioning respectively (e.g. Virués-Ortega, 2010; Reichow, Barton, Boyd & Hume, 2012). In a recent Cochrane Report, Reichow, Hume, Barton and Boyd (2018) found that the evidence from five studies (Cohen, Amerine-Dickens & Smith, 2006; Howard, Sparkman, Green, Stanislaw, & Cohen, 2014; Magiati, Charman & Howlin, 2007; Remington et al., 2007; Smith, Groen & Wynn, 2000) supports the use of EIBI compared to treatment as usual (TAU) for some children with ASD. However, the overall quality of evidence was graded 'low' due to the inclusion of non-randomised studies and the small number of studies that were included. Only one of the five studies (Smith et al., 2000) that was included in this Cochrane review used a RCT. RCT's are considered the gold standard of evidenced based practice (NICE, 2009). Individuals are randomly assigned to either an experimental or a control group to measure the effect of the intervention (Whitehurst, 2003). When individuals who are matched at baseline are randomly assigned to groups there is greater confidence that the effectiveness of the intervention can be measured without being compromised by selection bias (Keenan & Dillenburger, 2011). There are a number of difficulties with conducting RCT's on comprehensive models of education. One difficulty is that parents cannot be blind to the intervention that their child is receiving. Increasing knowledge on the effectives of comprehensive models of education also impacts

on the feasibility of conducting RCTS. Firstly, parents are less likely to sign up to comparison treatments that are not well evidenced or that have been shown to be less effective; and secondly, researchers face ethical difficulties when randomly assigning children to treatments if there is evidence to suggest that one intervention is superior to another (Remington et al., 2007). As a result, there is a lack of RCT's investigating the efficacy of EIBI.

Child specific variables as predictors of child outcomes

Age at the beginning of treatment

A number of researchers have suggested that age at the beginning of treatment may affect child outcomes following EIBI (Vietze & Lax 2018; Smith, Klorman, & Mruzek, 2015). Smith, Klorman, and Mruzek (2015) found that the younger children from a group of 71 children aged between 20 and 59 months had better outcomes on the Mullens Scales and marginally better outcomes on VABS averages and the Autism Diagnostic Observation Schedule (ADOS) severity ratings. Granpeesheh and colleagues (2009) divided 379 children into three age groups: 2 – 5.15 years; 5.15 – 7.14 years; and 7.14 – 12 years in order to measure the effects of age on the association between treatment intensity and mastered skills. The number of monthly treatment hours and age predicted outcomes in this study. The youngest group responded better to low intensity treatment; the younger and the middle group had similar gains following high intensity treatment; and there was no significant relationship between treatment intensity and skill mastery for the older group. While younger children may make superior gains in some areas; children who begin treatment before seven years can also make significant gains following EIBI (e.g. Remington et al., 2007; Waters et al., 2018). As mentioned, the brain of a younger children may be more malleable and therefore the impact of treatment may be greater (Dawson et al., 2010; Smith et al., 2015). However, a number of researchers have failed find a link between age at the

beginning of treatment and child outcome (Eikeseth, Klintwall, Jahr, & Karlsson, 2012; Eikeseth, Smith, Jahr, & Eldevik, 2002; Hayward et al., 2009). Nonetheless, a benefit of intervening earlier is that gap between the child with ASD and his typically developing peers may not be so great; therefore, less intervention will be required for him to 'catch up' with his peers (Klintwall et al., 2015).

Intelligence quotient

There is evidence to suggest that children who start EIBI treatment with higher IQ show greater treatment gains (Eikeseth et al., 2002; Dixon et al., 2016; Smith, Klorman, Mruzek, 2015). A number of researchers have excluded children from research based on IQ scores, for example, Eikseth, Smith, Jahr and Eldevik (2002) specified that children needed to have an IQ of 50 or above to be included in their study. Despite this cut off, the authors found that higher intake IQ strongly predicted both IQ and language scores at follow-up. Ben-Itzchak and Zachor (2007) found that IQ scores and social and communication skills impacted on the outcomes of children aged between 20 and 32 months with a diagnosis of ASD. Children who had higher IQ scores and better social and communication skills made greater gains on both receptive and expressive language, and play skills. Similarly, Smith, and colleagues (2015) found that higher scores on the Mullens Scales predicted higher scores Mullens and VABS scores at follow-up. In the Remington et al. (2007) study, the children who responded most positively to the intervention had higher IQ scores and mental ages as well higher scores on VABS composite, communication and social skills scores. Therefore, there is evidence to suggest that intake IQ predicts outcomes from EIBI.

Intensively delivered early intensive behavioural intervention

Research has demonstrated that there is a strong relationship between treatment intensity and treatment outcomes (Eldevik, Berg Titlestad, Aarlie Tønnesen, 2019; Linstead et al., 2017; Granpeesheh et al., 2009; Virués-Ortega, 2010; Virués-Ortega J, Rodríguez, &

Yu, 2013). Linstead and colleagues (2017) evaluated the effects of intensity of treatment on skill mastery across a number of curricular areas for children. There was a positive relationship across all areas, but the largest effect sizes were seen in academic, language and cognitive skills. Meta-analytic studies have also addressed treatment intensity and child outcomes (Eldevik et al., 2009; Makrygianni & Reed, 2010; Virues-Ortega, 2010): there was a correlation between treatment intensity and child outcomes on measures of intellectual and adaptive behavior in both studies. This correlation was also seen for older children; for example, Granpeesheh and colleagues (2009) found that there was significant relationship between skill acquisition and treatment hours for children between 2 and 7 years old; and the mean age of children in Linstead and colleagues (2017) study was 7.1 years. Early research on EIBI predominantly evaluated the effect of intensively delivered treatment.

Lovaas' (1987) conducted the first large scale study on EIBI. Nineteen children who received up to 40 hours per week of EIBI, which began at home, made significant gains on IQ and social functioning when compared to a control group that received less than 10 hours of the same intervention each week. The intensive EIBI intervention was delivered by highly trained therapists, every day for a year. The children's parents were trained in ABA and acted as co-therapists. Forty-eight percent of participants in the EIBI group achieved normal functioning and attended mainstream education following treatment compared to two percent of the control group. Since 1987, numerous evaluations have attested to the efficacy of EIBI with children with ASD (Howard, Sparkman, Cohen, Green, & Stanislaw, 2006; Remington et al. 2007; Sallows and Gaupner, 2005); however, children in subsequent research have not made the same gains as those in Lovaas' (1987) study.

In one of the few studies that was conducted in the UK, Remington and colleagues (2007) compared the outcomes of twenty-three children aged between 30 and 42 months who received home-based EIBI to twenty-one children who received local education authorities'

standard provision: TAU for children with ASD. Children were assigned to groups based on parent preference and treatment was delivered over a two-year period. The EIBI intervention was provided by the university of Southampton for thirteen families; and remainder was provided by a range of private ABA providers based in the UK. Children in the intervention group received an average of 25.6 hours of one-to-one teaching per week. TAU included speech therapy, treatment and education of autistic and related communication handicapped children (TEACCH), picture exchange communication system (PECS), Makaton and dietary interventions. Outcomes in this study were consistent with previous research: the intervention group made significant gains in IQ, mental age (MA), adaptive behaviour and language skills. Furthermore, 26% of children in the intervention group achieved IQ changes that were considered to be clinically significant; that is, their IQ scores exceeded 81.93. However, a follow-up study showed that group gains did not maintain two years after the treatment had terminated (Kovshoff et al., 2011). There were however notable differences in skill maintenance between the university and the parent managed group. Children in the parent managed group maintained or increased gains after the cessation of treatment; the university managed group did not maintain gains. Two clear differences between the two EIBI groups were the intensity of treatment and child profiles: the university led group received a less intensive treatment and had more severe ASD characteristics. The authors suggested that these differences plus variations in the intervention may have contributed to group differences at follow up. It is also possible that the parent group continued to deliver the intervention at home during the follow-up period. A number of researchers have suggested that on-going intervention after the termination of EIBI programmes may be required to maximise and maintain gains (Smith et al., 2019; O' Connor & Healy, 2010; Starr et al., 2016).

Eikeseth and colleagues (2012) compared the outcomes of group of children who received EIBI (n=35) based on the UCLA model (Lovaas, 1993) to a group of children who received and eclectic special education (n=24), which was TAU in Norway. Children were aged between 2 and 6 years. The intervention group received an average of 23 hours of one-to-one intervention each week. This study was different from the previous studies because treatment was delivered in typical community settings by staff in those settings - staff did not typically have a degree or prior training in ABA. Groups did not differ on any measures at intake. Following one year of treatment, the EIBI group scored significantly higher on standardised measures of adaptive behaviour. There was also a significant within group reduction in problem behaviours and other behaviours typically associated with an ASD diagnosis. Effect sizes were moderate to large on all measures following the first year of treatment. Children continued to make gains in the second year of treatment. This was a positive step because it demonstrated that EIBI could be delivered in a mainstream community school setting. However, it is important to highlight that many additional resources were put in place in the setting, for example, additional staff and a supervisor from a specialist center consulted at the school weekly. Parents also agreed to allocate 10 hours per week to the child's programme, including meetings, preparing materials and delivering discrete trial training and natural environment training.

Intensively delivered eclectic treatment compared to early intensive behavioural intervention

A number of studies (e.g. Eikeseth et al., 2002; Howard et al., 2005) have compared intensely delivered EIBI to intensely delivered eclectic treatment and found that intensively delivered EIBI was more effective. Eikeseth and colleagues (2002) compared the outcomes of thirteen children who received 28 hours of behavioural intervention per week to twelve children who received an eclectic special education of equal intensively over a 12 month

period. The intervention was delivered to children who were aged between 4 and 7 years in kindergarten and elementary school settings in Norway; children were assigned to groups based on the availability of supervisors. Children in the behavioural intervention group made significantly greater improvements than the eclectic group on standardised measures of IQ, language comprehension, expressive language, and adaptive behaviour. The authors identified a number of treatment variables that could have explained this. The biggest difference was the fact that specific behavioural techniques were used to teach children in the behavioural group and it was likely that the differences in child outcomes could be attributed to this. However, parents of the children in the EIBI group received extensive training and as a result the intensity of treatment may have been higher for this group. The behavioural group also received more supervision than the eclectic group. This study helped to answer questions about whether any treatment - if provided intensively - would results in meaningful gains for participants. It also demonstrated that EIBI could be an effective intervention for children between the ages of four and seven in a school.

Howard and colleagues (2005) supported the findings that intensively delivered EIBI was more effective than intensively delivered eclectic treatment; children who participated were under 4 years and had a diagnosis of ASD or PDD-NOS. The outcomes of a group of children who received high intensity EIBI (20-40 hours/ week) delivered in home, community and school settings were compared to two control groups. The first control group received high intensity "eclectic" public special education (25-40 hours/ week); and the second received a low intensity public early intervention programme (15 hours/ week). The groups were similar on all measures at intake. The EIBI group had higher mean standard scores on measures of cognitive functioning, communication skills and adaptive behaviour following 14 months of intervention; post-test scores were in the normal range for cognitive functioning, non-verbal communication and motor skills. The only area that scored in the

normal range in the control group was motor skills; many others reflecting loses. Thus, despite receiving similar intensity of treatment to the children in the EIBI group, the developmental trajectories of those receiving 'eclectic' treatment flattened or decreased. There were no significant differences between the two control groups at follow-up demonstrating that for these children intensive eclectic treatment was not more effective than a similar treatment of lower intensity. In a follow up to this study, Howard and colleagues (2014) reported the outcomes of the three groups following two additional years of treatment. Gains made by children in the EIBI group maintained throughout the second and third year; mean scores on standardised assessment of cognitive, adaptive, language and motor skills were higher for the EIBI group three years after treatment began. Results from Eikeseth et al., (2002) and Howard et al., (2005) studies supported the argument that not any intervention provided intensively will result in meaningful gains for children with ASD and PDD-NOS. Results from both studies demonstrate that EIBI results in substantially larger improvements on standardised measures when compared to intensively delivered eclectic treatment.

Supervision intensity and quality as a predictor of child outcomes

Those supervising ABA programmes are expected to have advanced knowledge in ABA and must pass an examination set by the BACB; supervisors should also have extensive clinical experience in developing and designing programmes for a variety of learners (Eikeseth, Hayward, Gale, Gitlesen, Eldevik, 2009). The BACB recommends that two hours of supervision are delivered for every 10 hours of treatment on a comprehensive ABA programme (BACB, 2014). Research suggests that supervision may significantly impact on the outcomes of children receiving EIBI (Dixon et al., 2016; Waters, Dickens, Thurston, Lu, Smith, 2018). Eikeseth, Haywards, Gale, Gitlesen and Eldevik (2009) evaluated the effect of supervision intensity with children aged between 28 and 48 months who received EIBI. Supervision intensity varied between three and eight hours per child per month. It was

reported that participant IQ scores increased by 0.21 with each hour of supervision that was provided. However, Eikeseth et al. (2009) suggested that the effect of supervision is not linear. Instead, the researchers suggested that if supervision intensity was too low the child would not benefit from it; supervision delivered at a certain intensity may yield optimum results; but increasing it beyond that may not affect outcomes in a meaningful way. In addition to supervision intensity, the quality of supervision and competence of an EIBI supervisor are important for child outcomes (Eikeseth, 2010). Dixon and colleagues (2016) found that supervisor credentials, which is a likely reflection of skills and experience, impacted child outcomes. In this study, children who were supervised by a BCBA mastered more skills than those who were supervised by individuals without these credentials; there was also a correlation between skill mastery and the number of years of experience that a supervisor had. In this study, supervisor credentials and years of experience had more of an impact on skill mastery than intensity of supervision. This research suggests that supervision intensity, and quality, in addition to supervisor credentials, impact outcomes for children who receive EIBI.

While the evidence for EIBI for children with ASD is limited due to the lack of RCT's; a large body of evidence demonstrates that children with ASD who are between the ages of 2 and 7 can make significant improvements on standardised assessments following EIBI. Child specific variables such as age and IQ at the beginning of treatment may be important pre-treatment variables. Intensity of treatment is an important factor; however, eclectic treatments delivered at similar intensity do not yield the same results as EIBI; therefore, the use of behavioural techniques is fundamental. In addition to treatment intensity, the intensity of supervision, supervision quality and supervisor credentials are key variables that impact outcomes.

Research to practice gap

There is general agreement that EIBI and other interventions based on ABA are effective for children with ASD; however, they are not typically delivered in maintained schools and other government funded settings in the UK. There is a difficulty translating research on EIBI into educational practice (Bibby, Eikeseth, Martin, Mudford, & Reeves, 2002; McMahon et al. 2016; Petterson, Ollson, & Ala'I – Rosales, 2016). EIBI is delivered in home programmes and dedicated ABA schools in the UK, however, only a small percentage of children with ASD are educated in this way. EIBI is typically not delivered in maintained special educational needs settings; instead, an eclectic approach to special education is adopted (McMahon et al., 2016). There are a board range of reasons for the difficulties in bridging the gap between research and educational practice including difficulties implementing EIBI in 'real life' settings; misconceptions about the intervention (Dillerburger, 2011); disagreement amongst professionals and policy makers about the type of intervention that should be provided (Reichow, Barton, Boyd & Hume, 2012); and conscious efforts to discount evidence (Morris & Maynard, 2009). The following sections will discuss some of the issues with the current ABA provision in the UK and how this type of service provision has limited scope in closing the research to practice gap. The current provision in maintained schools; and some of the barriers to delivering EIBI these settings will then be discussed.

Home Programmes and ABA schools. Currently in the UK, EIBI is predominantly delivered in home programmes and dedicated ABA schools. A number of organisations (e.g. Child Autism UK) and private consultants deliver home-based EIBI in the UK; and there are nine dedicated ABA schools (ABA4ALL, 2019). Home based programmes and ABA schools only educate a small percentage of children with ASD. There are a limited number of places in ABA schools; approximately 400 children with ASD are educated in these schools

(ABA4ALL, 2019); and there are a limited number of organisations and professionals (Peters-Scheffer et al., 2010) delivering home-based EIBI programmes. Furthermore, parents must find a provider and initiate the process of starting EIBI themselves - this is often an arduous process requiring adequate resources, including finances (Johnson & Hastings, 2001); because of these barriers a large percentage of children with ASD will not access EIBI. If EIBI is not implemented in local health and education systems, it is likely that this intervention will be delivered to children of parents with higher educational and socio economic status (Keenan et al., 2015). Geographical location will also limit access to EIBI (Matson & Williams, 2015). Ideally, EIBI should be provided at a local level in services that are freely available so that it is available to all children regardless of parental status or location.

The provision in maintained schools. EIBI is not typically delivered in maintained SEN schools in the UK. Schools often adopt an eclectic approach to education despite the fact that the evidence for eclectic programmes with children with ASD is poor (Eldevik et al., 2009; Makrygianni & Reed, 2010; Eikeseth et al., 2002; Howard et al., 2005). Teachers in these settings often have very little training in ASD – less than 50% of teachers in England report they are confident that they can effectively support a child with ASD (All Party Parliamentary Group on Autism, 2017). Heward (2003) defined eclecticisms as using a variety of principles and methods from different models of treatment to inform strategies; these strategies are applied as needed (Marwick, Dunlop, & MacKay, 2005; Parsons et al., 2009). It can include elements of ABA, speech and language therapy, occupational therapy; and programmes such as TEACCH, Sensory Integration, Floortime, Picture Exchange Communication Systems, Son-rise and other manualised programmes (Dillenburger, 2011). An eclectic approach is neutral in that it does not promote any intervention over another (McMahon et al., 2016); the model is based on selecting more than one approach

(Dillenburger, 2011). Those who support the eclectic approach view this as putting the individual needs of the child before theoretical orientation or preference (Callahan, Shukla-Mehta, Magee, Wie, 2010; McMahon et al., 2016; Schoen, 2003). As such, an eclectic approach may be attractive to those who see ABA is a single treatment or intervention rather than a science from which a large number of evidenced based interventions have been developed.

Lack of evidence for EIBI in maintained schools. The evidence base for intervention based on ABA in maintained schools is limited (Anderson, Smith & Wilczynski, 2018). When research on EIBI has been conducted in maintained schools, many additional resources such as additional staff, specialist supervisors and parental input have been put in place (e.g. Eikeseth et al., 2012). This type of model may not be feasible in the majority of schools; and is dependent on outside agencies rather than being a model of education that can be established and sustained in the school. Research on interventions that are feasible and effective in maintained schools is needed; researchers and practitioners need to consider the context that the intervention will be delivered in, available resources, for example, staffing levels and skills (Petterson, Ollson, & Ala'I – Rosales, 2016), and stakeholders' commitment (Metz, 2016).

Lack of training in ABA. While the evidence for EIBI is strong there are difficulties implementing it in clinical practise (Peters-Scheffer et al., 2010). The first issue may be the fact that teacher training does not typically cover topics in ABA and training on ASD is very limited (Dillenburger et al., 2014). EIBI programmes are based on detailed assessment of many skills and the development of individualised programmes to address skill deficits and problem behaviours. This requires many specialised skills in the context of behaviour change procedures and fluency in the principles of ABA (Slocum et al., 2014); BCBA's who have specialised in ASD and early intervention have this skill set, but they are not typically

employed in maintained schools. Teaching and administrative staff in maintained schools in the UK do not have specialist training in ABA. At present the majority of maintained schools do not employ the appropriate professionals to assist with the delivery of EIBI.

EIBI is too intensive for most clinical settings. In addition to the availability of professionals with appropriate skill sets, certain components of EIBI also make it difficult to implement in clinical settings (Peters-Scheffer et al., 2010). One of the major issues is delivering such intensive treatment (Hastings & Johnson, 2001). The intensity of treatment is difficult on a practical level in schools. EIBI is prescribed for twenty to forty hours of one-to-one treatment per week (Rivard et al., 2018) for 52 weeks of the year (Lovaas, 1987). This is not possible in a maintained school where children attend school for a maximum of six hours per day for 38 weeks of the year. Furthermore, children in the UK must receive an education based on the National Curriculum (Grindle et al., 2012), therefore a significant part of the school day is spent teaching subjects outlined in this curriculum. The financial implication of delivering intensive EIBI is also likely to be a significant barrier to providing EIBI in schools. In order to provide one-to-one teaching at this intensity it would be necessary for each child to have a one-to-one teaching assistant throughout the whole week; this would have huge financial implications for schools that can receive as little as £15,451 per child per year (Welsh Government, 2019).

Reframing comprehensive model of intervention

Intensive EIBI is difficult to implement in maintained schools and other clinical settings (Eldevik et al., 2019; Peters-Scheffer et al., 2013). However, delivering a low intensity behavioural intervention-less than 20 hours per week (Rivard et al., 2018) may be an alternative to EIBI (Eldevik et al.,2019). Lower intensity treatment requires less one-to-one treatment and therefore fewer teachers to deliver the treatment (Peters-Scheffer et al., 2013). Lower intensity treatment could be delivered alongside compulsory curricular

activities. In order to close the gap between research and implementation for early behavioural intervention for children with ASD low intensity comprehensive models of education must be explored. Research on low intensity behavioural intervention is limited. Some research has been conducted in mainstream settings (e.g. Grindle et al., 2012) while others has been conducted in special educational needs preschools and schools (e.g. Peters-Scheffer et al., 2010). The following sections focus on this literature.

A review of the literature for low intensity behavioural intervention

Grindle and colleagues (2012) carried out the first evaluation of an ABA provision in a typical mainstream educational setting in the UK; the intensity of treatment that was delivered in this model was lower than in much of the published literature. The outcomes of 11 children who received an education based on ABA was compared to a group who received TAU. Children in the ABA group received 15 hours of one-to-one ABA based teaching per week in the first year, and an average of six hours of one-to-one teaching per week in the second year. The control group was recruited from previous research conducted by Kovshoff, Hastings, and Remington (2011), therefore children in the control group were not tested at the time of this research. Children in the intervention group were aged between 43 and 68 months at the beginning of treatment; there were no inclusion or exclusion criterion. One-to-one teaching was delivered in an "ABA" classroom as opposed to a separate room away from the classroom which was typical in previous research. Children participated in group activities or attended a mainstream classroom with their one-to-one support when they were not in one-to-one sessions; they also accessed the national curriculum. Parents did not act as co-therapists; and therefore, intervention was only delivered during school term - 38 weeks per year. Within group measures showed that children in the ABA group made marginally significant gains in IQ. Gains between baseline and year 1 were significant on the VABS composite score, VABS communication, and number of other areas, measured by the

ABLLS. Children continued to make significant gains on the ABLLS and VABS composite, communication, daily living and social skills in the second year of treatment. Between group measures largely favoured the ABA group who made improvements in IQ, albeit non-significant, and significant gains in VABS communication, daily living, socialisation skills as well as on the overall VABS composite. Effect sizes were large on all VABS measures. This study supports the use of a low intensity ABA based teaching model that is supervised by a BCBA in a maintained school.

Eldevik, Titlestad, Aarlie and Tønnesen (2019) compared the outcomes of three groups of children: the first group (n=19) received 11.1 hours of ABA intervention per week; the second (n=36) received 18.2 hours of intervention; and the third (n=17) received an eclectic special education (TAU). Children who received 18.2 hours of treatment made statistically higher gains on all VABS measures than those who received an eclectic model of education. Furthermore, 19.4% of children in this group met the criterion for reliable change (+21 points) on the VABS scores; none of the children in the other groups met the criterion. There were no statistically significant differences in VABS scores between the group of children who received 18.2 hours of treatment and those who received 11.1 hours or between the those received 11.1 hours and those who received an eclectic education; effects sizes were medium for both. IQ data were reported for the group who received 11.1 hours of treatment and for the eclectic group; differences in IQ scores were statistically significant with a large effect size. Finally, autism severity scores measured by the Childhood Autism Rating Scale 2 (CARS 2; Schopler, Van Bourgondien, Wellmand & Love, 2010) were available for both of the ABA groups. There was a significant correlation between higher intensity treatment and improved ASD classification. Results from this study highlight the fact that children with ASD can make gains following ABA treatments of varying levels of intensity; results also confirm the dose-response relationship between hours of treatment and child outcomes.

Eldevik, Hastings, Jahr and Hughes (2012) evaluated the outcomes of children with ASD, who received a low intensity behavioural intervention (n=31) in a pre-school setting to those who received typical preschool education (n=12) in Norway. Children were aged between 2 and 6 years. Children in both groups were allocated a one-to-one staff member; and there was only one child with ASD in each setting. Children in the EIBI group received approximately 13.6 hours of one-to-one teaching per week; this was delivered in a room separate to the pre-school classroom. Functional and self-help skills were targeted for the remainder of the time by a staff member who was trained in ABA; the authors reported that it is likely that additional intervention was provided during this time. Children in the control group received an 'eclectic' education; data on the number of intervention hours per week was not available for the control group. Each group received between two and five hours of supervision from external agencies each week. Supervision for the intervention group was provided through a behavioural intervention center; and children in the control group received supervision through local pedagogical-psychological services. Children in the ABA group made statistically significant gains on standardised measures of IQ and adaptive behaviour when compared to the control group; effect sizes were large on measures of IQ and medium on measures of adaptive behaviour. Furthermore, six of the children met the criterion for reliable change in IQ (a gain of 27+ points) and two met the criterion for reliable change in adaptive behaviour (a gain of 21+ points); none of the children in the control group achieved these gains.

Peters-Scheffer and colleagues (2010) also evaluated a low intensity comprehensive educational model with children with ASD and mild to severe ID. Children in the intervention group (n=12), who were aged between 3 and 6 years, received 6.5 hours of one-to-one teaching per week in a pre-school setting for children with intellectual disabilities. When children were not in one-to-one teaching, they accessed typical pre-school teaching

that was delivered in a group format. The comparison group (n=22) received typical preschool education. Pre-school teaching consisted of elements of TEACCH, incidental teaching, structured play and group activities for both groups. Group teaching sessions for the ABA group were informally underpinned by the principles of ABA; the focus of these sessions was to generalise skills taught in one-to-one sessions and to teach new skills. Parents were also instructed to generalise skills taught during one-to-one teaching; some parents acted as co-therapists. All of the children attended the pre-school for an average of 28.38 hours per week. Data from standardised assessments that were conducted before treatment and following eight months of treatment were reported. Both groups made significant gains on developmental age and adaptive skills; however, gains made by children in the intervention group were significantly larger. The intervention group also made significantly larger gains on IQ following treatment. Differences on autistic symptom severity and emotional and behavioural problems were not significant at follow-up.

In a follow up study, Peter-Scheffer and colleagues (2013) compared the outcomes of a group of children with ASD and ID who received 4-10 hours (average 4.98) of one-to-one teaching ABA based per week (n=20) to a control group (n=20) who received standard provision in the Netherlands; the control group data was taken from an ongoing longitudinal study. Children were aged between 3 years and 8 years and both groups attended pre-schools or schools for children with ID in the Netherlands. Standard provision is these settings reflected an eclectic model, which comprised a mixture of interventions, including elements from the TEACCH-program, PECS, speech and language therapy and sensory integration therapy. Parents of children from the ABA group and their teachers were also instructed to generalise skills taught during one-to-one teaching. Standarised assessments were carried out over a two year period. There were no significant differences between the groups at pre-test. Both groups made gains on developmental age at post-test, however gains were significantly

larger in the interventions group. Outcome measures of developmental age, adaptive behaviour, interpersonal skills, receptive language and play skills favoured the intervention group. However, differences on expressive language, behavioural flexibility and maternal stress were not significant. Greater progress was made between baseline and first follow up than between first and second follow up; this is consistent with other studies (for example, Eikeseth et al., 2012).

One major difference in treatment between Peters-Scheffer and colleagues (2010) and (2013) and Eldevik et al., (2012) low intensity models and other low intensity treatment groups (e.g. Eldevik et al., 2006; Lovass, 1987) may be the teaching that was delivered outside of one-to-one work. Whilst the intensity of one-to-one teaching was lower than other studies, the teachers who delivered group teaching to the intervention group were trained in ABA. Peters-Scheffer et al., (2010) specified that group teaching sessions were underpinned by the principles of ABA and that skills taught during one-to-one sessions were generalized during these sessions. The authors state that children in the intervention group received an education based on the principles of ABA for up to 28 hours per week when one-to-one teaching hours and the informal behavioural approach to group teaching were combined. Parents of children in Peters-Scheffer et al., (2010) and (2013) received training in ABA and some parents acted at co-therapists. Eldevik et al., also reported that elements of the EIBI intervention were likely to have been implemented outside of one-to-one work. Preliminary results from these studies suggest that children with ASD can make significant gains in low intensity one-to-one teaching model when group teaching sessions are underpinned by the principles of ABA.

Low intensity models such as these demonstrate that children can make significant gains on standardised assessments following fewer one-to-one teaching hours per week. Peters-Scheffer and colleagues (2010) in particular demonstrated that the intensity of the

intervention based on ABA could increase by delivering group instruction that is underpinned by the principles of ABA. Grindle and colleagues (2012) demonstrated that a comprehensive model of education could be successfully implemented in a maintained school in the UK. This treatment was delivered in classroom without the need for additional teaching space to deliver one-to-one teaching; treatment delivery was limited to school - parents did not act as co-therapists. A combination of these novel treatment variables may make the delivery of a comprehensive model of educational that delivers fewer one-to-one teaching hours per week feasible in maintained schools in the UK.

A low intensity model of education for maintained schools in the UK

There are a number of benefits to proving a low intensity behavioural model in maintained special educational needs (SEN) schools. School placements are available to all children after their third or fourth birthdays in the UK; thus, the provision of a comprehensive educational model in maintained SEN school is likely to result in a greater number of children accessing an appropriate education as early as possible. As discussed previously, there are a number of benefits to providing intervention from an early age, and age at the beginning of treatment may affect child outcomes. Despite the fact that children can be reliably diagnosed with ASD at or before two years of age (Stenberg et al., 2014), children in the UK are often past school age before they receive a diagnosis (Brett, Warnell, McConachie, Parr, 2016). If the majority of children receive a diagnosis of ASD after their fourth birthday, the onset of treatment is likely to be later than this, unless it is provided as standard provision in maintained SEN schools. Therefore, the provision of comprehensive behavioural intervention in schools would mean that this type of education is freely accessible to every child who needs it from an early age. Free access to this model would mean that parents of children with ASD would not have source home programme funding and manage the programmes or try to access placements in ABA schools.

If comprehensive model of education based on low intensity one-to-one teaching hours were delivered in maintained SEN schools a greater number of children would access the intervention; this would help to close the research to practice gap for the use of comprehensive behavioural models with children with ASD. Providing ABA interventions in schools mean that there a greater number of teachers delivering the intervention - this can result in greater skill generalisation and maintenance (Eikeseth, 2017). High quality supervision and training can be provided onsite by a BCBA (e.g. Foran et al., 2015). To our knowledge, there have not been any evaluations of comprehensive educational models in maintained SEN schools in the UK.

The British Early Special Schools Teaching (BESST) Model.

The British Early Special Schools Teaching (BESST) model is a comprehensive educational model based on ABA; it is delivered to children in SEN schools in the UK.

There are three main components to the BESST model: individualised programmes that are delivered on a one-to-one basis; focused small group teaching sessions; and function based behaviour plans for every child who engages in problem behaviour. The BESST model is similar to traditional EIBI in that the principles of behaviour are applied to teach meaningful skills in both one-to-one and group teaching sessions; it is a comprehensive model that targets multiple areas of functioning; and each child programme is individualized and based on a number of assessments. A major difference between BESST methodology and traditional EIBI is the intensity of one-to-one teaching hours: children in the BESST model receive up to seven hours of one-to-one teaching per week; and there is a significant focus on the time spent outside of one-to-one teaching. When children are not in one-to-one teaching, they are in small group teaching sessions: the focus of these groups varies across children; however, time is often spent generalising skills taught in one-to-one sessions, working on requesting and play skills, and targeting compulsory areas of the national curriculum. Some

comprehensive EIBI models use functional assessments and implement individualized behaviour plans (e.g. Remington et al. 2007), however other models focus primarily on teaching educational skills (Remington). Every child who engages in problem behaviour in the BESST model has a function based behaviour plan to increase appropriate behaviour and decrease behaviours that are barriers to learning. Individualised behaviour plans are implemented across the whole school day.

Chapter 2: British Early Special School Teaching Model: Formulation Phase

There is a research-practice gap between evidence based educational interventions and their implementation in special educational needs (SEN) schools in the United Kingdom (UK; Dillenburger, 2011; Parsons et al., 2013). Interventions that have been shown to be effective in clinical research settings may not always be easy to implement in schools or community settings (Lord et al.; 2005, Smith et al. 2007). A clear example of the research-practice gap is educational interventions based in Applied Behaviour Analysis (ABA) (Dillenburger, 2011). Strategies that are underpinned by the principles of ABA have been shown to be effective at teaching skills and improving outcomes for children with autism and special educational needs (Howard et al., 2005); however, these strategies are rarely used in maintained SEN schools, in part because the interventions were not designed to be carried out in classrooms and may not be practical in schools or align with teachers' beliefs (Kasari & Smith 2013; Stahmer & Rieth 2015).

Interventions that are developed and evaluated in collaboration with teachers and practitioners could help close the research-practice gap. In participatory research, teachers and classroom staff contribute to the development of the intervention. This can increase teacher buy-in to develop interventions that have greater social validity, can be implemented with higher fidelity, and potentially result in more consistent delivery and improved outcomes (Kasari and Smith, 2013). Dingfelder and Mandell (2001) suggest that during the formulation phase of a new intervention, key stakeholders collaborate on interventions and choose research topics that are salient and relevant to actual practice. Novel interventions should be tested for efficacy in this first phase (Smith et al 2007; Thabane et al., 2010). The current paper describes the formulation phase of British Early Special School Teaching (BESST) model. The BESST model is the result of a collaboration between academic researchers, school administrators and teachers, and Board Certified Behavior Analysts (BCBA's.)

Formulation of the BESST model

Developing the Model

The formulation phase of the model involved collaborating with key stakeholders to design the intervention. Those involved in the formulation phase were the researcher (PhD candidate), who employed as a BCBA at the school, and her academic supervisor from Bangor University, who was also a BCBA-D (Doctoral level), the head teacher at the school, teachers from the foundation phase classrooms, speech and language therapists and parents. All of the research was led by the researcher. The formulation phase was incremental, with discussions starting early in September 2011; the model emerged over approximately two years of collaboration. The collaboration began with the expectation that we would work together to incorporate elements of EIBI into the classroom, within a typical SEN school budget. The following section describes the key decisions made during the formulation phase. Over the course of one academic year, postgraduate observers visited the classrooms and collected data on the implementation of the model. The data were intended to be descriptive and capture typical daily practice outside of one-to-one teaching.

Multi-Disciplinary Team

Board Certified Behaviour Analysts

A BCBA (the researcher) was full-time employee at the school (employment dates: January 2011 – December 2019); a BCBA-D provided consultation at the school for one day each week during the formulation and initial evaluation of the BESST model (January 2011 – July 2014), part of this involved providing clinical supervision to the BCBA and other ABA staff that were subsequently employed at the school. The BCBA-D continued to provide consultation at the school after this. The Behaviour Analysis Certification Board (BACB) was established in 1998, and sets standards for the training of behaviour analysts. To become

a BCBA, a candidate must complete an accredited MSc course in ABA, undertake 1500 hours of supervised fieldwork and pass a qualifying exam. It was hypothesised that having a behaviour analyst as a member of school staff would allow for an integration of the techniques and improve the collaborative aspects of the programme. On average, the behaviour analyst spent 1 hour a week focusing on each child enrolled in the intervention.

The role of the researcher within the school

The researcher's primary role within the school was to work as a BCBA. This involved developing and overseeing an ABA service within the school: identifying appropriate interventions for children in different parts of the school with consideration of research evidence and the contextual variables (discussed in more detail below). Prior to the formulation of the BESST model, the BCBA worked with children who were at risk of exclusion across the school. This involved conducting functional assessments, writing behaviour plans and training staff to implement these plans. Some of this work in described in 'Using applied behaviour analysis as standard practice in a UK special needs school' (Foran et al., 2015; see Appendix B). Following this work, these children who were at risk of exclusion remained at the school; this work was important because it helped to demonstrate the impact that interventions based on ABA can have for children across the school. The leadership team encouraged the BCBA to work in the early years provision to help teach pivotal skills that might prevent the developing of challenging behaviours . Once the service was developed to the BCBA role involved conducting assessments; writing, monitoring and updating teaching, functional skills programmes and behaviour plans; training staff to implement interventions; and attending meetings about the children on her caseload.

Researcher

The school employed the BCBA and supported her to enrol on a PhD programme and conduct research about the ABA provision in the school. There are some potential ethical

implications of being both a researcher and an employee that impacted the types of research designs that could be realistically employed. The headteacher supported and funded the PhD; however, the BCBA's priority was to support the clients. All research needed to be directly related to the BCBA's caseload, and conducted with minimal disruption to the children's education or the school day. The classroom teachers sometimes objected when the behaviour analyst removed the children from the classroom to participate in research in a controlled setting. School leadership and staff raised concerns about the ethics of continuously exposing children to research conditions for the purpose of demonstrating experimental control, or delaying treatment in a multiple baseline design. The researcher needed to balance the clinical demands of her role, with the desire to conduct research that was both behavioural and technological (Baer, Wolf & Rilsey, 1968). As a result, the evidence presented in this dissertation may not be as well controlled as research that is conducted in other research settings. However, practice based research may be an ideal way to conduct proof of concept research in this type of settings. The researcher was trusted by the headteacher who was allowed a voice in the design and measurement of the intervention. As discussed throughout this chapter, designing interventions and evaluating them in the setting that they are intended to implemented may be crucial when attempting to close the gap between research to practice (Dingfelder et al., 2011). Another ethical consideration relates to the teaching staff, and their ability to consent to research. In order to gather information on treatment integrity for discrete trial training (DTT) in the BESST model, teaching staff were invited to participate in research that involved measuring the quality of their DTT instruction using the York Measure of Quality of Intensive (YMQI; Lángh, U., Cauvet, E., Hammer, M., & Bölte, 2017). In some situations, it may have been difficult for staff to opt out of this type of research because it was being was embraced by the senior leadership team, and the staff had a professional relationship with the researcher, secondary to the research. However, the researcher

attempted to mitigate this by reassuring staff that they did not have to participate in the research, and that there would be no implications of either opting in or out of the research. A number of staff chose not participate in the research, which demonstrates that they felt comfortable doing so.

The role of t*eaching staff within the model*

All of the one-to-one teaching was delivered by teachers and teaching assistants employed by the school. None of the teaching team had any formal training in ABA. Each child received assessments and on-going intervention from a speech and language therapist (SALT) who collaborated with the teacher and BCBA to develop an integrated programme for each child.

Formal and informal processes involved in the development of the model

A number formal and informal processes were employed in the development of the BESST model. These processes helped the researcher to identify the treatment variables that would be acceptable and feasible within this setting. The process also helped to identify contextual variables that would need to explicitly considered throughout the formulation of the model. The researchers regularly met with the senior leadership team to discuss issues pertinent to the BESST model and ABA model in the school more generally; these included staffing levels, which directly impacted treatment intensity; the types of educational programmes and research that were considered to be acceptable to key stakeholders; as well as types of practice that they longer wanted to be part of the school. An example is that the school leadership did not want to limit the number of classroom staff that worked with each child, and they were not able to afford a model that required several hours of 1:1 teaching each day. The behaviour analyst discussed intensity of one-to-one teaching hours with the teachers in order to establish what she thought was practical they worked together to identify how the deliver as much one-to-one teaching as possible throughout the day. This was

collaborative and required compromise from both parties. The behaviour analysts worked closely with the teachers and senior leadership teams to develop function based behaviour plans that could be implemented with integrity. Other formal processes included conducting observations in the foundation phase classrooms to identify the typical practice in this setting and consider how the researchers could shape changes to the standard classroom model. Many informal processes were employed, these included regular informal discussions with teachers; the BCBA was always available to discuss and support issues related to problem behaviour and skills development. This was important in terms of building relationships to affect change, as well as gathering information which helped to shape the model. The BCBA spent time in classrooms modelling various aspects of educational and behavioural interventions, conducting formal and informal training and providing feedback to teaching staff. This was only possible because the researcher was employed as a full-time onsite BCBA.

There were opportunities to promote the model (both BESST and the ABA model in school). Early on in the development of the model, and thereafter, the researcher presented data to the board of Governors on a number of occasions; this was always very well received, and was important for future funding of ABA team, and thus the sustainability of the model.

Contextual Variables

As discussed in chapter 1, SEN settings are different in many ways to the settings in which comprehensive model of education and focused intervention packages are typically delivered. Contextual variables in this setting needed to be explicitly considered throughout the formulation phase of the model in order for the intervention to be implemented as designed, and sustainable in the long term (Dingfelder et al., 2011). A number of variables were identified through the processes described above; these directly impacted the development of the BESST model. The first consideration was funding: children in

maintained SEN schools in Wales receive as little as £15,451 per year (Welsh Government, 2019). This directly impacts staffing levels, which in turn affects the number of one-to-one teaching hours that can delivered in this setting. Furthermore, many of the stakeholders felt that intensive one-to-one teaching was impractical, and incompatible with practice in a SEN school. As a result, the model emphasised fewer one-to-one teaching hours. An emphasis was placed on quality group teaching that was underpinned by the principles of ABA throughout the rest of the day. The emphasis on group teaching was a direct result of the lower intensity of one-to-one teaching hours. Another contextual variable was staff education. Teaching staff in this setting had no prior experience or qualifications in ABA; furthermore, teaching assistants did not typically have a university qualification. This is unusual as interventions based on ABA are often delivered by highly trained therapists (Bibby et al., 2001; Leaf et al., 2016) who are educated to under graduate degree level or above; for example, Lambert-Lee and colleagues (2015) reported that all of the ABA tutors in their study that evaluated an educational model in an ABA school were educated to degree level. This directly impacted on the level of training that could be provided in this setting, as well as the type and complexity of interventions that could be implemented (see chapters 5 and 7). Another consideration for the BCBA was the fact that staff in this setting did not choose to work in a setting that utilised ABA based interventions. Much of the research on ABA in schools is conducted in ABA schools or University based settings where staff may be working towards their BCBA qualification and accruing supervision hours (Griffiths et al., 2015; Lambert-Lee et al., 2015). As such, relationship building with staff in this type of setting may be more relevant than in settings where staff are motivated and engaged with ABA. The BCBA needed to establish trusting relationships with the staff to encourage them to try the new interventions.

There are many strengths to the processes that were employed in the development of the model as evidenced by the fact the it still exists in this setting, and is now being implemented in five other SEN settings across the UK. Working closely with key stakeholders allowed the researcher to identify contextual variables and other factors relevant to the setting that may impact the how effective and sustainable the BESST model could be in this setting. However, because the model developed over a period of about two years, and in some ways quite organically, these processes, and the direct implication of employing each one, is difficult to quantify. It is likely that each of them was important to the success and sustainability of the model in some way. For example, it was crucial to identify the treatment variables that were feasible in the setting; and it is also likely that spending time with teaching staff, and building relationships was very important.

Chapter 3: British Early Special School Teaching Model: Initial evaluation.

Abstract

There is considerable evidence to support effectiveness of comprehensive models of education based on applied behaviour analysis (ABA). However, there is a gap between research and practice for such models (Dillenburger, 2011). This paper addresses the research to practice gap between interventions based on ABA and their implementation in maintained special educational needs (SEN) settings in the United Kingdom (UK). The British Early Special School Teaching (BESST) model is discussed. The BESST model is comprehensive model of education feasibly be implemented and sustained in a SEN setting. Children received 7-hours a week of one-to-one teaching, but all teaching was underpinned by the principles of ABA and skills were generalised across all activities. Outcome data show that children can make significant gains, with moderate effect sizes on standardised assessments and skills assessments.

Early intensive behaviour intervention (EIBI) is a comprehensive model of early education based on ABA, and involves the rigorous assessment and teaching of key developmental skills such as social referencing, joint attention, imitation, receptive and expressive language skills (Dixon et al., 2016; National Research Council, 2001). Skill deficits are systematically taught in a developmental sequence. EIBI has been most commonly used to teach young children with ASD (Eldevik, Titlestad, Aarlie, & Tønnesen, 2019; Lovaas, 1987; Remington et al., 2007), but has also shown to be effective with young children with other special educational needs (Eldevik, Jahr, Hastings, & Hughes, 2010; Eikeseth, Haywards, Gale, Gitlesen & Eldevik, 2009).

There is an emerging literature to suggest that ABA can be successfully implemented in mainstream schools. Young children with autism who are supported on a one-to-one basis in mainstream classrooms or ABA units make greater gains on measures of IQ and adaptive behaviour than children receiving TAU (Grindle et al. 2009, 2012; Peters Scheffer et al., 2013). In Grindle and colleagues' (2012) study, children received 13-15 hours of one-to-one teaching per week and were supported at a one-to-one staffing level for the rest of the day. These studies did not report how the teaching time outside of DTT was spent, but is likely that their one-to-one staff created learning opportunities to generalise the gains made in DTT. The data suggest there may be alternative and effective ways to deliver ABA programmes. ABA interventions can be successfully adapted to mainstream schools using intensive staffing levels, however children in SEN schools are not typically assigned a one-to-one staff member all day. It is not known if the interventions will generalise to less intensive settings.

To the best of our knowledge, there is little research on how to integrate teaching based on the principles of ABA into maintained SEN schools, with typical staffing levels and a multi-disciplinary team. Group teaching is common in schools, and most EIBI focuses on one-to-one teaching (Kasari and Smith, 2013). Some educators may feel that EIBI is not

compatible with their pedagogical beliefs, in particular they may worry that there will be a reduced emphasis on social skills and generalisation. Some worry that EIBI is overly focused on reducing behaviours associated with ASD. EIBI is expensive; few, if any, local authorities have the budget to provide all young students with autism 20-40 hours a week of one-to-one teaching. Much of the research on EIBI does not include children who score low on standardised assessments, speak multiple languages, are non-verbal, or live in poverty (Peters-Scheffer et al. 2013; Weisz, 2005). The interventions described in the research literature may not be an obvious fit for UK special needs schools or reflect the students in those settings. While there is good research evidence for EIBI, the research-practice gap means that few children with ASD or special educational needs benefit from an education that includes ABA.

It may be possible to deliver an education that combines the essential components of a comprehensive model of education based on ABA with a combination of individual and group teaching. The targets and principles of teaching an ABA programme can be consistently implemented throughout the school day, using a variety of teaching techniques.

Foran et al., (2015) (Appendix B) described such a model. In their pilot study, university researchers and behaviour analysts collaborated with teaching staff in a maintained SEN school to design a model that incorporated ABA into everyday teaching. The school employed a team of behaviour analysts, led by a BCBA. The BCBA worked with the classroom teacher to assess and set individual targets for children in the foundation phase and key stage 1. The classroom staff were trained to deliver DTT and NET, and each child received about 7 hours a week of one-to-one DTT. Every staff member worked with each child. Outside of DTT times, the children's learning targets were taught and generalised during group instruction, play, and classroom transitions. The behaviour analyst conducted a functional assessment or functional analysis and designed an individualised behaviour plan

(IBP) for each child to reduce behaviours that were barriers to learning, such as aggression, absconding, or climbing. Foran et al. (2015) found that the children who participated in the model made better than expected gains on measures of IQ and on skills assessments. Pitts, Gent and Hoerger (2019) evaluated a similar model with children aged four to 13 years old. Children made significant gains on the Vineland Adaptive Behaviour Scales II (VABS; Sparrow, Balla, & Cicchetti, 1984), and on a number of curriculum measures over one academic year of intervention; large effect sizes were reported in many areas. There was also a statistically significant reduction in the Behaviour Problem Inventory-S composite score, which demonstrated that problem behaviours reduced over the course of the intervention. The following sections describe the BESST model and presents outcome data from 13 children who received the intervention over one academic year.

Method

Participants

Children were recruited from a foundation phase or key stage 1 classroom of a maintained SEN school. Thirteen children (11 boys and two girls) took part in the study. Each child had a statement of special educational needs. Eight children had a diagnosis of ASD, three had diagnoses of social communication disorder, and two children had a diagnosis of pervasive developmental disorder not otherwise specified (PDD-NOS) at the beginning of the study. The average age of children at beginning of the intervention was 65.38 months (range = 51 - 74 months). To meet the inclusion criterion, children had to be less than 7 years of age and enrolled in the foundation phase or Key Stage 1 classroom on a full time basis at the beginning of the intervention. Informed consent to participate in the research was obtained from the children's parents (application no. 2012-7102). Data collection for baseline assessments started in September 2012 and post-test assessments started in June 2013; assessments for another group of children were conducted in September

2014 and again in June 2014. Data for both cohorts are combined and presented in this study. The classroom staff gave their consent to be filmed and observed for assessment purposes (application no. 1165); observations were carried out in 2014.

Child outcome measures

Standardised assessments

Standardised assessments were used to measure intellectual functioning (IQ) and adaptive skills. IQ and adaptive behaviour were measured before the intervention started and following approximately one academic year of intervention.

Intellectual functioning.

The Stanford–Binet Intelligence Scales–Fourth Edition (Thorndike, Hagen & Sattler, 1986) was used to measure changes in IQ.

Adaptive behaviour.

The Vineland Adaptive Behaviour Scales II (VABS; Sparrow, Balla, & Cicchetti, 1984) survey interview form was used to measure adaptive behaviour. The semi-structured interview was completed with parents or caregivers. Standardised scores for socialisation, communication, daily living, motor skills (for children under 7 years of age) and an overall adaptive behaviour composite score are reported. VABS data are only included for 12 children because the parents of one of the children were unable to complete the interview at follow-up.

Skills assessment: The Assessment of Basic Language and Learning Skill - Revised®

The ABLLS-R® was used to measure skill gains, and as a curriculum guide. The ABLLS-R® measures a range of skills including social and communicative functioning, and imitation and cooperation; these skills are essential for children to learn naturally from their environment (Partington and Sundaberg, 1998). Twenty-five skills areas are measured using the ABLLS®. For analysis, we divided these 25 areas into six meta-domains: learning skills,

language, social skills and play, academic self-help and motor skills, described by Grindle and colleagues (2012). Percentage of mastered skills across each of these meta-domains is reported.

Procedure

The intervention was delivered in the foundation phase classroom of a maintained SEN school. Behaviour analysts designed individualised learning programmes (ILP's) and individualised behaviour plans (IBP's). Teachers and teaching assistants implemented the intervention on a daily basis. Teachers organised the staff team and the classroom, and planned sessions that focused on the generalisation of skills taught in one-to-one teaching sessions. The staff to student ratio was about 1:2 over the duration of the project.

Assessments and Programmes

Each child had an ILP. ILPs were based on the outcomes of the Assessment of Basic Language and Learning Skill - Revised® (ABLLS-R®) (Partington, 2006), ABLLS-R®, the VABS, other ABA based curricula (Rogers and Dawson, 2010; Leaf, & McEachin, 1999), and the national curriculum. Additional targets were identified from observations of the child and consultation with teachers, teaching assistants, parents and SALTs. Programmes were designed by a behaviour analyst. The overall goal of ILPs was to identify and teach the skills necessary for a child to learn from the natural environment. It was a comprehensive model in that multiple areas of development were targeted; the skills that were taught were developmentally appropriate and introduced in a graduated fashion - basic skills were taught before introducing more complex skills.

Every child had an ILP booklet and workbox. The booklet contained the child's targets, information on potential reinforcers, a suggested schedule of reinforcement, and information on how to address problem behaviour that might occur during a work session. Data were collected in the booklet about the child's response to each learning trial. The

workbox contained the stimuli required to teach the skills on the child's programme; the teaching staff were responsible for making all of teaching materials.

One-to-one teaching

Children received seven hours of one-to-one teaching each week, and the teaching was delivered over 2-3 sessions each day. Teaching was delivered by multiple staff members during the week to encourage the children to generalise skills across people and to facilitate spontaneous generalisation outside one-to-one sessions.

Skill generalisation; time outside of one-to-one teaching

The teacher planned small group activities aimed to generalise skills being taught in one-to-one teaching sessions. Some examples included working on matching or receptive language skills during sand and water play; targeting imitation skills and following instructions during cooking, P.E., and playtime; and receptively identifying, labelling and requesting for colours during a painting activity. Children whose targets incorporated basic academics also worked on literacy, numeracy and writing during this time. Compulsory areas of the national curriculum were targeted in group sessions.

Basic daily living skills, such as personal hygiene and dressing skills were also targeted throughout the day using task analysis. Independent use of the toilet was a goal for each child. An adapted version of Cicero and Pfaft's (2002) toilet training programme was used to teach independent toileting.

Shaping and desensitisation programmes were used to address a range of issues. Eating programmes were introduced for children who had a particularly restricted diet. The remainder of the child's day was divided between play sessions, small group teaching sessions, breaks and lunchtime, compulsory activities such as registration and national curriculum subjects, and transitioning throughout the school.

All activities were underpinned by the principles of ABA– reinforcement, prompting and error correction procedures were used as appropriate. Skills such as requesting, imitation, following instructions, labelling and answering questions were targeted throughout all sessions; learning opportunities in the form of instructions or creating opportunities for the children to practice language were provided during all activities, including snack, playtime and during transitions where appropriate.

Individual behaviour plans

Each child had an IBP. IBP's were based on the outcome of a functional assessment or functional analysis, and included antecedent and consequence based strategies. IBP's provided the teaching staff with consistent strategies to reduce behaviours that were barriers to learning, such as aggression, self-injury, absconding, screaming, pica, and climbing in the classroom. The explicit goal of the IBP was to enable children to be safe and to participate fully in education. Self-stimulatory behaviours were not targeted unless the multi-disciplinary team agreed that the behaviours posed a danger to the child or interfered with learning.

Individualised behaviour plans were implemented throughout the school day. Teachers were consulted on the development of the plan to ensure it was practical and easy to implement.

Staff training and supervision

Behaviour analysts in the BESST model delivered staff training throughout the academic year. All formal training took place during working school hours at no extra cost to the school – training was delivered during inset days or after school training sessions. The aim of the training was to enable staff to implement interventions that are underpinned by the principles of behaviour; staff were not expected to have an in-depth knowledge of these principles. Training included a formal two-hour PowerPoint session on the topics of DTT, NET and the functions of behaviour. These trainings were supplemented with follow-up in-

situ training during normal school hours; feedback was provided on treatment integrity during and after in-situ training. When an IBP was introduced, behaviour analysts modelled novel components for staff and observed staff implementing the plans; feedback was provided on implementation and further training was provided when needed. Behaviour analysts were available to answer questions about behaviour plans throughout the week.

Fidelity Measures

The York Measure of Quality of Intensive Behaviour Intervention.

The York Measure of Quality of Intensive Behaviour Intervention (YMQI) is an assessment tool used to measure the quality of one-to-one DTT teaching (Lángh, U., Cauvet, E., Hammer, M., & Bölte, 2017). The YMQI includes 31 items in nine categories: Discriminative Stimuli (S^Ds), Reinforcement, Prompting, Organisation, Pacing, Teaching Level, Instructional Control, Generalisation and Problem Behaviour. Each category contains two to six items, for example, in the S^D category instructor behaviour is measured with regard to delivering the S^D only when the child is attending, and varying the wording of S^D's. To measure the quality of DTT each of the 31 items is scored on a 5 point Likert scale from 1-3, with half points (see Appendix C). A total of 8 out of 12 teachers, teaching assistants, and student interns consented to take part in the filming and YMQI evaluation. Two 10-minute recordings were taken for each teacher and two non-overlapping five-minute segments were selected and scored by trained observers. The two segments were averaged together to provide a total score for each teacher. Scores below 2.2 are considered poor practice, scores between 2.2 – 2.4 are considered good practice, and scores above 2.5 are rated as excellent. The YMQI has been shown to have good reliability and validity (Làngh et al., 2017).

Learning opportunities and task assignment.

We observed how staff interacted with the children outside of one-to-one teaching sessions to gather information on the learning opportunities that were provided to each child

during this time. Observations were carried out for a total of five days throughout the year. Learning opportunities were defined as a staff member delivering an instruction, or asking a child or small group of children a question that required a response. Successful and missed learning opportunities were recorded using frequency within 5 minute intervals. A successful learning opportunity was defined as a teacher delivering an instruction and following it up with an appropriate consequence (i.e. reinforcement, prompt or error correction). A missed learning opportunity was the teacher delivering an instruction and not following it up with an appropriate consequence. The rate of learning opportunities that was delivered to each child and percentage of successful learning opportunities are reported. The percentage of successful learning opportunities was calculated by diving the total number of successful learning opportunities by the total number of learning opportunities (successful and missed) and converting this to a percentage.

The school day was timetabled and children were always assigned a clear task or activity. At any time, one or two staff members conducted one-to-one teaching sessions, while the rest of the staff ran small group teaching or play sessions. Trained researchers observed each child for 5 minutes at a time and collected data on whether they had been assigned a clear task or activity. Data were collected using 30 second whole interval recording.

Behaviour plan implementation.

Each child's individualised behaviour plans (IBP) included antecedent and consequence based strategies. To measure fidelity observers collected data on whether or not staff implemented these strategies, and if contra-indicated strategies were employed following problem behaviour. Observations were carried out over three days. Two researchers observed each child for 15 minutes at a time and collected data using partial interval 30s intervals. Data are presented on the percentage of intervals during which

behaviour plans were correctly implemented; a reactive strategy was not implemented (e.g. did not prompt a child to ask for a break); and an explicitly contra-indicated reactive strategy was implemented (e.g. provided attention following problem behaviour). To calculate the percentage of intervals during which IBP's were correctly implemented, the total number of intervals during which both antecedent and consequence based strategies were implemented as described in an IBP was totalled. This figure was divided by the total number of intervals during which strategies ought to have been implemented (an interval was not counted if problem behaviour did not occur during that interval and if that child didn't have any antecedent strategies that were relevant in that instance); this was converted to a percentage. To calculate the percentage of missed reactive strategies, the total number of intervals with missed reactive strategies was totalled and this number was divided by the total number of intervals during which a reactive strategy ought to have been implemented and this was converted to a percentage. To calculate the percentage of intervals where staff delivered consequences that were contra-indicated, the total number of intervals with contra-indicated strategies was divided by the total number of intervals during which a reactive strategy ought to have been implemented and this was converted to a percentage.

Results

Child Outcomes

Child outcome measures for standardised assessment are presented in Table 1. Paired samples t-tests were conducted to test for differences between Time 1 and Time 2 for the Stanford Binet, VABS, and ABLLS-R®. Results from the Stanford Binet test showed significant main effects for verbal IQ, non-verbal IQ, and the combined full scale IQ for 13 children. Effect sizes were calculated using Cohen's d and were adjusted to take into account the repeated measures correlated design (Dunlap, Cortina, Vaslow &, Burke, 1996). Moderate effect sizes were found for non-verbal and full-scale IQ measures and

communication and daily living skills scales in the VABS for 12 children. The changes on the socialisation scale and the composite score were not statistically significant. The Stanford-Binet and the VABS are normative assessments, and the scores for a typically developing child would stay the same after one year. In this case, the scores increased which suggests that the children made greater than expected gains over the course of the assessment period.

The outcomes of the ABBLS-R® are presented in Table 2. The ABLLS-R® is not a normed assessment tool, but can be a useful measure for observing progress. Table 2 shows the participants made statistically significant changes on all curricular measures. Effects sizes for the six meta-domains were moderate to large; a small effect was found on the ABLLS-R® total.

Fidelity Measures

The York Measure of Quality of Intensive Behaviour Intervention.

Table 3 shows the results of the YMQI. The overall score falls in the excellent range (2.51). The quality of teaching with regard to organisation and pacing was excellent, and the generalisation and teaching level were rated as good.

Learning opportunities and task assignment.

On average, 1.25 learning opportunities per minute were provided to each child outside of one-to-one teaching; 86.4% of learning opportunities were followed up with an appropriate consequence. Children had a clear task to engage with for 98% of observed intervals.

Behaviour plan implementation.

The classroom staff correctly implemented behavioural strategies for 84.5% of opportunities. The staff missed an opportunity to implement a reactive strategy (e.g. did not

prompt a child to ask for a break) during 10.8% of intervals, and used a strategy that was explicitly contra-indicated during 1.2% of intervals.

Table 1.

Mean Assessment Scores and Standard Deviations for the Stanford-Binet Intelligence Scale and the Vineland Adaptive Behavior Scale at Time 1 and Time 2 and Results of Paired Samples t-test Analysis and Effect Sizes

	N	*M*	*SD*	*M*	*SD*	*p*	*d*
Full Scale IQ	13	45.30	6.86	51.07	11.60	.007	.44
Verbal IQ	13	47.30	6.21	50.46	8.43	.008	.34
Nonverbal IQ	13	48.15	7.61	56.23	14.96	.013	.51
Adaptive Behavior Composite	12	54.33	10.70	59.25	13.60	.110	.39
Communication	12	53.00	15.04	59.33	10.70	.043	.44
Daily Living Skills	12	51.17	13.72	59.50	19.88	.057	.45
Socialisation	12	60.00	11.13	61.17	15.72	.761	.08

Discussion

The BESST model was designed as a collaboration between special education teachers, parents, and BCBAs. The goal of the collaboration was to consider how evidenced based teaching can be incorporated into the classroom of a maintained SEN school. A strength of the BESST model is that it was delivered by teachers and classroom assistants who did not have formal training in ABA. The quality of DTT, assessed by the YMQI, was good to excellent. When children were not in one-to-one sessions, each teacher delivered approximately 1.25 learning opportunities per minute and followed through and reinforced learning on 86.4% of these opportunities. Children were assigned a clear activity for 98% of

observed intervals. Fidelity checks also showed that behavioural strategies were implemented correctly for 84.5% of opportunities.

Table 2.

Mean Assessment Scores and Standard Deviations for the Assessment of Basic Language and Learning Skills (Percentage of mastered skills) at Time 1 and Time 2 and Results of Paired Samples t-test Analysis and Effect Size for ABLLS Total and six meta domains

	Time 1			Time 2			
	N	*M*	*SD*	*M*	*SD*	*P*	*d*
ABLLS-R® total	13	13.01	11.98	30.71	21.46	<0.001	.39
Learning skills	13	21.31	18.12	46.46	25.03	<0.001	.94
Language	13	13.84	16.07	37.07	28.92	<0.001	.49
Social & play	13	11.40	15.29	29.13	25.42	0.001	.64
Academic	13	10.02	14.65	23.33	23.82	0.005	.53
Self-help	13	21.02	25.83	42.00	31.20	0.005	.71
Motor	13	22.47	19.29	39.79	24.78	<0.001	.72

Each member of staff delivered one-to-one teaching with every child; this may have helped children to generalise skills across people. Classroom staff implemented the children's one-to-one teaching targets across all sessions, allowing for generalisation opportunities throughout the school day. Behaviour analysts observed that teaching staff generalised the techniques from DTT, and utilised prompting, error correction, and reinforcement to help generalise and consolidate learning.

Children who participated in the BESST model showed increases in the IQ and on measures of adaptive behaviour after 3 school terms. Children made significant gains on skills taught over the course of the intervention

Table 3.

Mean Scores and Ratings on the Characteristics of Quality Teaching measured by York Measure of Quality of Intensive Behavioural Intervention for teaching staff in the BESST model

	Mean Score (range)	*YMQI Rating*
Discriminative stimulus	2.59 (1.5 – 3)	Excellent
Reinforcement	2.64 (1 – 3)	Excellent
Prompting	2.66 (1-3)	Excellent
Organisation	2.94 (1.5 – 3)	Excellent
Pacing	2.45 (1.5 – 3)	Excellent
Teaching level	2.39 (1.5 – 3)	Good
Instructional control	2.39 (1.5 – 3)	Good
Generalisation	2.21(1 – 3)	Good
Problem Behaviour	2.47 (1 – 3)	Good

The effect sizes reported in this paper are smaller than those found in more intensive ABA programmes. While this may be because the children received significantly fewer hours of one-to-one teaching, there are other factors that make it difficult to draw comparisons. The participants were a typical cohort in a maintained SEN school; their initial IQ scores of the children in this study is lower than reported in many EIBI studies including school based interventions (Grindle et al., 2012; Eldevick et al., 2012) and there is convincing evidence that children with higher IQ at the start of the intervention show greater treatment gains (Dietz, Buitelaar, Van Daalen, & Van Engeland, 2007). Furthermore, the Stanford Binet measure may not have been sensitive to changes in IQ as several children in this cohort scored at the floor of the assessment at intake. It is also important to note that the parents of

children in this study did not choose ABA; instead, it was delivered as standard practice. The process of accessing intervention based on ABA is arduous (Hastings & Johnson, 2001); therefore, parents who choose ABA may be more likely to attempt to implement the intervention at home or to generalise specific skills, this may impact outcomes.

The key stakeholders sought to incorporate elements of ABA into their teaching while preserving the culture of the SEN school. Recent research has found that children with ASD make gains in school programmes (Grindle et al., 2012; Peter-Scheffer et al., 2010, Peter-Scheffer et al., 2013), but there is less evidence for programmes in SEN schools. The BESST model included elements of ABA across the school day. It is important to note that the BESST model is not eclectic. In an eclectic treatment, interventions based on ABA may be delivered for a few hours a week, but are mutually exclusive to other interventions (Odom, Collet-Klingenberg, Rogers, & Hatton, 2010). The BESST model is a comprehensive model which targets multiple areas of development (Dixon et al, 2016); and model is delivered across the whole day in order maximise treatment intensity. In the BESST model, there was a consistent approach to learning and behaviour. All stakeholders worked together to integrate the interventions and teaching strategies. Regular BCBA input is likely to be essential to the success of the BESST model; interventions based on ABA should be designed and supervised by a BCBA (Vollmer, 2014); and this supervision has been shown to predict child outcomes in EIBI programmes (Dixon et al., 2016; Waters, Dickens, Thurston, Lu, Smith, 2018). The BCBA in the BESST model continuously modelled DTT, NET as well as modelling quality and focused interactions with children outside of one-to-one teaching. It is likely that the ongoing training and support that was provided had a significant impact on treatment integrity during one-to-one teaching sessions and on the quality of teaching that was delivered outside of one-to-one.

Formal assessments of social validity were not included in this study; however, there is some evidence that the model has social validity and this warrants discussion. The BESST model was originally implemented in one classroom in this school and it currently being implemented in four classrooms. Secondly, teachers and teaching assistants engage with the model, and often express their desire to remain in BESST classrooms once they have been introduced to the model. On larger scale, the BESST model has been replicated and adopted as standard practice in five SEN schools across the UK; like in the original model, BCBA's are employed as part of the school team in these settings. As discussed in chapter 1, SEN settings typically adopt an eclectic approach to education (Keenan & Dillenburger, 2011) and avoid adopting specific theories or approaches (Callahan, Shukla-Mehta, Magee, Wie, 2010; McMahon et al., 2016; Schoen, 2003). Senior leadership teams and teachers who adopt the BESST model, adopt ABA over an eclectic approach, this is a significant cultural change for these settings. This evidence that the model has been adopted and sustained in these settings can be considered direct evidence of the social validity of the model.

While there are many strengths to this model, this is preliminary research and there are a number of limitations that must be acknowledged. The first is that there is no control group. The researchers invited the administrators of several SEN schools that delivered TAU or eclectic treatments to participate in the research, however, none agreed to participate. Without a control group it is difficult to conclude that the gains were a result of the intervention and not for example, typical maturation. Outcomes of previous research has shown that children with ASD who receive TAU often loose skills over the course of an intervention period (Howard et al., 2005; Remington et al., 2007) because gains need to be greater than is typically expected to achieve positive means scores on standardised assessments. The children in the current study made larger than expected gains on standardised assessments when it could be expected that they would lose skills.

As stated, one of the main goals of the BESST model is to teach children the skills necessary to learn from the natural environment to enable them to learn in a less structured teaching environment with less intensive teaching and support. Future research could evaluate the potential cost-effectiveness of providing the BESST model of education to young children with ASD and ALN. It is important to establish if children who were part of the BESST model require less support in terms of one-to-one staffing and other support to manage problem behaviour and support learning as they get older when compared to children who did not receive the BESST intervention; it also important to identify if the model leads to a reduction in the number of children requiring more expensive placements due to placement breakdown in maintained SEN settings.

The current study can be considered in the context of Phase 1 of Dingfelder and Mandell (2011) diffusion of innovation theory, which is the formulation and systematic application of a new intervention. The model was designed with key stakeholders in order to incorporate elements of the intervention which are salient to the staff in special needs schools. The following steps should include between-group research, replication to other schools and settings, and formal manualisation of the intervention.

Chapter 4: The impact of contextual variables on prompting procedures

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Discrete trial training (DTT) is a focused intervention practice that can be used to teach a range of skills (Leaf, Cihon, Leaf, McEachin, 2016; Akmanoglu-Uludag & Batu, 2005; Akmanoglu-Uludag & Batu, 2004; Leaf et al., 2010; Leaf et al., 2014; Leaf et al., 2016a) to children with ASD and learning disabilities (LD). Discrete trial training can be implemented as a single intervention to teach specific skills or as part of comprehensive education models based on ABA.

The basic units of a discrete trial are discriminative stimulus, a response from the learner, and a teacher delivered consequence (Leaf et al., 2016a; Leaf, Sheldon, Sherman, 2010). The goal of DTT is to teach the learner to emit a specific response in the presence of the discriminative stimulus; prompts and error correction procedures are implemented to assist with this.

The identification of an effective DTT prompting procedure that was appropriate to maintained SEN schools was crucial to the success of the BESST model. There are a wide range of DTT procedures to choose from and the evidence suggests that no one procedure is consistently more effective than another.

Most DTT procedures clearly outline the type of prompt to be used and when it should be delivered, however more recent recommendations suggest that a progressive approach that utilises flexible prompt fading (FPF) is optimal (Leaf et al., 2016). Flexible prompt fading allows the therapist to make moment to moment decisions on the type of prompt to use, when to use it, and when to fade it in addition to other implementation guidelines. A number of studies have compared FFP to other more commonly implemented procedures. Leaf and colleagues (2014) compared FPF to error correction with four participants. Both procedures were equally effective but FPF resulted in quicker skill acquisition than error correction. Leaf and colleagues (2016) compared FPF to most to least prompting. Again, both procedures were effective, but FPF was the most efficient procedure

Chapter 4: The impact of contextual variables on prompting procedures in terms of trials, sessions and/ or teaching time.

Intensive training in ABA is required in order for teachers to have the skills to make moment to moment decisions (Leaf, Cihon, Leaf, McEachin, 2016). Leaf and colleagues (2016) suggest that up to 600 hours of training may be required to implement the progressive approach to DTT. As such, this approach is less appropriate in a setting where staff do not have formal training in ABA and where training time is limited.

When commonly implemented procedures, such as simultaneous prompting and no-no prompting, were considered in line with contextual variables it was decided that these procedures were not appropriate for settings where the BESST model is implemented. Simultaneous prompting was not considered to be appropriate because staff need to fade prompts and therefore monitor data on a trial by trial basis. Ongoing monitoring would be particularly difficult in a setting where staff work with many children across the week; and where staff are not formally trained in ABA. The need for moment-to-moment decision making about when to fade prompts would be likely to result in low treatment integrity in this setting. No-no prompting was not preferable because children are allowed to make multiple errors before the correct response is modelled (Gast, 2011). Furthermore, the use of reprimand is contraindicated in this setting; thus, delivering correct feedback in the form, "no" was not deemed appropriate. Therefore, a bespoke prompting procedure was designed.

A number of factors were assumed to be important when designing DTT procedure for the BESST model. The procedure needed to be effective and efficient in teaching a range of skills to children with ASD and LD. It needed be easy to implement by all staff and suitable for use with the majority of children. Due to limited time for staff training the procedure needed to be prescriptive: staff should not have to make moment-to-moment decisions about the type of prompt to use, or when to deliver a prompt. The development of faulty stimulus control and prompt dependency was also an important consideration due to

limited staff training; a procedure that did not require prompt fading was preferable. Prompt fading requires careful on going monitoring of the data, which would be very difficult in a setting where many staff work with many pupils across the week.

The effectiveness of prompting procedures has been demonstrated to be idiosyncratic across learners (e.g. Markham, Giles, & May 2020; Leaf, Sheldon & Sherdan, 2010). Research has not found that one strategy is consistently more effective than another. Therefore, components of well evidenced procedures that were suitable to this setting were combined to design a bespoke procedure that met the criterion outlined above. The result is a procedure known as the responsive prompt delay procedure (RPD). This procedure is prescriptive. It employs least to most (LTM) prompting following two non-responses to the discriminative stimulus (S^D); increasingly intrusive prompts are provided until the learner responds correctly. Because LTM is used staff do not need to make moment-to-moment decisions, such as when to fade prompts, during teaching sessions. This was important consideration for this setting because the intervention is being implemented by teachers and teaching assistants who commonly make treatment errors when implementing DTT (Carroll, Kodak, & Fisher, 2013). There is some evidence to demonstrate that errors can help with the learning process when compared to errorless methods, for some children (Leaf et al., 2010; Fentress and Lerman, 2012); however, repeated errors can impair learning and lead to escape maintained problem behaviour (Gast, 2011). RPD employs an error correction procedure, which again remains consistent across all learners; however, unlike procedures such as no-no-prompting which allows for multiple errors, the error correction is implemented following the first error, thereby, decreasing the chances of repeated errors. In addition to this, independent responses can contact differential reinforcement, which may further decrease the chances of prompt dependency (Cividini-Motta & Ahearn, 2013; Grow & Le Blanc, 2013). This bespoke procedure was compared to two commonly implemented procedures:

Chapter 4: The impact of contextual variables on prompting procedures

simultaneous prompting and no-no prompting.

Chapter 5: A comparison of Simultaneous Prompting, No-no prompting and Responsive prompt delay procedures

Abstract

Discrete trial training is a commonly used to teach children with autism spectrum disorder (ASD) and related intellectual disabilities. A number of prompting and error correction strategies can be implemented when using discrete trial training. These strategies need to be effective and efficient. We compared a novel procedure, responsive prompt delay, to simultaneous prompting and no-no prompting. A parallel treatments design, nestled in a modified multiple probe design (Horner & Baer, 1978), was used to compare the three procedures with three participants. The responsive prompt delay procedure was at least as effective as simultaneous prompting and no-no prompting procedures for three participants; the time required for each participant to master the skills was variable across procedures.

Discrete trial training (DTT) is commonly used as part of comprehensive educational programmes to teach young children with autism spectrum disorder (ASD) and related intellectual disabilities. DTT has been demonstrated to be effective in teaching social skills, language skills and academic skills (Fentress and Lerman, 2012; Kodak et al., 2016; Leaf et al., 2016; Soluaga, Leaf, Taubman, McEachin, & Leaf, 2008).

Many prompting and error correction strategies are effective; effectiveness varies across learners and may be impacted by teaching variables, such as the type of skill being taught (Carroll, Joachim, St. Peer, Robinson, 2015; Leaf et al., 2010; Leaf et al., 2014; Smith, Mruzek, Wheat & Hughes, 2006; Turan, Moroz, & Croteau, 2012; Worsdell et al., 2005). Simultaneous prompting has been demonstrated to be an effective tool for teaching skills such as tacting, receptive identification and reading words (Akmanoglu-Uludag & Batu, 2005; Akmanoglu-Uludag & Batu, 2004; Gibson & Schuster, 1992). Error correction procedures, including no-no prompting, have also demonstrated to be effective in teaching a range of skills (Leaf et al., 2010; Leaf et al., 2014; Leaf et al., 2016a; Smith et al., 2006). Research has not found that one strategy is consistently more effective than another.

Simultaneous prompting and no-no prompting are commonly implemented procedures; and both have been demonstrated to be effective, but procedural differences may impact on their suitability to some settings.

Simultaneous prompting is based on the principle of errorless learning; the likelihood of incorrect responses is reduced with this procedure because a controlling prompt in provided with the natural discriminative stimulus (i.e. 0 s response interval) on every trial. A controlling prompt is the least intrusive prompt that results in 100% accuracy when teaching novel skills. Stimulus control must be transferred to the natural discriminative stimulus. This is done by systematically fading prompts for each individual skill using a most to least criteria, following a set criterion of correct responses on the that skill (Gast, 2011). The

intrusiveness of the prompt is systematically reduced over a series of trials. This requires ongoing monitoring of each response and the corresponding data; teachers must constantly use the data to make treatment decisions. If prompts are not faded systematically and in a timely manner prompt dependency may occur (Grow & Le Blanc, 2013; Leaf et al., 2014; MacDuff, Krantz, & McClannahan, 2001); that it, the natural discriminative stimulus does not evoke the correct response (Green, 2001). While this procedure has been demonstrated to be effective it may be more suitable for an intensive educational model with a high staff to child ratio and staff who are formally training in ABA. The treatment integrity for prompt fading may be compromised in natural settings such as classrooms (Caroll et al., 2013; Grow et al., 2009); staff to child ratios are lower in these settings and staff work with many children across the day.

In error correction procedures, a delay follows the discriminative stimulus to allow the learner to respond independently. A prompt, or error correction is only implemented if the learner emits an incorrect response or fails to respond. Independent correct responses are differentially reinforced; differentially reinforcing independent correct responses may result in an efficient transfer of stimulus control (Grow & Le Blanc, 2013). The error correction is a contingency that is applied to errors or non-responses; it corrects and reduces errors and increases correct responding (Carroll, Joachim, Peter, & Robinson, 2015; Townley-Cochran, Leaf, Leaf, Taubman & McEachin, 2017; Worsdell et al., 2005). Examples of error correction include, corrective feedback (e.g. “no”), instructional feedback (e.g. the therapist says “it’s a car”), and remedial trials. Remedial trials provide the learner with additional opportunities to respond correctly in the presence of the discriminative stimulus following an error (Worsdell et. al.).

No-no prompting, which is a type of error correction, has been criticised for a number of reasons. Firstly, the learner is allowed to make multiple errors, because two consecutive

errors are allowed before the error correction is implemented. Another criticism, is the use of negative feedback, “no”, which may function as a conditioned aversive stimulus and could increase the likelihood that that a learner will engage in escape maintained behaviours (Gast, 2011). Furthermore, it is not appropriate to recommend punishment based procedures when appropriate reinforcement based interventions are available (BACB, 2017).

Behavioural interventions are increasingly implemented using a variety of techniques such as discrete trial teaching, natural environment teaching (Roane, Fisher, & Carr, 2016), and group instruction. These techniques are implemented in a variety of settings; staff in these settings may need to be fluent in a number of techniques. Ideally, behaviour programmes are delivered by trained technicians (Leaf et al., 2016), however, behaviour analytic programmes are delivered by individuals who do not have formal training in ABA in some settings (Foran et al., Eikeseth, Klinwall, Jahr & Karlson, 2012; Grindle et al., 2012; Peters-Scheffer, Didden, Mulders, Korzilius, 2010). In increasingly complex settings, practitioners must use prompting strategies that can be consistently implemented with a high degree of treatment fidelity.

Foran et al. (2015) (see Appendix B) designed a prompting procedure that suitable for the SEN setting that the model was being implemented in. As described in Chapter 4, it was designed with consideration to many contextual variables, which may impact its implementation in this setting: it was important that the prompting procedure was prescriptive and remained consistent across learners and skills.

The protocol for the responsive prompt delay procedure is as follows: the teacher delivered the discriminative stimulus and provided an opportunity for the learner to respond independently; independent correct responses were differentially reinforced. If a learner did not respond after a three second delay the discriminative stimulus was presented again. A prompt (least to most) was implemented following two non-responses to the discriminative

stimulus. If the learner responded incorrectly at any time, error correction using the most intrusive prompt and instructional feedback was delivered. Two remedial trials followed prompted and incorrect responses. Implementing least to most prompting provided the learner with the opportunity to respond with the least intrusive prompt; and errors were minimised by providing an intrusive prompt immediately following any error. It is consistent across learners, skills, and settings. Prompt fading is not required with this procedure which may make it easier for implementers in some settings.

This study compared the responsive prompt delay procedure to two well documented prompting strategies: simultaneous prompting and no-no-prompting. Three children took part in the study. It was hypothesised that the responsive prompt delay procedure would be at least as effective as the other two procedures.

A parallel treatment design (Gast & Wolery, 1988) nestled in a modified multiple probe design was used to compare the three procedures. The PTD was devised by Gast and Wolery (1988) to compare instructional practices, such as the ones compared in this study. The design allowed the three procedures to be compared simultaneously through concurrently operating multiple probe designs for each procedure (Gast & Wolery). Experimental control was demonstrated by showing that changes in the dependent variables occurred only after the independent variable was introduced. The modified multiple probe element of the design allowed for this to be demonstrated across skills for each participant in a time lagged fashion. An advantage of design is that it reduces the likelihood of threats such as maturation or history, and precludes the need for a control condition (Ledford & Gast, 2018). Another advantage of the multiple probe element is that is that provides a measure of maintenance for mastered skills. While this design is methodologically rigorous it takes a long time to complete, particularly due to the need to conduct full probe and daily probe sessions. We

attempted to mitigate the negative impact of this by choosing skills that were meaningful to the learners

Method

Participants

Participants were recruited from primary school classrooms in a maintained special needs school. All participants received an education based on the principles of ABA, which included discrete trial teaching. Full consent was obtained from Bangor University Psychology Ethics before the intervention began (application no. 2014-14291); informed consent to participate in the research was obtained from the children's parents.

Thomas was 7 years old and had a diagnosis of ASD. Thomas communicated using short sentences to mand and tact items; he did not initiate conversations, but could respond to basic intraverbals. Thomas engaged in low level problem behaviours, for example, knocking items over. Olivia was 8 years old and had a diagnosis of social communication disorder. Olivia had well-established mand and tact repertoires and initiated and engaged in conversation with adults and peers. Olivia did not engage in any problem behaviour at the time of the study. Mark was 6 years old and had a diagnosis of ASD. Mark had well-established mand and tact repertoires and engaged in conversation when initiated by adults. Mark sometimes engaged in protest vocalisations.

Setting

Sessions took place in a corridor close to the participants' classroom. The participant sat opposite the researcher at a table. Students, who were completing their MSc in ABA, implemented the majority of teaching sessions; the first author implemented the remaining sessions and supervised the students. Sessions were counter balanced across instructors and time of day. One average, two teaching sessions and two daily probes were conducted each

day; when a full probe was conducted this was usually conducted across one day. On average teaching took place three days per week.

Preference assessment

Interviews were used to identify preferred items for the first two participants prior to intervention. The researchers interviewed teaching staff and behaviour analysts; and eight preferred items were identified; these items were depicted on a choice board. A multiple stimulus without replacement (MSWO) (De Leon & Iwata, 1996) preference assessment was conducted with the third participant. Teaching staff suggested up to 15 items that were presented in the MSWO. The items were placed in front of the child and after the child interacted with an item it was removed from the array; the array was then reorganised by moving each item to the right. This was repeated four times and the eight items that were chosen most frequently during assessments were depicted on a choice board. Choice boards were presented to the participants before teaching and probe sessions; the item that was chosen was delivered at the end of that session.

Skills taught

Participants were taught a range of skills (see Table 1). The types of skills varied across children. The skill sets for Thomas and Olivia were tacting country names, auditory visual conditional discrimination (i.e. receptive identification) of items named in Welsh, and matching digital clock to analogue clocks. The skill sets for Mark were tacting animal names, matching Welsh labels to pictures of items and, auditory visual discrimination of items named in Welsh. The skills were not in the participants' repertoire and were not the target of any educational intervention prior to or during the study. The skills for each child were randomly assigned to one of three conditions using a random number generator. The researcher selected targets for each skill set that seemed to be equal in terms of difficulty;

these were randomly assigned to teaching conditions in order to control for minor variations in the level of difficulty (Gast & Wolery, 1988). The field size for all teaching and probe sessions was an array of three.

Table 1.

Skills taught using simultaneous prompting, no-no prompting and responsive prompt delay

Participant	Procedure	Skill Set 1	Skill Set 2	Skill Set 3
Thomas	**No-no prompting**	Ireland, Jamaica and Iceland	Carrot, jacket and door	16:10, 14:25 and 11:30
	Simultaneous prompting	Dominica, Madagascar and New Zealand	Butter, glasses and bed	15.20, 20:15 and 17.25
	Responsive time delay prompt	Australia, Grenada and Barbados	Chair, bread and socks	12.15, 16:50, 21:40
Olivia	**No-no prompting**	*Tacting:* * Ireland, New Zealand and Madagascar	17:25, 16:50 and 17:00	Boots, door and chair
	Simultaneous prompting	Dominica, Jamaica and Barbados	21:40, 15:20 and 20:15	Pear, bed and glasses
	Responsive time delay prompt	Iceland, Grenada and Australia	15:50, 19:25 and 12:35	Jacket potato and milk
Mark	**No-no prompting**	Possum, anteater and otter	Chips, Jumper, and Pear	Bread, milk, and glasses
	Simultaneous prompting	Bearded dragon, weasel and Python	Crisps, shoes, and book	Blueberry, cereal and aubergine
	Responsive time delay prompt	Gecko, sloth and platypus	Sandwich, T-shirt and butter	Dress, bed, and carrot

Controlling prompt assessment

A controlling prompt assessment was used to identify the controlling prompt; the controlling prompt was the least intrusive prompt that evoked correct responding with 100% accuracy on novel skills. Each participant's level of accuracy was assessed across four different prompt levels (positional prompt, model prompt, gestural prompt, and full physical prompt) for unknown skills. During the assessment, three index cards with words written in

French, Spanish or Welsh on were placed in front of the participant. The instructor presented the discriminative stimulus and provided a prompt simultaneously. Neutral feedback was provided for any selection. Each prompt level was tested four times; the least intrusive prompt was tested first and increasingly intrusive prompts were tested until the controlling prompt was identified. Thomas' controlling prompt was positional for matching clocks and. receptive identification of items named in Welsh. Olivia's controlling prompt was partial physical and for matching clocks and receptive identification of items named in Welsh. The controlling prompt for tacting countries was a full echoic prompt for Olivia and Thomas; Marks controlling prompt was a model prompt for all three skill sets. From this, a prompt hierarchy was developed; there were two to three prompts in each prompt hierarchy; it started with the controlling prompt and descended to less intrusive prompts. The controlling prompt was used during the first teaching session for new skills taught using the simultaneous prompting procedure. The intrusiveness of the prompt was decreased or increased following a specified number of correct or incorrect responses (see simultaneous prompting).

Response Measurement

The primary dependent variable was the percentage of correct responses during daily probe and full probe conditions. Correct responding was defined as the participant emitting the correct response within 3 to 5 seconds of the discriminative stimulus being presented. A skill was considered mastered when performance on a set of stimuli reached 91.6% (11 correct responses out of a total of 12) across three consecutive daily probe sessions. Once a participant met mastery criterion for a stimulus set, teaching on that set stopped and daily probes were no longer carried out for that skill set.

The second dependent variable was the total number of teaching trials and teaching sessions required to master skill sets across the three conditions. Average session duration is also reported for each condition: a teaching session started when the first discriminative

stimulus was delivered and finished when the learner responded to the final discriminative stimulus.

Procedure

Schedule of Reinforcement.

Teaching sessions: Praise was delivered on a fixed ratio (FR) 1 contingent on correct responding during all teaching sessions. A token economy system was used; each token board had 6 tokens. Tokens were delivered on an FR 3 contingent on correct responding (i.e. prompted correct responses during the simultaneous prompting condition, and independent correct responses during the no-no prompting and responsive prompt delay conditions) during teaching sessions. Access to backup reinforcers was delivered after the sixth token was delivered; this signalled the end of the work session.

Full probe and daily probe sessions: Reinforcement or corrective feedback were not delivered contingent on correct responses during the full probe and daily probe sessions. Instead, praise was delivered on a variable interval of 30 seconds (VI30) for compliance (sitting appropriately, having hands on knees or table). Access to tangibles was delivered after every 12 trials in the daily probe and after 18 trials in the full probe sessions.

Full Probe Sessions.

Full probes sessions were conducted throughout the study. Full probes included all of the skill sets; that is, mastered skill sets, skill sets currently in acquisition and untaught skill sets. Three full probe sessions were conducted prior to teaching to determine baseline levels of performance. One full probe session was conducted following mastery of any skill set. This was used to ensure that performance on that skill set and previously mastered sets had maintained (remained at or above 91.6% percent) and to ensure that performance on untaught skill sets had not improved before teaching had started. Each skill was probed four times during each full probe session. All targets were interspersed during full probe sessions, that

is, they were not grouped in their skills sets. The field size for all probe sessions was an array of three stimuli. During the full probe condition, the teacher presented the discriminative stimulus and allowed the participant 3 to 5 seconds to respond. Prompting and error correction procedures were not implemented during full probes sessions.

Daily Probes Sessions.

Daily probes (DP) were carried out before each teaching session to assess the acquisition of skill sets currently being taught; DP were used as a dependent measure to evaluate the effectiveness of each of teaching method (Gast & Wolery, 1988). Each skill was probed four times during DP sessions; therefore, each daily probe consisted of 12 probe trials. DP were conducted in the same manner as FP.

Prompting conditions.

Simultaneous Prompting. In the simultaneous prompting condition, the discriminative stimulus and a controlling prompt were provided simultaneously. Praise, tokens, and access to tangibles were provided for correct responding as appropriate (see schedule of reinforcement). If the participant responded incorrectly, the stimuli were removed and the next trial was presented. The controlling prompt was used when introducing new stimuli, and on subsequent sessions the prompt that was used in the previous teaching session was repeated. The intrusiveness of the prompt was decreased following three consecutive correct prompted responses; the intrusiveness of the prompt increased following an incorrect response (Leaf et al., 2014).

Responsive prompt delay procedure. In the responsive prompt delay condition, the teacher presented the discriminative stimulus and allowed 3 to 5 seconds for the participant to respond. If the participant responded correctly the researcher provided praise and access to tangibles as above, and all stimuli were removed from the table. If the child did not respond stimuli were removed momentarily and feedback or reinforcement were not provided. In a

subsequent trial, the same instruction and stimuli were used. If the child did not respond the least to most prompt implemented: the instruction was presented again, the least intrusive prompt was provided initially and if necessary, increasingly intrusive prompts were provided until the child responds correctly; the discriminative stimulus was not repeated (see Table 2 for examples of each prompt level for motor and vocal responses). The first remedial trial was then presented: stimuli were positioned in same way; the instruction was presented and the child was given 3 to 5 seconds to respond. During a second remedial trial the stimuli were rotated and the instruction was changed (if possible). A new trial was then introduced.

If the participant responded incorrectly at any stage, a 3-step error correction was implemented. First, the instruction was presented again and the most intrusive prompt was used. The stimulus related to the correct response was then isolated (held up) and a suitable model prompt was provided, for example, “it’s a bear”. This was followed by two remedial trials as above. When a remedial trial resulted in extra teaching trials during the responsive prompt delay procedure, additional trials were added to the subsequent teaching sessions for the other two conditions to ensure that an equal number of individual trials were provided across conditions.

No-no-prompt. The no-no prompt procedure was similar to that used by Leaf, Sheldon and Sherman (2010). The teacher presented the discriminative stimulus and allowed 3 to 5 seconds for the participant to respond. The consequence for correct responses was identical to the responsive prompt delay procedure. If the child did not respond or responded incorrectly the researcher said ‘no’ in a neutral voice and removed the stimuli. The same stimuli were then presented using the same discriminative stimulus; if the participant responded incorrectly or did not respond following the presentation of the second discriminative stimulus the researcher said, ‘no’ again and removed the stimuli; finally, the stimuli and the

discriminative stimulus was presented for a third time and a controlling prompt was provided simultaneously.

Table 2.

Least to most prompting system for the prompt delay procedure.

Skill Set	Prompt Level	Example
Skills requiring a motor response	Gestural	Pointing to the card
	Positional	Moving the card closer to the participant
	Partial Physical	From the participant's elbow, gently guiding their hand towards the correct card
	Full Physical	Taking the participants had and placing the participants hand on the correct card
Skills requiring a vocal response	First Phoneme	"G"
	First Syllable	"Gren"
	Full Word	"Grenada"

Additional procedures

Correct responding did not increase on the matching clocks stimulus sets after a number of sessions for Olivia and Thomas. Therefore, an additional prompt was introduced, whereby participants were asked to tact each digital clock prior to matching it to the analogue clock.

Interobserver Agreement and Treatment Fidelity

The instructor recorded participant responding during full probes, daily probes and teaching sessions; an independent observer simultaneously calculated participant responding during 29.1% of full probes, 26.73 % of daily probes. Interobserver agreement (IOA) was collected by comparing observers' data on a trial by trial basis; an agreement was defined as the two observers recording the same outcome on a corresponding trial (i.e., either a correct or incorrect response during full and daily probes). The number of agreements was totalled

and divided by the number of agreements plus disagreements and converted to a percentage to calculate interobserver agreement (IOA). The percentage interobserver agreement was 98.75% for full probes (ranging 95.5% to 98.57%), and 100% for daily probes across participants.

To assess treatment fidelity teaching sessions were recorded and analysed. The procedure for each of the prompting conditions was outlined in a treatment fidelity checklist. An observer reviewed teaching sessions using these checklists; teacher behaviour was scored as correct or incorrect for each of the steps outlined. Treatment fidelity was scored for 22.66% simultaneous prompting sessions (range 17.71% to 27%), 25.35% of no-no prompt (range 20% to 33%) and 22.29% of responsive prompt delay sessions (range 12.12% to 36%). The number of correctly implemented steps was totalled and divided by the number of correctly implemented steps plus incorrectly implemented steps and converted to a percentage. The instructor implemented the procedure correctly 98.56% of the time when implementing simultaneous prompt (ranging 97.1% to 99.84% across participants), 98.36% when implementing the no-no prompt procedure (ranging 97% to 99.21% across participants) and 98.45% when implementing the responsive prompt delay procedure (ranging from 97.1% to 100% across participants).

Results

Skills Acquisition and Maintenance

Thomas, Olivia, and Mark mastered all of the stimulus sets taught using the no-no prompt, simultaneous prompting and responsive prompt delay procedures (Figure 1, 2 and 3). Table 2 outlines the number of teaching sessions and trials to mastery, and the average duration of teaching sessions for each procedure.

Thomas' correct responding increased during daily probe sessions for the skills in stimulus sets one and two as soon as teaching began (Figure 1). Responding did not increase

for stimulus three (matching clocks) until DP 11 after the introduction of the additional prompt in previous the teaching session. Thomas mastered the skill sets taught using the responsive prompt delay procedure in fewer trials and sessions than those taught using the no-no prompting and simultaneous prompting procedures; however, the average session duration was longer for the responsive prompt delay procedure (Table 3). Thomas maintained the skill sets taught using all three prompting procedures.

There was increase in Olivia's correct responding during DP sessions for all skills in stimulus sets one and three as soon as teaching began (Figure 2). Correct responding for stimulus set two (matching clocks) increased in DP 12 following the addition of a further prompt in teaching session 11. Olivia mastered the skill sets taught using no-no prompting in fewer sessions and trials than those taught using the other procedures; the average duration of teaching sessions was less for the no-no prompting procedure (Table 3). Olivia maintained all of the skill sets taught using the simultaneous prompting and responsive prompt delay procedures. The skill sets taught using no-no prompting maintained with the exception of one probe (FP 8); correct responding on these skills increased to mastery criterion on the next full probe (FP 9).

Mark's correct responding increased on all skills sets once teaching started. The skill sets taught using both the no-no prompting and responsive prompt delay procedures took fifteen sessions to master. More teaching sessions and trials were required to master the skill sets taught using simultaneous prompting; and the average session duration was longer for this procedure (Table 3). Mark maintained all of the skill taught using responsive prompt delay and no-no prompting. Skill sets taught using simultaneous prompting reduced to below mastery criterion in one full probe (FP 8), but increased to mastery criterion in next full probe.

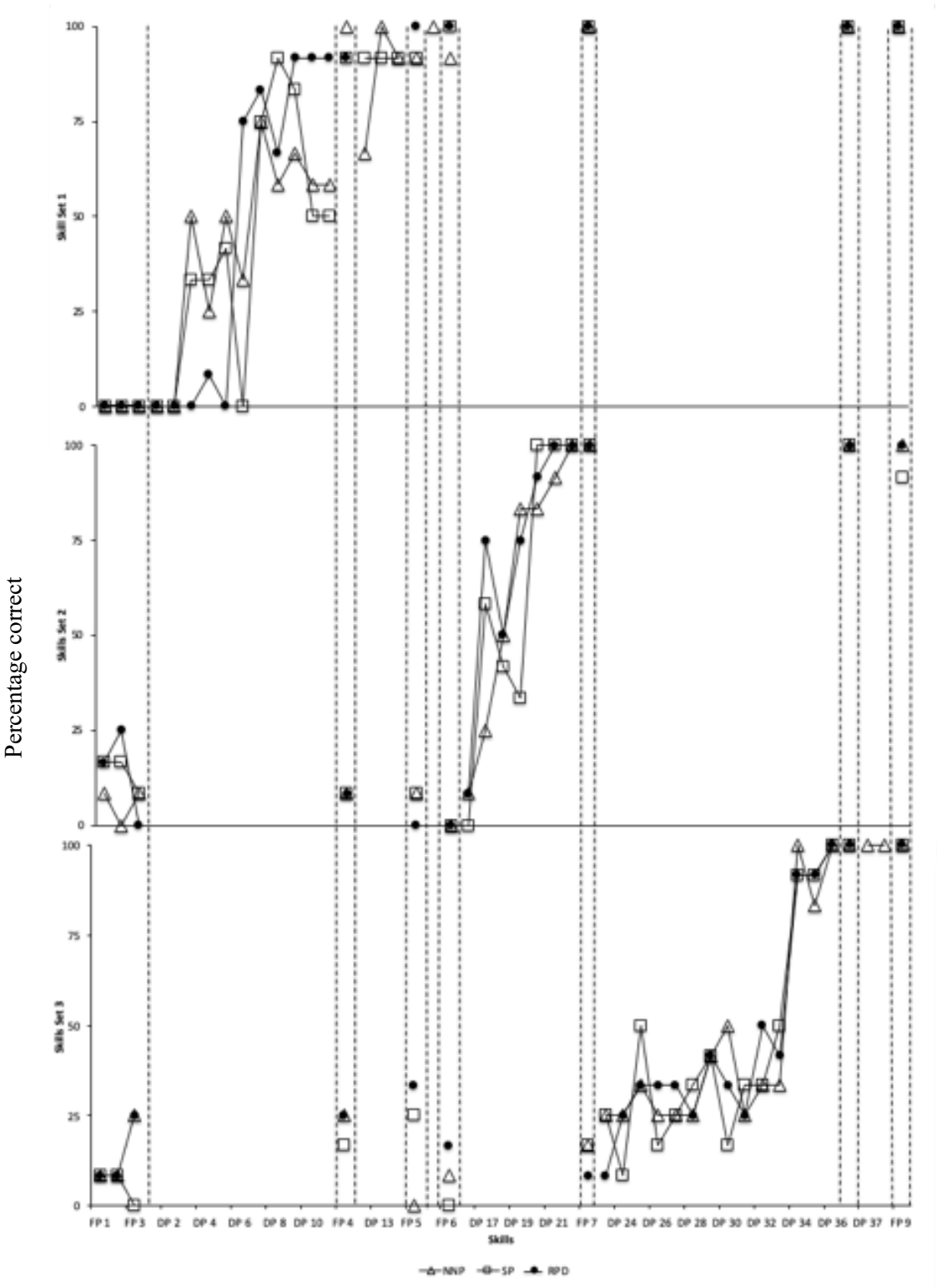

Figure 1. Percentage of correct responses for Thomas during full probe (FP) and daily probe (DP) sessions for skill set 1 (tacting countries), skill set 2 (matching Welsh words) and skill set 3 (matching clocks).

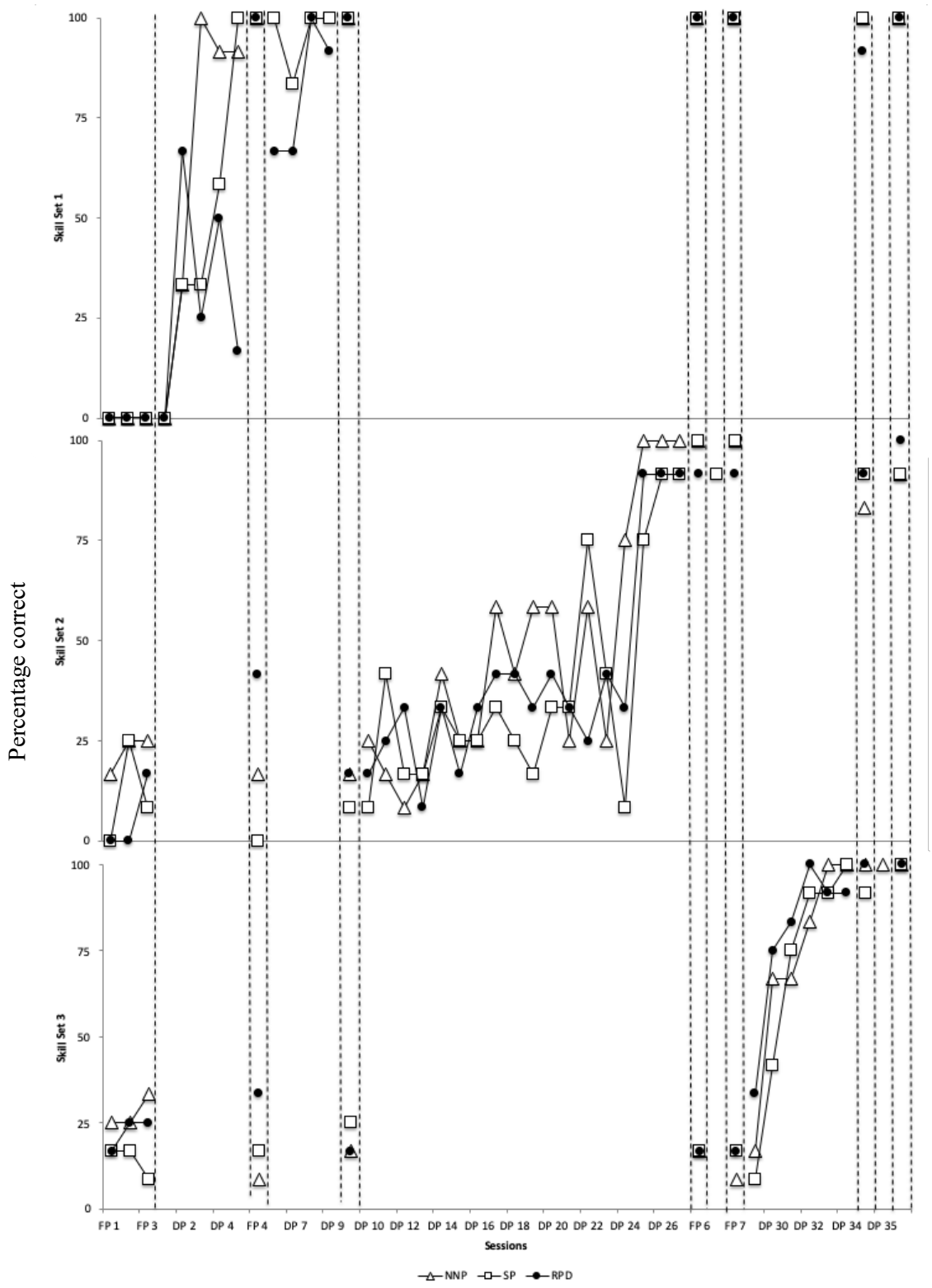

Figure 2. Percentage of correct responses for Olivia during full probe (FP) and daily probe (DP) sessions for skill set 1 (tacting countries), skill set 2 (matching clocks) and skill set 3 (matching Welsh words).

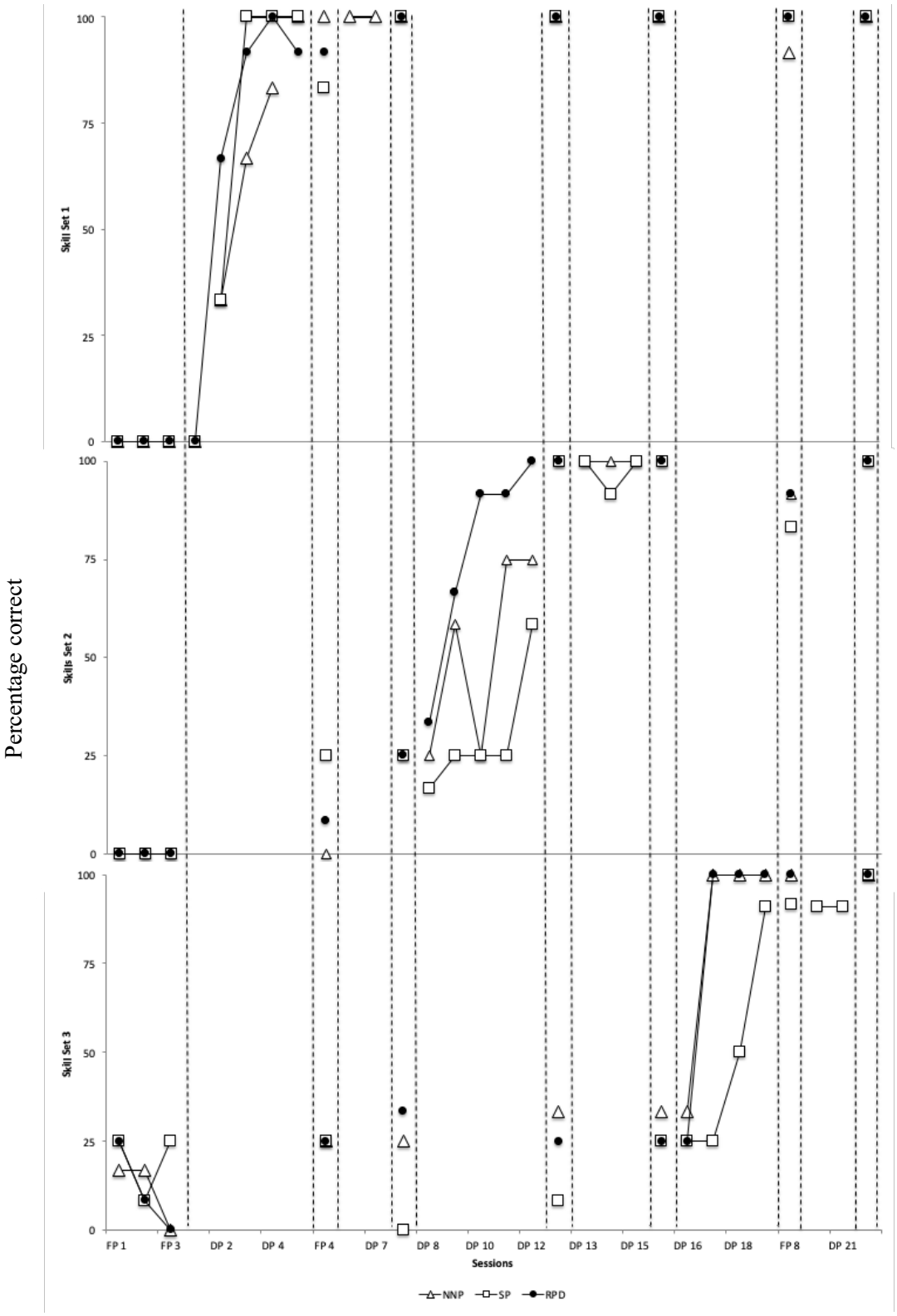

Figure 3. Percentage of correct responses for Mark during full probe (FP) and daily probe (DP) sessions for skill set 1 (tacting animals), skill set 2 (auditory visual discrimination of items names in Welsh) and skill set 3 (matching Welsh words to pictures).

Table 3.

Efficiency data: the total number of sessions and trials to mastery, and the average duration of teaching sessions for the three prompting procedures.

Participant	Prompting Procedure	No. of Sessions	Avg. Session Duration	No. of Trials
Thomas	**No-No Prompt**	39	04:43	779
	Simultaneous Prompt	35	04:51	691
	Responsive Prompt Delay	32	05.29	641
Olivia	**No-No Prompt**	30	04:34	585
	Simultaneous Prompt	33	03:53	641
	Responsive Prompt Delay	32	04:35	628
Mark	**No-No Prompt**	15	02:28	305
	Simultaneous Prompt	17	03:11	310
	Responsive Prompt Delay	15	02:44	241

Discussion

The responsive prompt delay procedure is a novel prompting procedure that combines advantageous components of well documented prompting procedures whilst eliminating some potential limitations. The learner has an opportunity to respond independently, and independent correct responses are differentially reinforced. Positive punishment is not intentionally delivered following incorrect or prompted responses. There is clear protocol for implementing prompting and error correction procedures which is consistent across learners, skills and settings. This procedure may be easier for some staff to implement.

The current study found that responsive prompt delay procedure was as effective as responsive prompt delay procedure. The no-no prompting procedure resulted in the slowest acquisition of skills for Thomas. Olivia mastered the skill sets taught using no-no prompting

in fewer sessions and in less instructional time than the other procedures. Mark mastered the skill sets taught using no-no prompting and responsive prompt delay procedures in the same number of sessions, but the average session duration was slightly longer for responsive prompt delay procedure. The differences between the three procedures were small for each participant; such differences may negligible when teaching a range of skills as part of a comprehensive educational programme. When all procedures are equally effective when run with high fidelity, behaviour analysts should consider the settings, in particular the staff who will be implementing the procedure, when choosing a prompting procedure.

These results are similar to a number of published studies that found that procedures that utilised an error correction were slightly more effective than errorless or near errorless methods (e.g. Leaf et al., 2010; Fentress and Lerman, 2012). Leaf and colleagues (2016) found an error correction procedure that utilized feedback and remedial trials to be more effective than most to least prompting. One major difference between the current study and Leaf et al (2016) is that maintenance, assessed in the full probe sessions, was high for all three procedures, whereas, maintenance was variable across procedures in Leaf and colleagues' study. Leaf et al. (2016) suggested that corrective feedback, may make reinforcement more differential; and that it may also serve as a mild punishment. It is possible that the corrective feedback, "no" in the no-no prompting procedure functioned as a positive punisher for Olivia's incorrect responses. Olivia mastered all three stimulus sets taught using this procedure in fewer sessions; and she immediately selected another stimulus when, "no" was delivered contingent on non-responses or incorrect responses during teaching sessions.

The responsive prompt delay procedure was effective for all three participants; however, it was the least efficient for two of the three participants. The additional time needed to implement the procedure can be explained by the time that it allowed for the

learner to respond independently, and by the use of remedial trials following prompted and incorrect responses.

The use of differential reinforcement during skill acquisition programmes has been recommended (Grow & Le Blanc, 2013). However, results from comparisons of differential and non-differential reinforcement procedures have again demonstrated that the effectiveness of these procedures may idiosyncratic across learners (Boudreau, Vladescu, Kodak, Argott & Kisamore, 2015; Fiske et al., 2014). Given that both differential and non-differential procedure can be effective, a combination of differential reinforcement and least to most prompting may be optimal in a setting where systematic prompt fading may not be feasible. Failure to fade prompts systematically may result in prompt dependency for some learners (Grow & Le Blanc, 2013; Leaf et al., 2014; MacDuff, Krantz, & McClannahan, 2001); this must be considered when choosing a prompting procedure.

Previous research has demonstrated that providing more information on correct responses (for example, instructional feedback) and/ or additional opportunities to respond in presence of the discriminative stimulus (for example, remedial trials) following an error resulted in quicker acquisition of skills (Ardoin et al., 2009; Worsdell et al. 2005). The findings of this study do not overwhelmingly support these findings. During the error correction in the responsive prompt delay procedure the learner was provided with instructional feedback and two remedial trials following an incorrect response. Conversely, in the no-no prompting condition, corrective feedback, “no”, was delivered following an incorrect response, and learner was not provided with any further opportunities to respond in presence of the discriminative stimulus. Despite this, the responsive prompt delay procedure was not consistently more efficient than the no-no prompting procedure. Future research could compare the responsive prompt delay procedure in the current study to a variation that implements one or no remedial trials following the error correction.

All of the procedures included in this study incorporate a number of different prompt types: full physical, partial physical, positional and gestural prompts; the order in which they are delivered varied depending on the procedure. As individual prompt types are not evaluated separately, we cannot draw conclusions about which prompt type would be most effective for an individual participant or skill. Prompt delay procedures, for example, progressive prompt delay, on the other hand, allow for specific types of prompts to be evaluated (Markham et al., 2020). However, the aim of this study was to compare the RPD to procedures that were commonly used in the UK at the time of the study; therefore, for the purposes of this research evaluating prompting procedures that incorporated different types of prompt was not an issue. Perhaps more relevant is that the RPD procedure incorporates least to most prompting, error correction, and remedial trials; and we do not know which of these, if any, was most effect in increasing skill acquisition. As reducing the number of components of this procedure would be potentially beneficial in this setting, future research should include a component analysis to identify the most effective components of this procedure.

Treatment integrity can impact on treatment effectiveness of behaviour analytic programmes (Carroll et al., 2013; DiGennaro et al., 2007; Grow et al., 2009). It is possible that treatment integrity may be compromised in school settings (Grow et al.; Kodak, Cariveau, LeBlanc, Mahon, Carroll, 2018) or when procedures are implemented by individuals who have not had formal training in ABA. Carroll and colleagues (2013) found that that treatment integrity was low for several DTT components when implemented by teachers and para-professionals. Failure to deliver a controlling prompt was one of the three most common treatment integrity errors made in their study. Kodak and colleagues (2018) found that failure to deliver a controlling prompt was one of the most frequent errors emitted by staff in special educational needs settings. Thus, simultaneous prompting method may

pose the most difficulty for implementers who are not formally trained in ABA: prompts continuously change depending on the learner's responses, and each skill being taught can be on different prompting level. There is a correlation between procedural integrity and treatment effectiveness in DTT; reduced levels of treatment integrity during DTT implementation can decrease the effectiveness of the intervention (Arkoosh et al., 2007; Carroll, Kodak, & Fisher, 2013; Di Gennaro Reed, et al., 2011; Wilder, Atwell & Wine, 2006). Therefore, the behaviour analyst must consider the complexity of a prompting procedure, and identify if it can be implemented with high treatment integrity by the staff in a particular setting. The procedure that is used in a particular setting must be suited to the staff skill set. All three procedures were implemented by MSc level behaviour analysts in this study and treatment integrity was high for all three procedures. Future research should be conducted with implementers who do not have formal training in ABA, for example those working in special educational needs settings. This research should include measures of treatment integrity to identify if there are differences across procedures when implementers do not have formal training.

The responsive prompt delay is a fixed protocol that does not require implementers to make too many moment-to-moment decisions, for example, when to fade prompts; this may make it easier to implement. Again, this may be particularly important in a setting where staff are not formally trained in ABA or where staff implement individualised programmes with many children. Future research should incorporate a social validity measures focusing on ease of implementation to measure implementers preference.

This study compared the procedures across a number of skills (i.e. tacting, matching and receptive identification). Each skill required a different response topography, and required participants to attend to different discriminative stimuli. All three procedures were effective in teaching all of the skills with the three participants.

There are a number of limitations to this study. The three participants had prior exposure to the responsive prompt delay procedure. Research has shown that proximal exposure to a prompting or error correction strategy may influence relative acquisition rates; thus, affecting the outcomes of comparisons to other procedures (Coon & Migel, 2012; Kodak, et al., 2016). Therefore, future research should investigate the efficacy of the responsive prompt delay procedure with learners who have not been exposed to it. That said, the effect of the independent variable on dependent variable was almost immediate across all three condition; thus, proximal exposure to the responsive prompt delay may not have impacted these participants responding.

Another limitation is the lack of differentiation in skill acquisition across teaching conditions, which poses the questions as to whether the outcomes may have been affected by learning to learn effects. However, as discussed, results were consistent with previous research that has found that children acquire skills with many different procedures (e.g. Leaf et al., 2010; Markham et al., 2020). If skill acquisition had been affected by learning to learn skills, the number of sessions to mastery across conditions might be more consistent. These skills might also be expected to generalise to the classroom, and anecdotally, these participants did not demonstrate notable acceleration in their learning in outside of the intervention. As such, it is more likely that skill acquisition was a result of the individual teaching procedures; and as discussed, this design allowed for this to be replicated across skills and learners. A more plausible reason for the lack of differentiation is the fact that the three participants had relatively advanced learner behaviour; making it easier for them to master skills. Therefore, future research should evaluate the relative effectiveness of the three prompting procedures with learners with beginner repertoires.

Finally, in order to ensure that the number of trials were equal across teaching sessions the researcher yoked remedial trials in the responsive prompt delay procedure and

added an equal number of trials to the other two procedures when necessary. As a result, the number of trials in the simultaneous prompting and no-no prompting teaching sessions may have been artificially inflated. However, inclusion of trials to criteria as a secondary dependent variable helps to rectify this issue.

In summary, the results from this study support previous findings that many prompting and error correction procedures can be effective in teaching skills to learners with ASD and related developmental disorders. The responsive prompt delay procedure was as effective as simultaneous prompting and no-no prompting. This procedure incorporates some of the advantageous components of the other procedures and eliminates some of the limitations. Errors are minimised, but learners are provided with opportunity to respond independently, thus, reducing the likelihood of prompt dependency for some learners. Corrective feedback, "no" is not incorporated, thus, positive punishment is not intentionally used. Instead, differential reinforcement, instructional feedback and further opportunity to responding in the presence of the discriminative stimulus are provided. The procedure may be easier to implement as there is a clear protocol for delivering prompts which remains consistent across trials; however, further research is needed to confirm this. Ease of implementation is an important consideration particularly when there are a large number of individuals who are not formally trained in ABA implementing these procedures (Leaf et al., 2016). There may be higher chance that treatment fidelity will be compromised with procedures that are difficult to implement; therefore, behaviour analysts need to be responsive not only to the needs of learners, but also to individual settings and to those implementing the procedures.

Chapter 6: Contextual influences on behavioural interventions in SEN settings

The British Early Special Schools Teaching (BESST) model is described in chapter three. Each child with the BESST model has an individualised, function based behaviour plan (IBP). Strategies such as following through with demands and the use of vocal redirection are commonly used. Behaviour analysts train each staff member in the child's classroom to implement IBP's. When plans are implemented with high treatment integrity, each staff member responds to problem behaviour in the same way. These strategies are implemented across all activities, for example, if a child throws a toy during play time a consistent response might be, "we play nicely with our toys"; or if a child does not respond to a demand during discrete trial training (DTT) the prompting procedure is implemented (see Chapter 5). As part of many FBP, the staff were encouraged to positively state that alternative behaviour the child should engage with in a neutral voice. For children who engage in challenging behaviour to access attention, the staff are discouraged from reprimanding the child or commenting on the inappropriate behaviour. An interesting, but unexpected, result of these plans was that attention in the form of predictable, repetitive statements from staff appeared to replace the reprimand as the social reinforcer for the problem behaviour. This problem was regularly observed with children in the BESST model and was a particular issue because problem behaviour increased when staff consistently implemented IBP's.

Considering the context

Board certified behaviour analysts working in the BESST model must consider a number of factors when developing interventions to increase or decrease behaviour. As discussed in chapter 5, consideration of the overall setting and the individuals who are implementing the procedures is crucial. Individuals who are not formally trained in applied behaviour analysis (ABA) increasingly implement behaviour programmes in schools (Foran et al. 2015; Eikeseth et al., 2012; Grindle et al., 2012; Peters-Scheffer, Didden, Mulders & Korzilius, 2010); this is particularly relevant in special educational needs (SEN) schools

where the BESST model is implemented. If an intervention cannot be feasibly implemented then an alternative intervention ought to be used. In these setting, behaviour analysts must consider whether the use of extinction in combination with other procedures is practical and ethical (McNaul & Neely, 2018).

It was clear from observations in classrooms that it would not be possible to use extinction with problem behaviour that was maintained by predictable, repetitive statements. The strategies that appeared to maintain the problem behaviour were commonly used with a number of children and it was very difficult for staff to withhold this attention completely. Therefore, the researcher sought to evaluate a number of evidenced based interventions that could be implemented without the use of extinction in order to identify which interventions resulted in a decrease in problem behaviour. The effects of noncontingent reinforcement, functional communication training and pre-session satiation without extinction were evaluated. The study was conducted in two parts. Firstly, a functional analysis was used to confirm that each participants problem behaviour was maintained by predictable attention prior to treatment. Secondly, a treatment analysis was conducted to measure the effectiveness of each procedure.

Chapter 7: Positive, predictable attention as a reinforcer for problem behaviour

Chapter 7 – Paper 3: Problem behaviour maintained by predictable attention

Abstract

A number of children in the British Early Special Schools Teaching Model engaged in problem behaviour that was maintained by attention in the form of positive, predictable statements from teachers. Statements included simple redirection or stating the appropriate alternative to the problem behaviour. Staff in this setting found it very difficult to withhold this quality of attention; therefore, varying responses to problem behaviour or the use of extinction were not appropriate recommendations. The study was conducted in two parts. First, the attention condition of the standard functional analysis was modified to demonstrate the effects of attention in the form of positive, predictable statements on the problem behaviour of two children. Following this, the effects of function communication training, non-contingent reinforcement and pre-session satiation without extinction were evaluated. Functional communication training and non-contingent reinforcement reduced problem to near zero levels for both children; pre-session satiation did not consistently reduce the problem behaviour of either child.

Chapter 7 – Paper 3: Problem behaviour maintained by predictable attention

Functional analysis (FA) methodology was first described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/ 1994). The original methodology considered the effects of attention, escape, and automatic reinforcement on problem behaviours. While functional analyses often produce clear outcomes, results can be inconclusive, which has implications for treatment (Roscoe, Schlichenmeyer, Dube, 2015). One potential reason for undifferentiated outcomes may be that the relevant antecedent or consequent events are not included the in FA conditions (Schlichenmeyer, Roscoe, Rooker, Wheeler, & Dube, 2013). In an attempt to deal with this issue, the standard FA has been manipulated to make it more sensitive to idiosyncratic influences on problem behaviour. It is more likely that the relevant antecedent and consequent event are included when appropriate modifications are made (Schlichenmeyer et al.,2013).

A number of researchers have manipulated the attention condition of the FA to increase its sensitivity to idiosyncratic qualities of attention (Richman & Hagopian, 1999). Kodak, Northup and Keeley (2007) evaluated the effects of five types of attention (reprimands, unrelated comments, tickles, eye contact and physical attention) on the problem behaviour of two children. Reprimands and tickles resulted in higher rates of problem behaviour for one participant; reprimands and unrelated comments results in higher rates of problem behaviour for the second. In another study, Richman and Hagopian (1999) used an extended functional analysis to demonstrate that physical attention and exaggerated attention maintained problem behaviour for two children after the standard FA failed to demonstrate that attention maintained the children's problem behaviour. Bowman, Hardesty and Mendres-Smith (2013) found that physical attention and vocal sympathy resulted in higher levels of problem behaviour than reprimand for a 14-year-old boy with multiple diagnoses. Minor manipulations to the attention condition of standard functional analysis methodology may be necessary to increase its sensitivity to different qualities of attention; and this may lead to

more differentiated outcomes of FA, which may in turn lead to more effective interventions (Hagopian, Rooker, Jessel, & DeLeon, 2013; Schlichenmeyer et al., 2013).

Predictable, Repetitive Statements as a Reinforcer for Problem Behaviour

We found that a number of children in the British Early Special Schools Teaching (BESST) model (chapter 2 and 3) engaged in problem behaviour that was potentially maintained by quality of attention that was not captured in standard FA. For these children, problem behaviours seemed to be maintained by attention in the form of positive predictable, repetitive statements from adults and children. Behaviours included responding incorrectly during discrete trial training (DTT) in order to access the error correction, which is predictable and has some repetitive components (see Chapter 5); continuously requesting for items at snack time to hear a staff member saying, “not available”; repeatedly standing up during teaching sessions to hear the staff member saying, “sit down”. Children also engaged in more serious behaviours such aggression towards adults and self-injury, which were maintained by a teacher saying, “use kind hands”. Behaviour analysts observed that teaching staff in this setting consistently struggled to withhold predictable, repetitive statements, so while it may be easier to recommend that staff vary their responses to problem behaviour, and thus withhold predictable statements, this was not an appropriate recommendation in this setting. Staff in this setting may have found it difficult to withhold predictable statements for a number of reasons. Firstly, the problem behaviour stopped, at least momentarily, when staff delivered predictable attention; this negatively reinforced staff behaviour. Secondly, the nature of the responses that staff delivered following problem behaviour were positive (for example, a redirection or stating the appropriate alternative) and delivered in a neutral tone, as opposed to being a reprimand; staff may have found it easier to withhold a reprimand because it may be perceived negatively. When staff are not formally trained in ABA, and fluent in the functions of behaviour, they may not consider the impact of their behaviour on

the future frequency of behaviour; this may make it more difficult for them to identify a simple redirection or statement as a problem. Another issue may be that strategies, such as stating the appropriate alternative or redirecting to the current activity are commonly recommended for children in the setting, particularly while teaching staff wait for an individualised behaviour plan (IBP). If staff have been using these strategies while they wait for an IBP, they may already be under stimulus control for this quality of attention. Finally, many of the lower level behaviours are very subtle and staff may find it difficult to identify them as problem behaviours for some time. For example, when pupils responded incorrectly during DTT staff assumed that they didn't know the correct response, or when a pupil manded for items that were had finished they assumed that the pupil didn't understand 'finished'. However, in both cases, the behaviours appeared to be maintained by access to the predictable statements; many examples were supported by FA separate to this research. In another setting, where it might be easier to control the environment and where staff are more fluent in the principles of ABA, extinction could be implemented with these procedures. As discussed in the previous chapters there are many contextual variables in special educational needs (SEN) settings that must be considered when deciding on appropriate interventions. Because it was difficult to restrict this quality of attention to zero levels in this setting three interventions - noncontingent reinforcement (NCR), functional communication training (FCT) and pre-session satiation were implemented without the use of extinction. The following sections will discuss the use of extinction before briefly discussing NCR, FCT and pre-session satiation without extinction.

As a behaviour change procedure, extinction involves systematically withholding reinforcement for behaviour that previously contacted reinforcement. The result is the process of extinction: a reduction in the rate of a previously reinforced behaviour, when that behaviour no longer contacts reinforcement (Fritz et al., 2018). Extinction can result in an

initial increase in the frequency of the problem behaviour (extinction burst) or some other dimension of the problem behaviour, for example, intensity or duration (Davis, Frederick, Alberto, Gama, 2012). For this reason, extinction is not always suitable, particularly with individuals who engage in high rates of aggression or self-injury (Vollmer, Marcus, & Ringdahl, 1993). Implementing extinction procedures with high treatment integrity may be challenging when the behaviour is maintained by attention, for example, a caregiver may find it difficult not to deliver attention when the behaviour increases in frequency or intensity (Fritz et al., 2017). Attention extinction may be particularly difficult to implement in a school where there are many sources of attention from staff and peers. Extinction procedures may not be used consistently, resulting in and the intermittent reinforcement of problem behaviour (Worsdell, Iwata, Hanley, Thompson and Kahng, 2000).

Noncontingent Reinforcement

Noncontingent reinforcement is an evidenced based intervention that is commonly used to decrease problem behaviour (Richman, Barnard-Beak, Grubb, Bosch, Abby, 2015; Ritter et al., 2018). It has been used to treat problem behaviour maintained by social positive reinforcement (e.g. Lalli, Casey, & Kates, 1997), social negative reinforcement (O'Callaghan, Allen, Powell, & Salama, 2006) and automatic reinforcement (Boyle, Ortman, Beckam, Aholt, & Keenan, 2018). Noncontingent reinforcement involves delivering the reinforcer that maintains problem behaviour on a time-based schedule, independent of the occurrence of the problem behaviour (Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993). The initial schedule of reinforcement is usually dense and calculated based on baseline levels of responding. Reinforcement is gradually thinned to a leaner schedule (Ritter, Barnard-Brak, Richman, & Grubb, 2018). Behaviour change can occur during noncontingent reinforcement because delivering the functional reinforcer on a dense schedule may function as an abolishing operation (AO) for that reinforcer; thus, reducing the motivation to engage in the

problem behaviour to access the reinforcer (Ritter et al., 2018; Vollmer et al., 1993). Furthermore, the contingency between the problem behaviour and the putative reinforcer is weakened when the reinforcer is delivered on a response-independent schedule (Richman et al., 2015). Noncontingent reinforcement can be implemented with or without extinction. When it is implemented with extinction, reinforcement is withheld following the problem behaviour; and when implemented without extinction reinforcement continues to be delivered following the problem behaviour, however the quality or the schedule of reinforcement may be altered (Worsdell, et al., 2000).

There are a number of benefits to noncontingent reinforcement which make it relatively easy to implement in clinical settings (Carr, Severston, & Lepper, 2009). Firstly, the likelihood of extinction induced side effects are decreased when compared to interventions such as extinction alone or differential reinforcement of zero rates of behaviours (DRO) (Vollmer et al., 1993). Secondly, while alternative appropriate behaviours are not systemically targeted, the procedure may result in an increase in appropriate behaviours that are already in the individual's repertoire (e.g. Roane, Fisher, & Sgro, 2001; Virues-Ortega, Iwata, Fahmie, & Harper, 2013).

Richman and colleagues (2015) conducted a meta-analysis single-case experimental designs of noncontingent reinforcement; 55 articles were included in the analysis. The analysis included participants of various ages, and the procedures were implemented in a range of settings. Noncontingent reinforcement resulted in statistically significant reductions in problem behaviour and effect sizes were large.

Fritz and colleagues (2017) evaluated the effects of noncontingent reinforcement without extinction with five individuals with a diagnosis of autism spectrum disorder (ASD). Noncontingent reinforcement without extinction was initiated on a continuous schedule and gradually thinned to a fixed-time 5-minute schedule for all participants. The intervention was

effective for three participants; however, problem behaviour increased to and remained at baseline levels following schedule thinning for the fourth and fifth participant. The combination of noncontingent reinforcement with schedule thinning plus differential reinforcement of alternative behaviour (DRA) subsequently resulted in zero rates of problem behaviour for these participants.

Pre-Session Satiation

Pre-session satiation involves delivering the putative reinforcer, for example, attention, for a specified duration prior to periods of time where the reinforcer is not available. It is an antecedent intervention involving the manipulation of motivating operations: providing pre-session access to a reinforcer in this way may function as an AO, thus, reducing the motivation to engage in the problem behaviour during periods of time when it is not available (Edrisinha, O'Reilly, Sigafoos, Lancioni, & Young Choi, 2011; O' Reilly, 1999). This procedure is different from non-contingent reinforcement because the putative reinforcer is delivered for a period of time prior to periods of deprivation; whereas, with non-contingent reinforcement the reinforcer is delivered after a prespecified passage of time (Richman et al., 2015), for example, every 15 minutes. A number of researchers have evaluated the effects of pre-session satiation on problem behaviour (e.g. Berg, et al., 2000); however, the evidence base is sparse in comparison the other two procedures.

Pre-session satiation may be very useful in clinical settings where the ratio of staff to children is low making it difficult to implement procedures such as noncontingent reinforcement. Providing pre-session access to attention, and thus potentially satiating the individual of attention, may have an abolishing effect on problem behaviour during periods of time where levels of attention are low.

McComas, Thompson and Johnson (2003) compared two ten-minute pre-session conditions with three participants whose problem behaviour was maintained by attention.

Continuous attention was provided for ten minutes in the first condition, and no attention was provided for the same duration in the second condition. Pre-session access to attention resulted in low levels of problem behaviour for all three participants when compared to the no attention condition. In another study, designed to evaluate the effects of pre-session satiation on problem behaviour, O' Reilly and colleagues (2007) compared the effects of two pre-session conditions on the problem behaviour of a young boy with ASD in a classroom based work-sessions. In the first pre-session condition, the boy had 15 minutes of continuous access to snacks; and in the second he was deprived of snacks for 2 hours. The young boy engaged in low levels of problem behaviour in sessions that followed continuous access to snacks and high levels in session that followed snack deprivation. This research demonstrates that pre-session access to the putative reinforcer can have an abative effect on problem behaviour.

One limitation associated with both non-contingent reinforcement and pre-session satiation is that they do not systematically establish appropriate alternative behaviours. Therefore, a procedure such functional communication training may be preferable.

Functional Communication Training

FCT involves reinforcing an appropriate communicative behaviour that serves the same function as the problem behaviour (Boyle et al., 2018; Wacker et al., 2013). When FCT is first introduced mands are reinforced on a dense schedule; once the communicative response has been established the schedule of reinforcement is usually thinned (Hanley, Iwata and Thompson, 2001). FCT is a function based intervention that is effective for decreasing problem behaviour and simultaneously increasing appropriate communicative responses (Andzik, Cannella-Mallone, Sigafoos, 2016). The effect of FCT has been demonstrated with a range of socially maintained problem behaviours (Hagopian, Sullivan, Acquisto, & LeBlanc, 1998; Kurtz, Boelter, Jaramolowiez, Chin, & Hagopian, 2011). Extinction is

commonly used with FCT (Hanley, Piazza, Fisher, & Maglieri, 2005). Few researchers have examined that effects of FCT without extinction; when it was examined, FCT without extinction did not reliably reduce problem behaviour (Hagopian et al., 1998; Kelley, Lerman, & Van Camp, 2002).

A review of the literature on practitioner implemented FCT demonstrates that FCT can be effectively implemented by teachers and other staff in schools (Andzik et al., 2016). Lambert, Bloom and Irvin (2012) demonstrated that FCT can be effectively implemented by teachers in a SEN setting. Teacher implemented FCT resulted in a decrease in problem behaviour and an increase in the appropriate communicative response for three participants.

As an alternative to FCT with extinction, Worsdell, Iwata, Hanley, Thompson & Kahng (2000) evaluated the effectiveness of concurrent schedules of reinforcement during FCT with five participants. During this evaluation both the FCT response and the problem behaviour contacted reinforcement. Continuous concurrent schedules for the communicative behaviour and problem behaviour resulted in a decrease in inappropriate behaviour and an increase in the communicative response for one participant. However, problem behaviour persisted with four participants. The researchers then thinned the schedule of reinforcement for the problem behaviour and continued to reinforce the FCT response on a continuous schedule; problem behaviour decreased and communicative responses increased for the remaining four participants; differing concurrent schedule were effective for each participant. The researchers demonstrated that problem behaviour maintained by social positive reinforcement could be reduced even when the problem behaviour continued to contact reinforcement on an intermittent schedule. This schedule may be typical of what happens in clinical settings when extinction procedures are not implemented with high treatment integrity (Worsdell et al., 2000).

The Current Study

The current paper is made up of two studies. In the first study an extended functional analysis was conducted to identify if attention in the form of positive, predictable and repetitive statements maintained problem for two participants. In the second study, a treatment analysis, the effects of NCR, FCT and pre-session satiation without extinction were evaluated to identify which procedure, if any, could reduce problem behaviour that is maintained by the kind predictable attention that is common in BESST classrooms. These studies will contribute to the literature in a number of ways. Firstly, there are no empirical evaluations of function based behaviour intervention with individuals whose problem behaviour was maintained with this particular quality of attention. There is also limited research evaluating FCT without extinction to reduce attention maintained problem behaviour; and limited research evaluating the effects of pre-session satiation.

General Method

Participants

Participants were recruited from primary school classrooms in a maintained SEN school. Both participants were enrolled in the BESST model, a low intensity model of education that was underpinned by the principles of applied behaviour analysis (see chapter 3). Consent was obtained from Bangor University Psychology Ethics before the intervention began; parents consented for children to take part in the study (application no. 2014-7102).

Philip was a four year old boy with a diagnosis of ASD and learning disability. He communicated using Picture Exchange Communication System (PECS) and had some emerging vocal-verbal communication. Philip engaged in a range of behaviours that appeared to be maintained by attention in the form of predictable statements or responses from adults. For example, Philip engaged in self-injurious behaviours (hitting his head on objects), which appeared to be reinforced by staff saying, “be careful”; he would repeatedly stand up during

work sessions, which appeared to be reinforced by the teacher saying, “sit down”; he repeatedly manded for food that was no longer available at snack time, which appeared to be reinforced by the teacher saying, “it’s finished”; and he responded incorrectly during work sessions which appeared to be maintained by the teacher implementing the error correction procedure.

Simon was a five year old boy with a diagnosis of ASD. He had recently started to communicate vocally. Simon also engaged in a range of problem behaviours that appeared to be maintained by attention in the form of predictable statements or responses from adults and children. Simon engaged in aggression towards adults and peers, which appeared to be reinforced by a teacher saying, “use kind hands” or a peer engaging in protest vocalisations; he regularly absconded from work table, which appeared to be maintained by an adult following him and blocking access to stimuli and, saying “work time”, he also responded incorrectly during work sessions, which appeared to be reinforced by the teacher implementing the error correction procedure.

Setting

Sessions were conducted in a small room (Simon) and a small area at the end of a corridor (Phillip). Each area had at least one table and a number of chairs. The participant, the therapist and one or two observers who collected data were present during all sessions.

The participant and the therapist left the room to go for a walk for approximately five minutes between each session; the route that they took was the same each time. This also happened before the first session of the day or before the first session after a break. The child returned to his classroom after a number of sessions on days when more than three sessions were being conducted.

Dependent Measures and Data Collection

Philips behaviour included self-injurious behaviour, disruption and absconding. Phillip's self-injurious behaviour was hitting his head on objects. Disruption included tipping objects, climbing, scrunching up paper and books, kicking object, biting objects and throwing objects. Absconding included climbing under or over tables and chairs and attempting to leave the room.

Simon's behaviour included absconding, disruption, aggression, protest vocalisations, swearing and disrobing. Absconding included climbing onto a window ledge or other surfaces. Disruption included banging chairs, standing on chairs and other stimuli, throwing objects, grabbing items that did not belong to him, turning laptops off, shutting the top of laptops and playing with fire extinguishers. Aggression included hitting and pushing others. Disrobing was pulling his trousers down.

Observers used pen and paper to record the frequency within 10's interval for each class of behaviour during each five or 10 minute condition. Data are reported as rate of problem behaviour per minute.

Interobserver Agreement

A second observer independently collected data during 48% of all sessions across the two studies. Interobserver agreement (IOA) was collected by comparing observers' data for each 10 second interval; an agreement was defined as the two observers recording the same outcome during the interval (i.e., whether or not the target behaviour occurred, and when it occurred. how frequently). The number of agreements was totalled and divided by the number of agreements plus disagreements and converted to a percentage. The percentage interobserver agreement was 97.4% (ranging 83% to 100%) across participants.

Experimental Designs

Study 1: Functional Analysis

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A functional analysis was conducted for each participant using a multi-element design (Iwata et al., 1982/ 1994).

Study 2: Treatment Analysis

The treatment analyses were conducted using a multiple treatment with reversal design. This design was used for a number of reasons. Firstly, it is appropriate for comparing two or more interventions for reversible behaviours (Ledford, Barton, Severini & Zimmerman, 2019); and is commonly used to compared both antecedent and consequence based interventions (Gast, Ledford & Severini, 2018). A review carried out by Rooker, Jessel, Kurtz, and Hagopian (2013) found that 21 out 58 comparison studies employed a multiple treatment with reversal design; a total of 48 used reversal design. The alternative was alternating treated design (ATD), which is also effective when comparing interventions (Wolery, Gast, & Ledford, 2018). However, due to constraints on conducting research in this setting (discussed in Chapter 2) the feasibility of implementing an ATD in this setting would be difficult. From a practical point of view, multiple treatment design is more feasible. It was easier for the researcher to implement a whole phase of one treatment than to rapidly several treatments in one research session, which may have impacted treatment fidelity (Ledford et al., 2019). Furthermore, there is a possibility that rapidly alternating treatments could have had a negative impact on the participants (Cooper, Heron, Heward, 2020). The researcher was concerned that the participants may engage higher levels of problem behaviour following the research session, because this is not consistent with what they typically experienced. An alternating treatments design may also be less popular with teachers as it does not reflect typical practice. Finally, it was possible that the participant may not have been able to discriminate between rapidly alternating conditions in an ATD design (Ledford et al.).

Study 1: Functional Analysis

Procedure

A functional analysis was conducted with each participant to empirically demonstrate that problem behaviour was maintained attention in the form of positive predictable, repetitive statements. Functional analysis conditions included the standard functional conditions: control, attention in the form of positive but unpredictable comments, and escape; and an additional condition during which attention in the form of predictable statements were delivered.

In the control condition the therapist sat beside participant on the floor. The participant had access to a number of medium preference toys, which were selected based on free operant observations in the child's classroom. Attention in the form of descriptive statements about the participants on-going appropriate behaviour, for example, "you put the puzzle piece in", "you're sitting very nicely" or in the form predictable statements through play was delivered on a fixed time (FT) 10' s schedule. Attention was not delivered contingent on inappropriate behaviour, instead the participant was redirected to the toys; the therapist did not place any demands in the control condition.

In the unpredictable attention condition the therapist sat approximately 0.5 meter away from the participant: the therapist sat on the floor during Philip's FA and on a chair during Simon's FA. The therapist had a purple clipboard with reading material on it and delivered the statement, "I'm busy now, I'm working' at the beginning of the session. Attention in the form of unpredictable attention was delivered on fixed ratio (FR) 1 contingent upon problem behaviour. The attention was unpredictable because the statements were not repeated, so the participant only heard each statement once; the statements were positive for example, "are you ok?", "I like your toys", "good boy". The participant had access to the same items that were available in the control condition.

In the escape condition the therapist sat opposite the participant at the table; DTT stimuli and a token economy were visible. The therapist delivered demands from the participants individualised education plan; a 10' s break from the demands was delivered on an FR 1 contingent upon problem behaviour.

The discriminative stimuli in predictable attention condition were identical to those in the unpredictable attention condition for Philip. To make it easier for Simon to discriminate between the two attention conditions the discriminative stimuli (visual and vocal) changed slightly. A red laminated A4 sized sheet of paper replaced the purple clipboard and the therapist said, "I'm not available, you play with your toys" before sitting on the chair at the beginning of the session. Attention in the form of positive, predictable and repetitive statements about the appropriate alternative to the problem behaviour were delivered on an FR 1 contingent upon problem behaviour for both participants. For example, each time the child kicked materials or toys the statement "we play nicely with toys", was delivered. Functional analysis conditions lasted five minutes for Simon and 10 minutes for Phillip.

Results

Figure 1 and Figure 2 show the results of the functional analysis for Phillip and Simon. Problem behaviour was highest for both participants in the predictable attention condition.

Philip. Philip's mean rate of problem behaviour was 5.4 responses (range 3.6 – 6.8) per minute in the predictable attention condition. Predictable attention resulted in a higher rate of problem behaviour than unpredictable attention, which resulted in mean rate of 2 response (range 1.6 – 2.2) per minute. Mean rate of problem behaviour was lower in the escape condition: 0.46 (range 0.4 - 0.6) in; and in the control condition: 0.55 (range 0.2 – 1.2).

Simon. The outcome of Simon's FA was similar. He engaged higher rates of problem behaviour in the predictable attention condition; his mean rate of problem behaviour was 9.3 responses (range 8.3 – 10.9) per minute in this condition. Again, problem behaviour was notably higher

when predictable attention was available in comparison to unpredictable attention: 1.5 (range 1.5 – 2.3). Simon's mean rate of problem behaviour was 0.12 (range 0 - 0.3) per minute in the escape condition; and 0.26 (range 0 – 0.4) in the control condition.

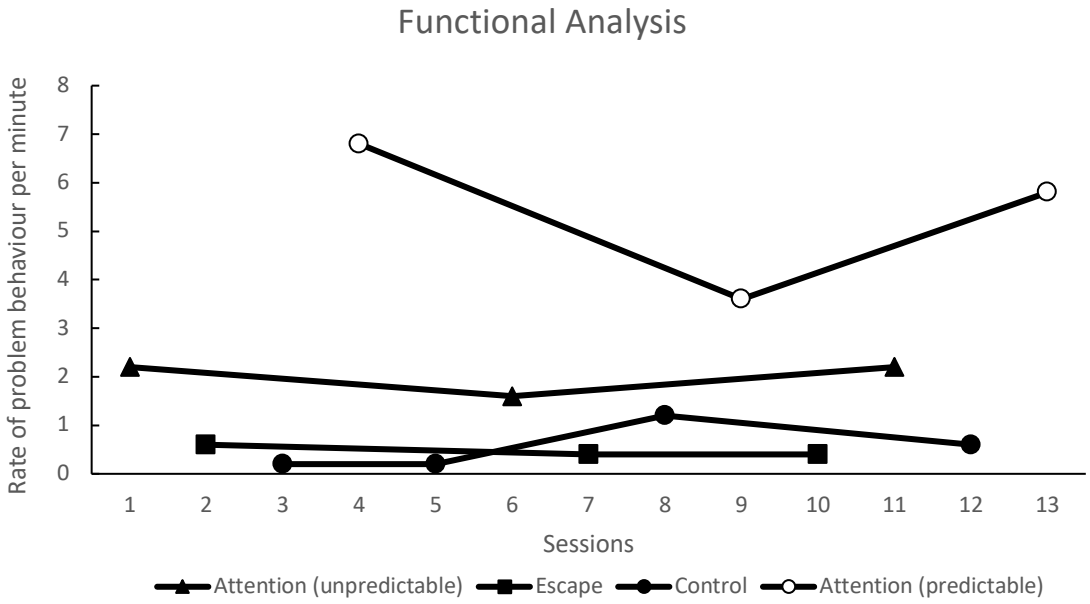

Figure 1. Results from functional analysis of problem behaviour for Philip.

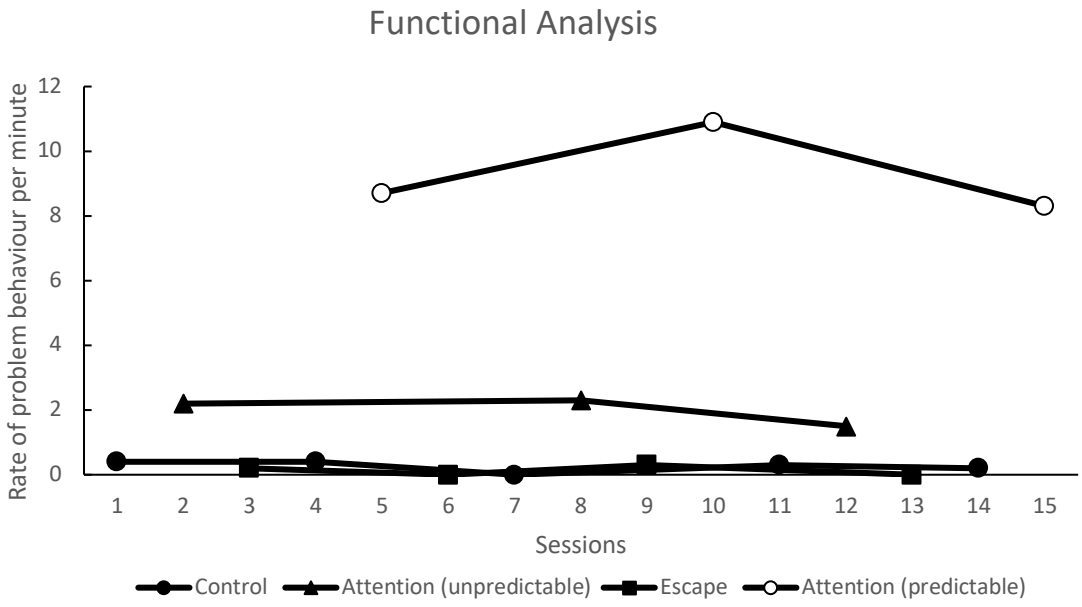

Figure 2. Results from functional analysis of problem behaviour for Simon.

Study 2: Treatment Analysis

Procedure

During the treatment analysis FCT, NCR and PSS conditions were compared to baseline conditions, which were identical to the predictable attention condition in the functional analysis. The conditions were ordered in a way that allowed for each intervention to be compared to baseline on at least two occasions, either by being implemented immediately before or after a baseline condition. We also aimed to replicate each intervention three times for each participant. To reduce threats to internal validity the order of conditions was counter balanced for each participant; thus, reducing the likelihood of multiple treatment inferences. The order of conditions was also counterbalanced across participants, thus, further reducing threats to internal validity and enhancing the demonstration of effect. The session duration was 5 minutes for each condition during the treatment analyses. For Phillip, between three and 10 sessions were conducted each day, and between three and 14 sessions were conducted per week. For Simon, between three and nine session were conducted each day, and between seven and 24 session were conducted each week.

The tangibles that were available in the control condition and both attention conditions in the functional analysis were also available in the NCR and FCT conditions in the treatment analysis. Tangibles were different in the FCT condition.

Functional Communication Training without Extinction

The purpose of the FCT condition was to teach the participants to mand for items that served the same function as the problem behaviour and to establish whether access to these items following a mand would result in a decrease in problem behaviour.

It was clear from the distinction between the typical attention condition and the predictable attention condition, and from observations of the children in their classrooms, that it was the predictability, and therefore repetitiveness, of the attention or responses that was

important. Therefore, we included objects that the participants could mand for and interaction with these objects produced a predictable response. For Philip, we selected objects that the experimenter delivered predictable attention with, for example, we included a shape sorter and when Philip put a shape in the experimenter would say, 'oh you put the triangle in'. The objects that were available for Simon produced predictable responses, for example, the Talking Tom® app, which delivered predictable responses depending on how Simon interacted with the character. These were considered to be functionally equivalent because interaction with the objects produced a predictable response in the same way that engaging in problem behaviour, for example, throwing a toy or responding incorrectly during DTT, might. The Talking Tom® app was considered to be functionally equivalent because the responses produced was directly linked to how he interacted with the app, making the responses predictable.

Mand Training

Mand training was conducted prior to functional communication training. The mode of communication was symbol exchanges or vocal-verbal mand for both participants as this was how they typically manded. Mand training focused on symbol exchanges, but if a child vocally manded this was immediately reinforced as this is consistent with what would happen in class. The first stage of mand training involved presenting each item in isolation with the symbol presenting each item being placed in front of it. If the participant reached for an item without exchanging a symbol, the therapist blocked it momentarily and simultaneously prompted the participant to exchange a symbol. Least to most prompting was used for PECS exchanges. The least intrusive prompt was a gesture prompt; this was followed by a partial physical prompt, whereby, the teacher prompted the participant to reach for a symbol by tapping his elbow; and finally, a full physical prompt was used. The therapist clearly labelled each item as she gave it to the participant. Once the child exchanged a symbol for the item in

isolation the five items that were presented in the FCT were presented together. Mand training ceased when the participant manded independently for a least 80% of trials over two consecutive sessions or 100% of trials on the first session when items were presented together.

Functional Communication Training

Procedure

Phillip. During the FCT without extinction condition the therapist and the participant sat at a table. All of the stimuli were placed on a table and the symbol representing each item was placed on a choice board. Phillip could interact with the item that he manded for for as long as he chose to. If he wandered away from the table the experimenter prompted him to mand by pointing to the choice board. Predictable attention was delivered when Philip interacted appropriately with the items that he manded for, for example, if Philip painted with red paint the therapist said, "you painted with the red paint". Predictable attention was delivered on an FR6 following problem behaviour. This schedule approximated what might occur in the natural environment, where extinction procedures may not be consistently implemented (Fritz et al., 2017) resulting in intermittent reinforcement of the problem behaviour (Worsdell et al, 2000).

Simon. Simon's FCT condition was identical to Philips with the exception that attention was not delivered for appropriate interactions with the toys; instead the objects that were included produced predictable responses. The therapist stayed at the table, but diverted her attention away from Simon.

Noncontingent Reinforcement without Extinction

Procedure

During the NCR without extinction condition the therapist and participant sat on the floor; a number of medium preference toys (identical to those presented during the functional

analysis) were placed within arm's reach. NCR was provided as attention in the form of descriptive statements about the participants on-going appropriate behaviour and/ or predictable statements through play; these were identical to the statements that were delivered in the control condition of the functional analysis. When the session started the therapist said, "let's play". The therapist delivered NCR on a FT 20-second schedule; this interval was based on the mean inter-response time during baseline sessions. An omission contingency of 10 seconds was used: the scheduled delivery of the reinforcer was delayed by 10 seconds if problem behaviour occurred at the end of the 20-second interval. The therapist interacted with the stimuli when she was not interacting with the participant. Predictable attention was delivered on an FR6 following problem behaviour.

Pre-session Satiation

Procedure

This condition had two phases: The first phase lasted for 10 minutes: during this phase the therapist and participant sat on the floor with identical stimuli to those in the NCR and functional analysis conditions. Pre-session access to the putative reinforcer was provided during this phase: attention in the form descriptive statements about the participants on-going appropriate behaviour and/ or predictable statements through play were delivered continuously. Attention was not delivered contingent on inappropriate behaviour, instead the participant was redirected to the toys. The second phase begun immediately after the first phase. The second phase lasted 5 minutes. During this phase the therapist moved away from the participant and diverted her attention by looking at some papers; scheduled attention was not delivered during this phase. The participant had access to a number of medium preference toys (identical to those presented during the functional analysis and NCR conditions). Predictable attention was delivered on an FR6 following problem behaviour. Data reported are for the second phase of the pre-session satiation procedure.

Results

The results of the treatment analysis are depicted in Figure 3 for Phillip and Figure 4 for Simon.

Initial baseline data are identical to those in the predictable attention condition in the FA.

Philip All three procedures resulted in decrease in Phillip's problem behaviour compared to baseline conditions.

Functional communication training without extinction (Figure 3).

Functional communication training without extinction resulted in the lowest rates of problem behaviour; problem behaviour was most stable in this condition. Phillip's problem behaviour decreased following the introduction of FCT without extinction and remained at near zero levels during the first treatment analysis; his mean rate per minute was 0.13 (range 0 – 0.2) during this phase. Problem behaviour increased slightly during the second treatment analysis: mean rate per minute was 1.06 (range 0.8-1.6); and decreased to near zero levels during the third treatment analysis: mean 0.25 (range 0 – 0.4). Data were stable in the first treatment analysis, slightly variable in the second and there was decreasing trend in the third. Phillips rates of problem behaviour were lower during all FCT without extinction sessions when compared to baseline. Problem behaviour contacted reinforcement in one FCT session (session 23).

Noncontingent reinforcement without extinction (Figure 3).

Philips problem behaviour decreased during NCR without extinction relative to baseline conditions; however, responding was more variable than in the FCT condition. Problem behaviour decreased to a mean rate of 0.86 (range 0.2 – 2) per minute in the first treatment analysis. It was slightly higher during the second treatment analysis; mean rate per minute was 0.52 (range 0 – 0.8) and it increased again in the third treatment analysis; mean rate per minute was 1.32 (0.2 – 2.6). Data are also more were variable in final treatment analysis

for NCR without extinction. Phillip's problem behaviour was lower during all NCR sessions when compared to baseline with the exception of sessions 11 and 49 which had rates of problem behaviour (2 and 2.6 respectively) that were equal to two baseline sessions (7 and 18). Problem behaviour contacted reinforcement in three sessions (sessions 11, 44, 46) in this condition.

Pre-session satiation without extinction (Figure 3).

There was less of a decrease in Phillips rate of problem behaviour in pre-session satiation condition when compared to FCT and NCR; these data were more variable than the data in the other conditions. Phillip's means rate of problem behaviour was 1.72 (range 1.2 – 2.8) in the first pre-session satiation condition; and 3.15 (range 2 - 5.2) in the second pre-session satiation condition. Data are variable during both treatment analyses for pre-session satiation. The rate of problem behaviour was comparable to baseline in more than half of sessions (sessions 14; 42 – 45) in the pre-session satiation condition. Problem behaviour contacted reinforcement in every session in this condition.

Simon

All three procedures resulted in a decrease in problem behaviour relative to baseline for Simon.

Functional communication training without extinction (Figure 4).

Problem behaviour decreased to zero levels following the introduction of FCT without extinction; rates of problem behaviour remained at zero levels during the first and second treatment analysis. Simon's mean rate of problem behaviour increased very slightly during the third treatment analysis for FCT without extinction: 0.25 (range 0 - 0.6). There were no overlapping data points between FCT without extinction and baseline conditions for Simon. Simons lowest rate of problem behaviour was 8.3 (session 3) per minutes during baseline sessions and his highest rate of problem was 0.6 (session 47) during the FCT condition. As the intervention had an immediate effect on problem behaviour, decreasing it to zero level, problem behaviour did not contact reinforcement in this condition.

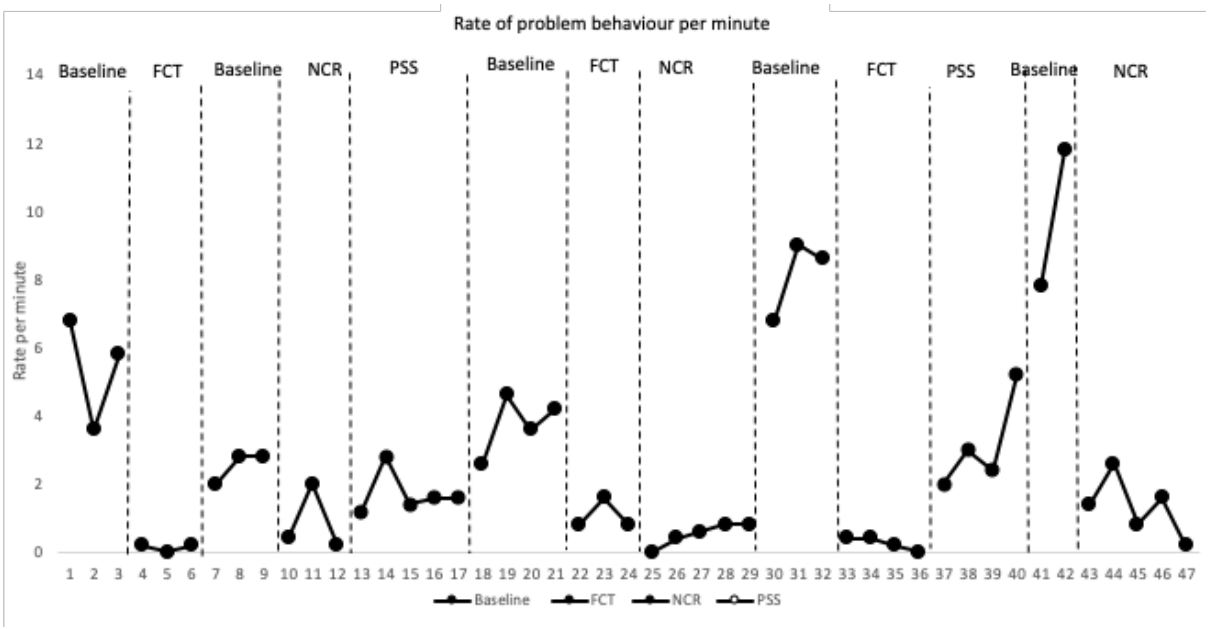

Figure 3. Rate per minute of problem behaviour during baseline, NCR without extinction, FCT without extinction, and pre-session satiation conditions for Phillip.

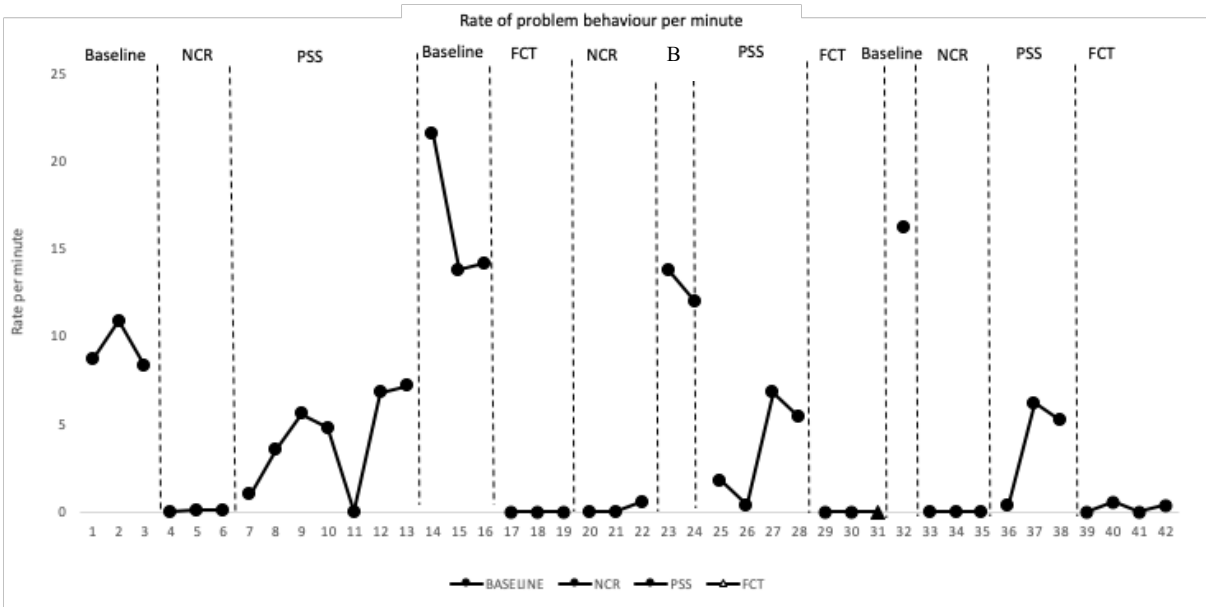

Figure 4. Rate per minute of problem behaviour during baseline, NCR without extinction, FCT without extinction, and pre-session satiation conditions for Simon.

Noncontingent reinforcement without extinction (Figure 4).

NCR resulted in zero levels of problem behaviour during each treatment analysis. Simon's means rate of problem behaviour was 0.06 (range 0-0.1) per minute in the first treatment analysis; 0.2 in the second treatment analysis (range 0 – 0.6); and 0 in the final

treatment analysis. Simon's data are stable throughout each of the three treatment analyses for this procedure. There were no overlapping data points between NCR without extinction and baseline conditions: Simons lowest rate of problem behaviour during baseline sessions was 8.3 (session 3) and his highest rate of problem behaviour was 0.6 (session 22) per minute during NCR. Due to every low levels of problem behaviour in every session, problem behaviour did not contact reinforcement in this condition.

Pre-session satiation without extinction (Figure 4).

The pre-session satiation without extinction did not result in a stable decrease in Simon's problem behaviour; his rate of problem behaviour was higher in the pre-session satiation without extinction than in the FCT and NCR without extinction in more than 75% of sessions. The mean rate of problem behaviour in the first pre-session satiation treatment analysis was 4.14 (range 0 – 7.2). Data are variable in this treatment analysis: the rate of problem behaviour in sessions 7 and 11 are low; both of these sessions were conducted first thing in the morning, so Simon had not had access to the toys that were available with the exception of the 10 minute pre-session satiation condition that was conducted previously. A similar pattern was seen in the second treatment analysis for pre-session satiation: the mean rate of problem behaviour was 3.6 (range 0.4 – 6.8) and data were variable. The rate of problem behaviour was low in sessions 25 and 26; both of these sessions were conducted first thing in the morning; rate of problem behaviour increased in the third session and decreased slightly in the fourth. The mean rate of problem behaviour in the final treatment analysis for pre-session satiation was 3.93 (range 0.4 – 5.2). None of the sessions in this phase were conducted first thing in the morning, however, sessions 36 and 38 were both conducted following a long break. None of the sessions in the pre-session satiation treatment analysis had equal rates of problem behaviour to the baseline conditions; however, discrepancy between pre-session satiation and baseline was not as great as it was in the NCR and FCT without extinction conditions. Simon's

lowest rate of responding during baseline sessions was 8.3 (session 3) and his highest rate of problem during pre-session satiation without extinction was 7.2 (session 13); and the rate of problem behaviour was 5 or more in half of pre-session satiation sessions. In total, Simon's problem behaviour contacted reinforcement in nine sessions in this condition.

Discussion

In first study, an experimental functional analysis clearly demonstrated that both participants' problem behaviours were maintained by attention in the form of positive predictable, repetitive statements. Following this, the effects of FCT, NCR and pre-session satiation were then evaluated to identify which procedure could reduce problem behaviour that was maintained by attention in the form of predictable, repetitive statements. The intention was to implement each procedure without extinction; reinforcement was available on an FR 6 for the problem behaviour in each condition. However, Simon did not engage in problem behaviour frequently enough to contact reinforcement during either FCT and NCR. As a result, it could be argued that his problem behaviour was placed on extinction in these conditions. However, due to the fact that problem behaviour was at zero in more than half of NCR conditions and 80% FCT conditions; the reduction in problem behaviour was more likely to be a result intervention acting as an abolishing operation for the predictable attention in these conditions. Each return to baseline consistently resulted in an increase in rate of problem behaviour for both participants. This quality of attention has not been addressed in the literature and it poses an interesting challenging in clinical settings: it is possible that predictable attention is more likely to be available when staff respond consistently to problem behaviour; strategies such as, following through with demands and the use of redirection are likely to reinforce problem behaviour that is maintained by this type of attention. It may be very difficult to remove the discriminative stimulus for these behaviours in the natural environment. Reducing this attention to zero levels may not be possible in clinical settings

such as SEN schools because staff in these setting may struggle to withhold it and these strategies are likely to be implemented as part of other children IBP's; therefore, interventions that could be implemented without extinction were evaluated in order to increase the ecological validity of the research.

NCR resulted in a decrease in problem behaviour for both participants. Delivering the functional reinforcer on a dense schedule independent of responding had an abative effect on problem behaviour for both participants. Phillips problem behaviour contacted reinforcement in several sessions in this condition; despite this, his responding was lower than baseline responding in all but two sessions. Therefore, delivering NCR on a dense schedule of reinforcement while reinforcing the problem on a leaner schedule resulted in a decrease in Phillip's problem behaviour. These findings support other research that found NCR without extinction to be effective (Fritz et al., 2017; Hagopian, LeBlanc, Maglieri, 2000). NCR resulted in a more stable reduction in problem behaviour for Simon - his problem behaviour remained at zero levels during each treatment analysis. As a result, there were no opportunities to reinforce Simon's problem behaviour.

FCT was effective for both participants' resulting in almost zero levels of problem behaviour. Philip's responding was more stable in this condition than in the NCR condition. Phillip's problem behaviour contacted reinforcement during the second treatment analysis for FCT; despite this, it decreased in the following session and did not increase enough to contact reinforcement during the remainder of the study. This adds to the literature on FCT without extinction. Similar to NCR, the FCT condition resulted in zero levels of responding for Simon, and as such, problem behaviour did not contact reinforcement in his condition. Simons data adds to literature on FCT by demonstrating that FCT can effectively decrease problem behaviour maintained by attention in the form of predictable statements.

Chapter 7 – Paper 3: Problem behaviour maintained by predictable attention

Pre-session satiation did not consistently decrease problem behaviour for either participant. Rates of problem behaviour were higher and more variable for both participants in this condition when compared to NCR and FCT. Unlike the other conditions, the independent variable did not seem to have an abolishing effect on the reinforcer in this condition. The motivating operation for the problem behaviour may have been in place even after prolonged exposure to reinforcer, resulting in persistent rates of problem behaviour for both participants. As a result, problem behaviour contacted more reinforcement; thus, strengthening the behaviour. This could also be explained by the fact that the putative reinforcer was only delivered contingent on problem behaviour in this condition; whereas, predictable attention was delivered on FT-20's in the NCR condition and on an FR1 following the FCR in the FCT condition. Therefore, participants could only access predicable attention by engaging in problem behaviour in this condition. These findings are different to McComas, Thompson and Johnson (2003) study who found that pre-session access to attention decreased problem behaviour when compared to pre-session conditions during which attention was not available. That is, pre-session attention served as an AO for attention as a reinforcer for participants in that study. One difference between the current study and McComas and colleagues is that the current study compared pre-session access to attention to baseline conditions as opposed to no pre-session access; therefore, there is a limit to how much comparison can be drawn between the two studies. Nevertheless, pre-session satiation resulted in stable, low levels of problem behaviour in McComas and colleagues' study and it did not in the current study. There was some variation in Simon's problem behaviour that warrants discussion. The rate of problem behaviour was notably higher in the PSS condition when sessions were either conducted first thing in the morning or following a long break (sessions 7, 11, 25, 26, and 36); the only measurable difference in those sessions being that he had not had access to the toys for a prolonged period of time. Therefore, this

difference could possibly be explained by the combined effect of him being deprived of access to the toys and of having had prior access to the putative reinforcer. The difference in these sessions is unlikely to be explained by the pre-session access to attention alone, because problem behaviour was consistently higher in all of the other PSS conditions, while the attention that delivered beforehand was consistent. The results of the current study are similar to Roantree and Kennedy (2006) who found that pre-session attention did not function as an AO for problem behaviour; problem behaviour was higher following 20 minutes of pre-session attention when compared to 20 minutes of pre-session deprivation in Roantree and Kennedy's study. That is, pre-session attention functioned as an EO rather that an AO. It is not possible to draw conclusions as to whether pre-session attention functioned as an EO for participants in the current study; however, the results demonstrate pre-session attention did not function as an AO.

There are a number of limitations to this study. The first relate to the design and order of conditions. While the multiple treatment design was most suitable for this setting, an ATD may have been more appropriate design. The ATD design reduces some of the threats to internal validity associated with the multiple treatment design, such as sequence effects and separation of treatment issue (Wolery et al., 2018). Nonetheless, for a number of reasons discussed above, the multiple treatment with reversal design seemed to be more appropriate for this setting. There are some of limitations associated with the order of the conditions. The first issue is that there was limited replication across adjacent conditions; it is recommended that there are at least three potential demonstration between two adjacent conditions (Ledford et al., 2019). However, while there was limited number of comparisons of adjacent conditions, each intervention was implemented three times for each participant, with the exception of PPS which was only implement twice for Phillip; thus, allowing for three demonstrations of the effect of each intervention for each participant. Each return to baseline

resulted in an immediate increase in problem. Problem behaviour consistently decreased following the reintroduction of NCR and FCT for both participants; and there were similar levels of responding across each of the three conditions for both participants. Another issue is that there were a limited number of data points in phases. Due to time constraints, the minimum standard of three data points (Ledford et al., 2019) per phase was employed for the majority of treatment analysis conditions. However, fewer than three sessions were conducted for some of the later FA phases (one phase for Simon; two for Philip). There were a number of reasons for this: firstly, there were restrictions on time due to clinical commitments, and secondly the return to baseline reliably resulted in an immediate increase in problem compared to adjacent conditions, as such it seemed to be therapeutically counterproductive to expose the participant to this condition for extended periods of time. However, this is a limitation and future research should be designed to allow for sufficient measurement occasions. As result of not returning baseline there are limited changes in level and trend between some adjacent conditions, particularly when NCR and FCT; however, when either of these conditions were adjacent to baseline, which occurred on a number of occasions there was an immediate decrease in the rate of problem behaviour; and this was replicated across participants. Again, this is a limitation to the study and future research should endeavour to ensure that these limitations are rectified. Future research should also consider employing an ATD if it is suitable in the setting in which the research is being conducted.

There are a number of factors specific to the FCT condition that warrant discussion. The first is related to the fact that functional communicative response (FCR) does not specify the maintaining reinforcer. This may impact on the generality of treatment effects because individuals in others settings may not deliver the correct quality of attention or any attention with the toy. However, ensuring that teaching staff and parents are sufficiently trained to

deliver the correct quality of attention when the intervention is generalised to other settings would help to increase the chance that it would have generality. The individual reinforcing the mand for the toy would need to know that this specific quality of attention is delivered with the toy, as they would if the child was manding for a specific quality of attention. A possible area of future research may be to investigate procedures that involved delivering predictable attention contingent on appropriate alternative responses or a FCR that specifies the quality of attention. Anecdotally, there are specific situations in BESST model classrooms where staff deliver predictable statements (without tangibles) contingent on appropriate alternative responses; for example, if a child engages in incorrect responses to access the error correction procedure, staff may deliver predictable responses contingent on correct responding. The issue of generality may be is less of a problem with, for example, the Talking Tom® app as specific responses are delivered following engagement with the app; this is a low teach app that can be easily delivered in most settings. There are a number of possibly limitation related to the attention or responses that were delivered. The first being that there is no confirmation that the statements correlated with the statements that were delivered in class. Secondly, there is no evidence that the attention that was delivered following interaction with the toys was functionally equivalent to the attention that was delivered in the classroom or during functional analysis conditions. However, as mentioned previously, the toys were selected based on the fact that predictable responses could either be delivered by the items or by an adult following interaction with the item; and the attention that was delivered was predictable and specific to the behaviour that the child engaged in. To give some comparisons, when a child threw a toys during the FA condition the experimenter said, “we play with toys”, and when the a child put the cube in the shape sorter, the experimenter said, “you put the cube in” or when the child touch Talking Tom® tummy the specific response was generated; and each time that the child engaged in that response, the

response stayed the same. Therefore, while some the responses may not have correlated directly with this attention that was delivered in class it can be argued that the quality of attention was the same and that the reinforcers were functionally equivalent rather than arbitrary. Another consideration for the functional analysis is that the attention duration was not controlled relative to the escape condition. That is, participants had a 10's break following problem behaviour in the escape condition, whereas, a brief statement was delivered contingent on problem behaviour in both attention conditions. As a result of this, there was potentially more time to respond outside of the presence of the reinforcer in the attention condition. While this was not an issue in this study because problem behaviour was zero in almost every session in the escape conditions for both participants, it may be a useful consideration for future research as it may be important in the event that functional analysis outcomes are less differentiated,

Another limitation is that the schedule of reinforcement for NCR and FCT were not thinned. Delivering NCR on such a dense schedule may be impractical in many settings. This is also true for FCT, for example, it is not feasible to reinforce mands on an FR1 in a SEN classroom, therefore the schedule of reinforcement for the FCT response would need to be thinned. A possible side effect of this may be resurgence: resurgence occurs when problem behaviours reemerges after the schedule of reinforcement for the alternative response is thinned (Briggs, Fisher, Greer, & Kimbell, 2018; Mace & Nevin, 2017; Pritchard, Hoerger & Mace, 2014). Future research should evaluate the effectiveness of both procedures with schedule thinning. Another limitation to the study is that procedures were not generalised to the classroom. It is possible that problem behaviour would be higher in the classroom where there are several people who are likely to serve as a discriminative stimulus for the problem behavior. This may be particularly true in the case of Simon's FCT condition; the tangible items alone may not compete with predicable attention from adults or children. However,

NCR delivered on a dense schedule may be equally effective in the classroom as the schedule may be sufficient to function as an AO for the problem behaviour across settings. Finally, as mentioned previously, problem behaviour did not occur during the FCT or NCR condition for Simon, and therefore it is not possible to draw conclusions on the effect of these procedures without extinction for Simon. Future research should be designed to increase the chances that problem behaviour contacts reinforcement in every condition, for example, problem behaviour could be reinforced on a richer schedule of reinforcement in the early stages of the intervention or a discriminative stimulus that signals that availability of reinforcement could be available in each condition to increase the chance that the behaviour would occur.

In conclusion, these findings add to the literature in a number of ways. Firstly, to our knowledge, this is the first study to empirically demonstrate the effects of this quality of attention using the functional analysis methodology. The findings add to the functional analysis literature by further demonstrating that manipulations to standard FA methodology may help to identify idiosyncratic qualities of attention as maintaining contingencies for problem behaviour. These findings may be useful to behaviour analyst in many settings as this form of attention may be available as result of consistent responding to problem behaviour. Secondly, it is the first study to identify a number of function based interventions that can reduce problem behaviour maintained by this quality of attention to zero levels. It adds to the literature on FCT, NCR and pre-session satiation without extinction; particularly for FCT without extinction and pre-session satiation as the literature for these procedures is limited. Thirdly, this study is important as it has a particular emphasis on evaluating function based interventions that can be used in schools, where the resources, including staffing and expertise, may impact treatment integrity (Trump, Ayres, Quinland, Zabala, 2019). In a climate where behavioural interventions are increasingly implemented by staff who are not formally trained in behaviour analysis (e.g. Foran et al. 2015; Eikeseth et al., 2012; Grindle et

al., 2012; Peters-Scheffer et al., 2010) it is crucial to identify procedures that can be feasibly implemented in these settings.

Chapter 8: General discussion

Interventions based on applied behaviour analysis (ABA) are not typically implemented in special education needs (SEN) schools in the United Kingdom (UK). Despite what we know about the effectiveness of comprehensive models of education based on ABA, and the ineffectiveness of eclectic models, an eclectic approach to special education dominates in the UK. There were three broad aims of this thesis: to investigate if interventions based on ABA could be implemented in an SEN setting with typical staffing levels and resources; to develop and evaluate a comprehensive model of education that delivers low intensity one-to-one teaching hours by collaborating with key stakeholders; and to evaluate focused intervention practices that were used to increase skills and decrease behaviours that are barriers to learning for children with Autism Spectrum Disorder (ASD) and intellectual disabilities (ID) in this setting. We found that interventions that are underpinned by the principles of ABA can be successfully implemented in a generic SEN school. The British Early Special Schools Teaching (BESST) model, a comprehensive model of education with low intensity one-to-one teaching hours, and a number of focused intervention practices resulted in positive gains for children with ASD and other ID.

In the remainder of this discussion, I summarise the findings of the four preceding research chapters and how they contribute to the current literature, before discussing their strengths and limitations, future research directions, and the implications of these findings for special education.

Chapter summaries and contributions to the literature

Historically, comprehensive models of education are delivered at a high intensity (Eldevik, Berg Titlestad, Aarlie Tønnesen, 2019; Linstead et al., 2016;); and ideally behaviour analytic programmes are delivered by trained technicians (Leaf et al., 2016). However, this makes them incompatible with existing educational provision. Therefore, we need to re-evaluate how behaviour analytic services are delivered so that they can be

accessible to more children. Comprehensive models of education and focused intervention packages differ both terms of the focus of the intervention and the intensity at which it is delivered. According to the Behavior Analytic Certification Board (BACB), comprehensive models of education target a range of skills deficits associated with ASD and are delivered for 35-40 hours/ week; whereas, focused intervention packages target a limited number of behaviours for between 10-15 hours per week (BACB, 2019). However, an emerging literature suggests that it is possible to deliver a comprehensive model of education that target multiple areas of skill development, as well as reducing behaviours that are barriers to learning, with a lower number of one-to-one teaching hours (Grindle et al, 2012; Lotfizadeh, Kazemi, Pompa-Craven & Eldevik, 2020; Peters Scheffer et al., 2010; Pitt, Gent, Hoerger, 2019; Smith et al., 2019).

Low intensity comprehensive models of education have been evaluated in home-based programmes (Smith et al., 2019), special needs preschools and schools in the Netherlands (Peters-Scheffer et al., 2010; Peters-Scheffer et al., 2013) and a maintained school in the UK (Grindle et al., 2012). Data from these studies show that children can make significant gains on standardised assessments and skills assessments following a comprehensive model of education that incorporates low intensity one-to-one teaching hours. The reduction in treatment hours is reflected in clinical practice: Lotfizadeh and colleagues (2018) found that only 14 out of 239 individuals who received EIBI between 2012 and 2014 received more than 15 hours of treatment per week; and Eldevik and colleagues (2019) reported that EIBI intervention hours in Norway had decreased from about 35 to 20 hours per week in the last decade. This decrease in treatment hours may be due to the cost of higher intensity programmes which can be between $40,000 and $60,000 per person (Amendah, Groose Peacock, & Mandell, 2011), practical difficulties with scheduling, the availability of professionals trained in ABA (Smith et al., 2019) or difficulties delivering intensive treatment

in schools (Grindle et al., 2012). Regardless, this change in services delivery suggests that it may be necessary to reframe comprehensive models of education to fit current service provision. If these models of education were provided in existing educational settings, such as SEN schools, they will be accessible to more children (Keenan & Dillenburger, 2011).

An important step in attempting to bridge the gap between research and practice is to delineate the steps involved in designing new or adapted models of education (Odom, Collet-Klingenberg, Rogers, & Hattan, 2010). As such, Chapter 2 describes the formulation phase of the BESST model. The formulation phase involved collaboration with the senior leadership team, teachers, other professionals and parents. The goal was to develop a comprehensive model of education that could be implemented without additional costs to the school; during the formulation phase contextual variables that would impact the feasibility of treatment specific variables were identified. These contextual variables helped to shape the model.

Chapter 3 presents experimental data for thirteen children who were enrolled in the BESST model; children made significant gains on measures of IQ, including full scale, verbal and non-verbal IQ; moderate effects sizes were found for non-verbal and full-scale IQ. Significant main effects and moderate effect sizes were found for the communication and daily living skills scales in the VABS. Statistically significant main effects with moderate and large effect sizes were found for the six ABLLS meta-domains. Significant gains were made on ABLLS-total. Teaching staff were rated between ‘good’ and ‘excellent’ on the 10 characteristics of teaching quality assessment by the YMQI. When children were not in one-to-one teaching sessions teaching staff continued to deliver learning opportunity at a rate of 1.25 per minute per child. This research demonstrates that a comprehensive model of education with low intensity one-to-one teaching hours can be effectively implemented by teaching staff when stakeholders are invested in the formulation phase and behaviour analysts are sensitive to the needs of the setting.

This research adds to the literature in a number of ways. Firstly, to our knowledge it is the first evaluation of a low intensity model of education in a SEN school in the UK. All of children in the foundation phase classroom of this SEN school were included. Children had lower IQ at the beginning of the intervention than those included in previous research; this may be reflected in the effect sizes which were smaller than those in previously reported (e.g. Grindle et al., 2012); however, it may also be a result of lower treatment intensity or other variables which were not accounted for. Nonetheless, this evaluation demonstrates that a cohort of children who may be representative of children in other SEN schools can make significant gains on standardised assessments and skills assessments following nine months of intervention in the BESST model. Secondly, we described what children did while they were not in one-to-one teaching in more detail than has previously been described in the literature. The authors of previous low intensity research have stated that it is likely that children worked on ABA targets outside of one-to-one teaching (e.g. Peters-Scheffer et al., 2010); however, they did not describe what happened during this time. It is likely that time spent working on developmentally appropriate skills outside of one-to-one teaching contributed significantly to child outcomes in this study: focusing on developmentally appropriate targets outside one-to-one teaching and ensuring that all teaching is underpinned by the principles of ABA is key in ensuring teaching is coordinated in a meaningful way and that effective, evidenced-based approaches are implemented across the school day. Finally, to our knowledge, this is the first paper to describe the formulation phase of comprehensive model of education; involving key stakeholders in this process may be integral to the success of the intervention (Kasari and Smith, 2013). Overall this paper is crucial in laying the foundation for future, larger scale research into the BESST model in SEN schools in the UK; some of this research has already started.

An important consideration for comprehensive models of education is the focused intervention practices that are used to teach the skills or reduce problem behaviours. These practices must be effective and result in meaningful behaviour change; and they must be feasible to implement in the setting. Behaviour analysts in the BESST model must identify effective interventions whilst considering contextual variables. A major consideration was staffing: staff in this setting were not required to have prior training in ABA; the ratio of staff to children was not one-to-one; and each staff member worked with many children across the week (Foran et al., 2015). These factors affected the type of prompting procedure that could be used and the types of interventions that could be implemented to reduce problem behaviour. Chapter 5 compared a prompting procedure that was designed for this setting, responsive prompt delay procedure, to two commonly implemented prompting procedures. Chapter 7 evaluated a number of function based interventions to reduce attention maintained problem behaviour.

Data presented in Chapter 5 shows that the responsive prompt delay procedure was as effective as simultaneous prompting and no-no-prompting for three participants. Advantages of this procedure was that it was prescriptive: staff did not need to make moment to moment decisions about the type of prompt to use or when to fade a prompt; the procedure was consistent across learners. This was important for staff in this setting as they did not have prior training in ABA and they worked with many children across the week, which may further complicate systematic prompt fading. It was important for the children's progress because if prompts are not faded properly prompt dependency can occur (Grow & Le Blanc, 2013; Leaf et al., 2014). Furthermore, the responsive prompt delay procedure emphasises the use of positive reinforcement; and does not intentionally use positive punishment, in the form of "no", for incorrect or prompted responses. This was very important for this setting as much of the work with staff focused the use of reinforcement based intervention over punishment

based interventions; and the use of reprimand was contraindicated. The reason for this was that historically some staff in this setting replied on reprimand as a behaviour management strategy and tended to interact with children with a negative way. Because to this, it was very important to use an error correction procedure that utilised positive reinforcement, and emphasised positive interactions. This is another example of how contextual variables were a focus during the development of interventions in this setting; it is important to illustrate this in behaviour analytic literature as behaviour analysts increasing work in variety of clinical settings (Eikeseth et al., 2002; Green, Brennan & Fein, 2002; Peters-Scheffer et al., 2010; Reichow et al., 2012).

Chapter 7 compared three function based interventions that were designed to be implemented within this context. A number of children in the BESST model engaged in problem behaviour that was maintained by attention in the form of predictable, repetitive statements. This quality of attention was available when staff responded to problem behaviour in a consistent way. Practise based evidence from this setting suggested that extinction could not be implemented consistently for this quality of attention. As such, we intended to compare functional communication training, non-contingent reinforcement and pre-session satiation without extinction. Functional communication training and non-contingent reinforcement both resulted in near zero levels of problem behaviour for both participants; one participants problem behaviour was so infrequent in the NCR and FCT conditions that it did not contact reinforcement. Pre-session satiation without extinction did not result in a consistent reduction in problem behaviour for either participant.

Both of these studies contribute to the literature in a meaningful way. The responsive prompt delay procedure is a novel procedure and it has not been empirically evaluated until now. There is limited research on functional communication training without extinction and limited research on pre-session satiation; therefore, this research adds to the evidence base for

these procedures. More importantly, this research demonstrates the importance of evaluating novel or adapted procedures in settings where interventions based on ABA are not typically implemented. If the gap between research and practice in ABA is to close in the UK behaviour analyst must be sensitive to settings and continue to adapt and evaluate procedures when evidenced based procedures cannot be effectively implemented.

Methodological limitations

Whilst each research chapter included in this thesis makes a valuable contribution to this area, there are some limitations that are important to consider. Although the evaluation of the BESST model demonstrated that children could make statistically significant within group gains; there was a relatively small sample size, thus limiting the statistical power of the findings. The lack of a control group is also a limitation to this study; the researchers made several failed attempts to source a control group. Without a control group it is difficult to conclude that the gains made by the group were as a result of the intervention and not for example, typical development. However, it is probable that gains occurred as a result of the intervention. The first consideration is that scores on standardised assessments increased when the expectation is that they would stay the same over time; when typical learning occurs an individual's IQ score remains the same. Therefore, the gains that were made were greater than expected; that is, children learned more than is typically expected over the course of the intervention. Secondly, it is common for children with ASD in control groups or eclectic treatment groups to lose skills (e.g. Eldevik et al., 2019) over the course of an intervention period. Again, this is because in order to achieve the same standardised score they need to develop significant skills – that is to keep up with the development of their typically developing peers. For this reason, it is common for mean standardised scores for control groups to decrease over the course of the intervention. There are a number of examples of this in the literature. For example, in a recent study, Eldevik and colleagues

(2019) compared two different intensities of ABA treatment (18.2 hours and 11.1 hours per week) to an eclectic special school treatment. As was expected, outcomes were better for the higher intensity group; but the low intensity group also made significant gains in some areas. The eclectic group on the other hand produced negative mean scores on IQ and on all VABS scores following one year of treatment. In Remington et al., (2007) study the control group made loses on IQ scores between time 1 and time 2, and time 1 and time 3. Howard et al., (2005) found that a low intensity eclectic intervention produced a negative mean score change in many areas; Eikeseth and colleagues (2002) found that children who received an eclectic model of education that was delivered intensively made loses on expressive and receptive language measured by the Reynell Developmental Language Scales and on communication assessed by the VABS. This suggests that children with ASD often lose skills, which is reflected in a negative mean score at follow-up. Therefore, one could expect that the cohort in the current study would have negative mean score change between time 1 and time 2. This was not the case and it is therefore likely that gains made were as a result of the intervention that was delivered.

The lack of RCT's is an ongoing issue with ABA based interventions, including comprehensive models of education (Reichow, Hume, Barton and Boyd, 2018); and this research did not employ an RCT design. However as stated, the BESST model research was conducted at the formulation phase of the model: it was developed as feasibility research to identify if the model was effective; and inform and trial aspects for future larger scale research. Therefore, while an RCT is the 'gold standard' it was not appropriate at this stage of the evaluation (Smith et al 2007; Thabane et al., 2010).

A number of methodological limitations have been discussed in relation to chapter 7. One important limitation is that one of the participants problem behaviour did not contact reinforcement during the NCR and FCT conditions; as such it is difficult to draw conclusions

about the effective of these procedure without extinction for this participant. Some other limitations been discussed in relation to the constraints on conducting research in this type of setting, which may be exacerbated by the fact that the researcher's primary role was to work as a BCBA, and not a researcher.

Future research

Further larger evaluations of the effectiveness of the BESST model in SEN settings should be conducted. These studies should employ a control group; and ideally randomised control study would be conducted.

Comprehensive models of education are by nature multicomponent (Grindle et al., 2012); and as a result, it is difficult to identify which components had the greatest impact. It is likely that low intensity one-to-one teaching hours, quality group instruction and interactions outside of one-to-one teaching, and the implementation of individualised behaviour plans across the day are all integral to the success of the intervention. It is unlikely that low intensity one-to-one teaching hours alone would result in such positive gains (e.g. Lovass, 1987). However, component analyses could be conducted as part of future research to identify which components have the largest impact. Future research should also include follow-up to identify if children maintain gains following the BESST model and to identify the level of input that is required for skills to maintain.

Treatment integrity was high for all three prompting procedures in Chapter 5; however, the procedures were implemented by researchers who had a minimum of an MSc in ABA. Future research should compare treatment integrity for the prompting procedures when they are implemented by teaching staff in SEN schools. YMQI data (Whiteford, Blacklock, & Perry, 2012), presented chapter 3, demonstrated that teaching staff implemented the progressive prompt delay procedure to a high standard, that is, 'good' to 'excellent'; however, a detailed comparison of the three procedures would be more conclusive. Future

research should also incorporate a social validity measure (Carr, Austin, Britton, Kellum, Bailey, 1999) to measure implementers preference for the different procedures.

Future research should also be conducted to improve the ecological validity of the research findings in this chapter. In this study functional communication training and non-contingent reinforcement decreased problem behaviour when reinforcement was delivered on dense schedule. However, for these procedures to be feasibly implemented in a SEN setting the schedule of reinforcement would need to be thinned. Future research should also evaluate the procedures when they are implemented by teaching staff in the children's classrooms. It is possible that sources of reinforcement that are available in the classroom may compete with the reinforcement that was available during non-contingent reinforcement condition or the functional communication training conditions outside of the classroom. Future research should also be conducted on pre-session satiation. This area is under researched and this intervention that may be very useful in settings where there are periods of low attention across the day. While problem behaviour was low in some sessions following exposure to the putative reinforcer pre-session satiation did not consistently decrease problem behaviour. The effectiveness of precession satiation combined with access to preferred items could be evaluated in the future.

Implications for practice

In addition to implications and contributions of these findings to the current literature, there are a number of implications for practice that must be considered.

Bridging the gap between research and practice.

Broadly speaking, if a comprehensive model of education delivered lower intensity one-to-one teaching hours it may fit more easily into existing educational provision such as maintained SEN schools; and delivering these and focused intervention practices in

maintained schools has a number of benefits for practice. One major benefit is that it makes them more accessible (Keenan et al., 2015).

While children who were enrolled in the BESST model did not make the same gains as children in other studies, this research helps to demonstrate that a comprehensive model of education can be effectively implemented in SEN schools in the UK. This research helps to bridge the gap between research and practice for comprehensive models of education and focused intervention practices in these settings. As discussed, it is typical for SEN schools in the UK to adopt an 'eclectic' approach to education. This amounts to teachers implementing variety of approaches across the week; often teachers are not proficient in delivering any of the interventions and therefore, fidelity is low (Hewerd, 2003). Those who adopt an eclectic approach sometimes claim to use ABA, for example, the eclectic group in Smith and colleagues 2019 study included ABA in their techniques. However, ABA is not a single tool or treatment that is used for 20 minutes of the day; it is a science from which a large number of evidenced based interventions have been developed. Interventions based on ABA are designed and supervised by BCBA's who have specialised training in ABA (Dixon et al., 2016). In order to be effective, these procedures need to systematically implemented and individual interventions or components of comprehensive models should be selected based on the learning needs of the child and should be implemented with high treatment integrity (Odom et al., 2010).

Reframing comprehensive models.

Historically, EIBI is delivered intensively; that is for 30-40 hours per week (Lovaas, 1987; Remington et al., 2007): the majority of learning opportunities are presented in a one-to-one teaching format; generalisation is programmed, but this typically occurs in a one-to-one teaching session (Smith et al., 2019). It is not feasible to deliver high intensity one-to-one teaching hours in most state funded settings and in order to make it more feasible and

acceptable one-to-one teaching hours need to be reduced (Peters-Scheffer, et al., 2010). A low intensity model does not mean that the child is only presented with developmentally appropriate targets for, for example, seven hours per week; instead, it means that teaching that is delivered outside of one-to-one teaching is based on the child's individualised developmentally appropriate targets - teaching staff are trained to maximise learning opportunities throughout the day. In this model all teaching is underpinned by the principles of ABA. This model of education emphasises high quality teaching throughout the entire school day, some of which is delivered on a one-to-one basis. This has huge implication for practice because it means that a comprehensive model of education can be feasibly implemented in maintained SEN settings.

Fading the BESST model; the importance of skills maintenance.

If behaviour analysts are part of the staffing in SEN schools, as described in chapters 2 and 3, the BESST model can be faded while aiming to ensure that children maintain their skills. There is evidence to suggest that on-going intervention after the termination of EIBI programmes may be required to maximise and maintain gains (Smith, Hayward, Gale, Eikeseth & Klintwall, 2019; O' Connor & Healy, 2010; Starr et al., 2016); providing this additional support may result in continued learning for children who may otherwise lose skills (e.g. Remington et al., 2007). Furthermore, there is evidence to suggest that ongoing ABA support may be common following intensive EIBI programmes and that this may be a significant factor in skill maintenance (Smith et al., 2019). Smith and colleagues (2019) conducted a follow-up study with 19 adolescents, approximately 12 years after EIBI had ended. In the original study participants made significant gains on cognitive and adaptive skills following two years of EIBI; and these gains maintained 12 years later. Following EIBI, the participants from this group received on average 9.4 years of ABA services; this included home based programmes, ABA support in mainstream school and placements in

ABA schools. The authors suggested that the maintenance of skills, which was not consistent with previous research (Kovshoff et al., 2011; Perry et al., 2017), could be attributed to the on-going ABA services that these individuals received.

Children who were enrolled in the BESST model can have continued input from BCBA's following intervention in the BESST model (see Appendix B). If behaviour analysts are part of the staff team, they can continue to provide support, at a lesser intensity, as children move throughout the school. The children who were part of the research conducted in chapter 3 had varying levels of input from the behaviour analyst once they graduated from the BESST model. For example, some children needed additional, but less intensive support, around educational targets and behaviour management; while others were ready learn in the generic SEN classrooms throughout the school with some support with behaviour management. Children who required further support with educational targets were placed in classrooms that utilised ABA based teaching curricula such as direct instruction and that focused heavily on developing language and self-help skills. IBP's are implemented across the day in these classes and the principles of ABA are applied to all activities. Resources in terms of behaviour analyst input and staffing ratios are higher than they are in the generic SEN classrooms but lower than in the BESST model classrooms. This is information is intended to descriptive; further research is needed to describe and evaluate what happens once children graduate from the BESST model.

Improving the education of all children in SEN settings.

If behaviour analysts are employed as a part of the staffing in a SEN schools, they can have a positive impact on the education of all children in SEN school. In this setting, the behaviour analyst worked with younger children who were enrolled in the BESST model and worked with older children by supporting staff to implemented a range of focused intervention practices aimed to increase skills and decrease problem behaviour (see Appendix

B). Furthermore, while the interventions described in Chapter 5 and 7 are implemented with children in BESST model, behaviour analysts working in SEN setting could support staff to implement interventions like these with older children. Again, further research is needed to demonstrate this.

Ongoing training and support for staff in SEN settings.

Teaching staff in SEN schools receive extensive training and supervision from behaviour analyst when ABA based interventions are implemented as standard practice. This includes training on ASD as well as interventions based on ABA; and leads to greater understanding of both (Grindle et al., 2012) amongst teaching staff who typically have little knowledge of ABA (Dillenburger et al., 2014) and very limited expertise in ASD (All Party Parliamentary Group on Autism, 2017). This is pertinent in classes where the BESST model is implemented, but relevant thought the school. Children who receive interventions based on ABA must supervised by a BCBA (BACB, 2014); and intensity and quality of supervision can impact child outcomes (Dixon et al., 2016; Hayward, Gale, Gitlesen and Eldevik, 2009). Weekly or bi-weekly supervision is recommended (Eikeseth, 2010) for children in comprehensive programmes. An important component of the BESST model is the supervision that was provided; each child in the BESST model had approximately one hour of supervision per week. As a result of this supervision, the teaching staff received ongoing bespoke training on updated individualised education plans or individualised behaviour plans for each child. This means that each staff member had detailed up to date knowledge on each child's progress and areas that needed development.

We saw that staff generalised skills from DTT to other activities in chapter 3. Therefore, it may be that staff across the school generalise the skills that they learn through training on specific individuals' programmes or through more generic training packages. When the principles of ABA are systematically implemented across the day, they can be used

to increase the effectiveness of other approaches, for example, the systematic use of reinforcement during speech and language sessions can help to increase the child's performance in these sessions. In theory, this applies to all activities; because if the principles of ABA are systematically applied across the day the benefits of their application can impact on all activities.

BCBA input is essential.

It is important to note again, that BCBA's must be involved in order for ABA to be implemented as it ought to be. The BCBA is at the centre of this model, which is one of the many components that helps to differentiate it from an eclectic model that incorporates ABA as an 'intervention'. BCBA's must adhere to an ethical code of conduct and specific guidelines when designing practices or research based on ABA (Baer, Wolf and Rilsey, 1968; 1987). Without this, it is not ABA. BCBA's working with individuals with ASD must also consider the 'Applied Behavior Analysis Treatment for Autism Spectrum Disorder' set out by the BACB. These guidelines specific four core characteristics and 11 practical elements of ABA related to working with children with ASD. All of the items emphasised are areas that BCBA's receive education and training on prior to sitting the BACB examination. BCBA's are integral in the delivery of interventions based on ABA in a SEN setting.

Conclusions

This thesis described the formulation and evaluation of a comprehensive educational model, BESST, that was implemented in a SEN setting; focused intervention practices that could be implemented in this setting were also evaluated. Outcome data demonstrates that these interventions can have a significant positive impact for many children. Additionally, it has further elucidated current practices and challenges related to the implementation of these interventions in maintained SEN schools in the UK. Further research has been suggested

across these areas, and the implications for improving educational practices have been outlined.

References

ABA4ALL. (2019). ABA in the UK. Retrieved from https://www.abaa4all.com/aba-in-the-uk;accessed13/12/19

All Party Parliamentary Group on Autism. (2017). *Autism and education in England.* Retrieved from file:///Users/psp83a/Downloads/APPGA-autism-and-education-report%20(2).pdf

Amendah, D., Grosse, S. D., Peacock, G., & Mandell, D. S. (2012). *The economic costs of autism: A review.* Oxford University Press. doi:10.1093/med/9780195371826.003.0088 Retrieved from https://oxfordmedicine.com/view/10.1093/med/9780195371826.001.0001/med-9780195371826-chapter-078

American Psychiatric Association. (2018). What is autism spectrum disorder. Retrieved from https://www.psychiatry.org/patients-families/autism/what-is-autism-spectrum-disorder

Anderson, C. M., Smith, T., & Wilczynski, S. M. (2018). Advances in school-based interventions for students with autism spectrum disorder: Introduction to the special issue. *Behavior Modification, 42*(1), 3-8. doi:10.1177/0145445517743582

Ardoin, S. P., Binder, K. S., Zawoyski, A. M., Foster, T. E., & Blevins, L. A. (2013). Using eye-tracking procedures to evaluate generalization effects: Practicing target words during repeated readings within versus across texts. *School Psychology Review, 42*(4), 477.

References

Ardoin, S. P., Williams, J. C., Klubnik, C., & McCall, M. (2009). Three versus six rereadings of practice passages. *Journal of Applied Behavior Analysis, 42*(2), 375. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19949527

Andzik, N. R., Cannella-Malone, H. I., & Sigafoos, J. (2016). Practitioner-implemented functional communication training. *Research and Practice for Persons with Severe Disabilities, 41*(2), 79-89. doi:10.1177/1540796916633874

Autism Speaks. (2019). *Health insurance coverage for autism*. Retrieved 11.01.20 from https://www.autismspeaks.org/health-insurance-coverage-autism

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis1. *Journal of Applied Behavior Analysis, 1*(1), 91-97. doi:10.1901/jaba.1968.1-91

Baer, D. M., Wolf, M. M., & Risley, T. R. (1987). Some still-current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 20*(4), 313. Retrieved from https://search.proquest.com/docview/1311941106

Beavers, G. A., Iwata, B. A., & Lerman, D. C. (2013). Thirty years of research on the functional analysis of problem behavior. *Journal of Applied Behavior Analysis, 46*(1), 1. doi:10.1002/jaba.30

Behavior Analyst Certification Board. (2019). Applied behavior analysis treatment of autism spectrum disorder: Practice guidelines for healthcare funders and managers. Retrieved from www.bacb.com/wpcontent/uploads/Clarifications_ASD_

Behaviour Analyst Certification Board. (2014). Applied behavior analysis treatment of autism spectrum disorder: Practice guidelines for healthcare funders and

managers. Retrieved from https://www.bacb.com/wp-content/uploads/2017/09/ABA_Guidelines_for_ASD.pdf

Behavior Analyst Certification Board. (n.d.). Experience standards. Retrieved February 2, 2014 from http://www.bacb.com/index.php?page=69.

Behavior Analyst Certification Board. (n.d.). Standards for Board Certified Behavior Analysts (BCBA). Retrieved March 5, 2014 from http://www.bacb.com/index.php?page=158

Ben-Itzchak, E., & Zachor, D. A. (2007). The effects of intellectual functioning and autism severity on outcome of early behavioral intervention for children with autism. *Research in Developmental Disabilities, 28*(3), 287-303. doi:10.1016/j.ridd.2006.03.002

Berg, W. K., Peck, S., Wacker, D. P., Harding, J., McComas, J., Richman, D., & Brown, K. (2000). The effects of presession exposure to attention on the results of assessments of attention as a reinforcer. *Journal of Applied Behavior Analysis, 33*(4), 463-477. doi:10.1901/jaba.2000.33-463

Betz, A. M., Fisher, W. (2011). Functional Analysis History and Methods. In Fisher, W.W., Piazza, C.C., & Roane, H. S., *Handbook of Applied Behavior Analysis* (pp. 206-225). New York, NY: The Guilford Press.

Bibby, P., Eikeseth, S., Martin, N. T., Mudford, O. C., & Reeves, D. (2002). Progress and outcomes for children with autism receiving parent-managed intensive interventions. *Research in Developmental Disabilities, 23*(1), 81-104. doi:10.1016/S0891-4222(02)00095-1

Blacklock, K., Perry, A., & Geier, J. D. (2014). Examining the effectiveness of intensive behavioural intervention in children with autism aged 6 and older. *Journal on*

Developmental Disabilities, 20(1), 37. Retrieved from https://search.proquest.com/docview/1529941980

Blood, E. (2007). From FBA to implementation: A look at what is actually being delivered. *Education & Treatment of Children, 30*(4), 67-81.

Bowman, L. G., Hardesty, S. L., & Mendres-Smith, A. E. (2013). A functional analysis of crying. *Journal of Applied Behavior Analysis, 46*(1), 317-321. doi:10.1002/jaba.4

Boyle, M. A., Ortman, M. E., Beckman, A. C., Aholt, S. L., & Keenan, G. L. (2018). Functional communication training and noncontingent reinforcement in treatment of stereotypy. *Behavioral Interventions, 33*(1), 79-86. doi:10.1002/bin.1514

Brett, D., Warnell, F., McConachie, H., & Parr, J. (2016). Factors affecting age at ASD diagnosis in UK: No evidence that diagnosis age has decreased between 2004 and 2014. *Journal of Autism and Developmental Disorders, 46*(6), 1974-1984. doi:10.1007/s10803-016-2716-6

Briggs, A. M., Fisher, W. W., Greer, B. D., & Kimball, R. T. (2018). Prevalence of resurgence of destructive behavior when thinning reinforcement schedules during functional communication training. *Journal of Applied Behavior Analysis, 51*(3), 620-633. doi:10.1002/jaba.472

Burscher, A. V. S., Cidav, Z., Knapp, M., & Mandell, D. S. (2014). Costs of autism spectrum disorders in the United Kingdom and the united states. *JAMA Pediatrics, 168*(8), 721-728. doi:10.1001/jamapediatrics.2014.210

Callahan, K., Shukla-Mehta, S., Magee, S., & Wie, M. (2010). ABA versus TEACCH: The case for defining and validating comprehensive treatment models in autism. *Journal of Autism and Developmental Disorders, 40*(1), 74-88. doi:10.1007/s10803-009-0834-0

References

Carbone, V. J., Morgenstern, B., Zecchin-Tirri, G., & Kolberg, L. (2010). The role of the reflexive-conditioned motivating operation (CMO-R) during discrete trial instruction of children with autism. *Focus on Autism and Other Developmental Disabilities, 25*(2), 110-124. doi:10.1177/1088357610364393

Carr, J. E., Austin, J. L., Britton, L. N., Kellum, K. K., & Bailey, J. S. (1999). An assessment of social validity trends in applied behavior analysis. *Behavioral Interventions, 14*(4), 223-231. doi:10.1002/(SICI)1099-078X(199910/12)14:4<223:AID-BIN37>3.0.CO;2-Y

Carr, E. G., Smith, C. E., Giacin, T. A., Whelan, B. M., & Pancari, J. (2003). Menstrual discomfort as a biological setting event for severe problem behavior: Assessment and intervention. *American Journal on Mental Retardation, 108*(2), 117-33.

Carroll, R. A., Kodak, T., & Fisher, W. W. (2013). An evaluation of programmed treatment-integrity errors during discrete-trial instruction. *Journal of Applied Behavior Analysis, 46*(2), 379-394. doi:10.1002/jaba.49

Centre for Disease Control. (2019). *What is autism spectrum disorder*. Retrieved from https://www.cdc.gov/ncbddd/autism/facts.html

Chaplin, J., Hastings, R.P. (2014). Improving the quality of behavioural support plans through service development initiatives. International Journal of Positive Behavioural Support, 4(2), 14-23. Retrieved from: https://www.ingentaconnect.com/content/bild/ijpbs/2014/00000004/00000002/art0000

Cicero, F. R., & Pfadt, A. (2002). Investigation of a reinforcement-based toilet training procedure for children with autism. *Research in Developmental Disabilities, 23*(5), 319-331. doi:10.1016/S0891-4222(02)00136-1

References

Cividini-Motta, C., & Ahearn, W. H. (2013). Effects of two variations of differential reinforcement on prompt dependency. *Journal of Applied Behavior Analysis, 46*(3), 640-650. doi:10.1002/jaba.67

Cohen, H., Amerine-Dickens, M., & Smith, T. (2006). Early intensive behavioral treatment: Replication of the UCLA model in a community setting. *Journal of Developmental and Behavioral Paediatrics, 27*(2), 145-155. doi:10.1097/00004703-200604002-00013

Committee on Science, Technology, and Law, Federal Judicial Center, National Research Council, Policy and Global Affairs, & Committee on the Development of the Third Edition of the Reference Manual on Scientific Evidence. (2011). *Reference manual on scientific evidence*. Washington, D.C: National Academies Press. doi:10.17226/13163 Retrieved from https://www.nap.edu/13163

Cook, B. G., & Odom, S. L. (2013). Evidence-based practices and implementation science in special education. *Exceptional Children, 79*(2), 135-144. doi:10.1177/001440291307900201

Cook, C. R., Crews, S. D., Wright, D. B., Mayer, G. R., Gale, B., Kraemer, B., & Gresham, F. M. (2007). Establishing and evaluating the substantive adequacy of positive behavioral support plans. *Journal of Behavioral Education, 16*(3), 191-206. doi:10.1007/s10864-006-9024-8

Cook, C. R., Mayer, G. R., Wright, D. B., Kraemer, B., Wallace, M. D., Dart, E., . . . Restori, A. (2012). Exploring the link among behavior intervention plans, treatment integrity, and student outcomes under natural educational conditions. *Journal of Special Education, 46*(1), 3-16. doi:10.1177/0022466910369941

References

Coon, J. T., & Miguel, C. F. (2012). The role of increased exposure to transfer-of- stimulus-control procedures on the acquisition of intraverbal behavior. *Journal of Applied Behavior Analysis, 45*(4), 657-666. doi:10.1901/jaba.2012.45-657

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied Behavior Analysis* (2nd ed.). Essex: Pearson Education Limited.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2020). *Applied Behavior Analysis* (3rd ed.). Essex: Pearson Education Limited.

Davis, D. H., Fredrick, L. D., Alberto, P. A., & Gama, R. (2012). Functional communication training without extinction using concurrent schedules of differing magnitudes of reinforcement in classrooms. *Journal of Positive Behavior Interventions, 14*(3), 162-172. doi:10.1177/1098300711429597

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., . . . Varley, J. (2010). Randomized, controlled trial of an intervention for toddlers with autism: The early start denver model. *Pediatrics, 125*(1), e17-e23. doi:10.1542/peds.2009-0958

Dietz, C., Swinkels, S.H., Buitelaar, J.K., van Daalen, E., & van Engeland, H. (2007). Stability and change of IQ scores in preschool children diagnosed with autistic spectrum disorder. European Child & Adolescent Psychiatry, 16, 405– 410. doi: 10.1007/s00787-007-0614-3

DiGennaro Reed, F. D., 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*(3), 611-615. doi:10.1901/jaba.2011.44-611

References

Dillenburger, K. (2011). The emperor's new clothes: Eclecticism in autism treatment. *Research in Autism Spectrum Disorders, 5*(3), 1119-1128. doi:10.1016/j.rasd.2010.12.008

Dillenburger, K., Röttgers, H., Dounavi, K., Sparkman, C., Keenan, M., Thyer, B., & Nikopoulos, C. (2014). Multidisciplinary teamwork in autism: Can one size fit all? *The Australian Educational and Developmental Psychologist, 31*(2), 97-112. doi:10.1017/edp.2014.13

Dingfelder, H., & Mandell, D. (2011). Bridging the research-to-practice gap in autism intervention: An application of diffusion of innovation theory. *Journal of Autism and Developmental Disorders, 41*(5), 597-609. doi:10.1007/s10803-010-1081-0

Dixon, D., Linstead, E., Granpeesheh, D., Novack, M., French, R., Stevens, E., . . . Powell, A. (2016). An evaluation of the impact of supervision intensity, supervisor qualifications, and caseload on outcomes in the treatment of autism spectrum disorder. *Behavior Analysis in Practice, 9*(4), 339-348. doi:10.1007/s40617-016-0132-1

Edrisinha, C., O'Reilly, M., Sigafoos, J., Lancioni, G., & Choi, H. Y. (2011). Influence of motivating operations and discriminative stimuli on challenging behavior maintained by positive reinforcement. *Research in Developmental Disabilities: A Multidisciplinary Journal, 32*(2), 836-845. doi:10.1016/j.ridd.2010.10.006

Eikeseth, S. (2009). Outcome of comprehensive psycho-educational interventions for young children with autism. *Research in Developmental Disabilities, 30*(1), 158-178. doi:10.1016/j.ridd.2008.02.003

References

Eikeseth, S. (2010). Examination of qualifications required of an EIBI professional. *European Journal of Behavior Analysis, 11*(2), 239-246. doi:10.1080/15021149.2010.11434348

Eikeseth, S., Hayward, D., Gale, C., Gitlesen, J., & Eldevik, S. (2009). Intensity of supervision and outcome for preschool aged children receiving early and intensive behavioral interventions: A preliminary study. *Research in Autism Spectrum Disorders, 3*(1), 67-73. doi:10.1016/j.rasd.2008.04.003

Eikeseth, S., Klintwall, L., Jahr, E., & Karlsson, P. (2012). Outcome for children with autism receiving early and intensive behavioral intervention in mainstream preschool and kindergarten settings. *Research in Autism Spectrum Disorders, 6*(2), 829-835. doi:10.1016/j.rasd.2011.09.002

Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2002). Intensive behavioral treatment at school for 4- to 7-year-old children with autism. *Behavior Modification, 26*(1), 49-68. doi:10.1177/0145445502026001004

Eldevik, S., Eikeseth, S., Jahr, E., & Smith, T. (2006). Effects of low- intensity behavioral treatment for children with autism and mental retardation. *Journal of Autism and Developmental Disorders, 36*(2), 211-224. doi:10.1007/s10803-005-0058-x

Eldevik, S., Eldevik, S., Hastings, R., Hastings, R., Jahr, E., Jahr, E., . . . Hughes, J. (2012). Outcomes of behavioral intervention for children with autism in mainstream pre-school settings. *Journal of Autism and Developmental Disorders, 42*(2), 210-220. doi:10.1007/s10803-011-1234-9

References

Eldevik, S., Jahr, E., Eikeseth, S., Hastings, R. P., & Hughes, J. C. (2010). Cognitive and adaptive behavior outcomes of behavioral intervention for young children with intellectual disability. *Behavior Modification,* **34**, 16-34.

Eldevik, S., Hastings, R. P., Hughes, J. C., Jahr, E., Eikeseth, S., & Cross, S. (2010). Using participant data to extend the evidence base for intensive behavioral intervention for children with autism. *American Journal on Intellectual and Developmental Disabilities, 115*(5), 381-405. doi:10.1352/1944-7558-115.5.381

Eldevik, S., Hastings, R. P., Hughes, J. C., Jahr, E., Eikeseth, S., & Cross, S. (2009). Meta-analysis of early intensive behavioral intervention for children with autism. *Journal of Clinical Child & Adolescent Psychology, 38*(3), 439-450. doi:10.1080/15374410902851739

Eldevik, S., Titlestad, K. B., Aarlie, H., & Tønnesen, R. (2019). Community implementation of early behavioral intervention: Higher intensity gives better outcome. *European Journal of Behavior Analysis,* 1-18. doi:10.1080/15021149.2019.1629781

Fennell, B., & Dillenburger, K. (2016). Applied behaviour analysis: What do teachers of students with autism spectrum disorder know. *International Journal of Educational Research,* 1-17. doi:10.1016/j.ijer.2016.06.012

Fentress, G. M., & Lerman, D. C. (2012). A comparison of two prompting procedures for teaching basic skills to children with autism. *Research in Autism Spectrum Disorders, 6*(3), 1083-1090. doi:10.1016/j.rasd.2012.02.006

Floyd, A. and Arthur, L. (2012) Researching from within: external and internal ethical engagement. International Journal of Research & Method in Education, 35 (2). pp. 171-

180. ISSN 1743-7288 doi: 10.1080/1743727X.2012.670481 Available at http://centaur.reading.ac.uk/26294/

Foran, D., Hoerger, M., Philpott, H., Jones, E. W., Hughes, J. C., & Morgan, J. (2015). Using applied behaviour analysis as standard practice in a UK special needs school. *British Journal of Special Education, 42*(1), 34-52. doi:10.1111/1467-8578.12088

Fritz, J. N., Jackson, L. M., Stiefler, N. A., Wimberly, B. S., & Richardson, A. R. (2017). Noncontingent reinforcement without extinction plus differential reinforcement of alternative behavior during treatment of problem behavior. *Journal of Applied Behavior Analysis, 50*(3), 590-599. doi:10.1002/jaba.395

Fryling, M. J., Wallace, M. D., & Yassine, J. N. (2012). Impact of treatment integrity on intervention effectiveness. *Journal of Applied Behavior Analysis, 45*(2), 449-453. doi:10.1901/jaba.2012.45-449

Gast, D. L. (2011). An experimental approach for selecting a response-prompting strategy for children with developmental disabilities. *Evidence-Based Communication Assessment and Intervention, 5*(3), 149-155. doi:10.1080/17489539.2011.637358

Gast, D. L., & Ledford, J. R. (2018). Withdrawal and Reversal Designs. In Ledford, J. R. , & Gast., D. L. Single Case Research Methodology Applications in Special Education and Behavioral Sciences (pp. 77-96). NY: Routledge.

Gast, D. L., Ledford, J. R., Severini, K. E. (2018). Withdrawal and Reversal Designs. In Ledford, J. R. , & Gast., D. L. Single Case Research Methodology Applications in Special Education and Behavioral Sciences (pp. 215-238). NY: Routledge.

Granpeesheh, D., Dixon, D. R., Tarbox, J., Kaplan, A. M., & Wilke, A. E. (2009). The effects of age and treatment intensity on behavioral intervention outcomes for children with

autism spectrum disorders. *Research in Autism Spectrum Disorders, 3*(4), 1014-1022. doi:10.1016/j.rasd.2009.06.007

Green, G., Brennan, L. C., & Fein, D. (2002). Intensive behavioral treatment for a toddler at high risk for autism. *Behavior Modification, 26*(1), 69-102. doi:10.1177/0145445502026001005

Griffith, G., Fletcher, R., & Hastings, R.P. (2012). A national UK census of Applied Behavior Analysis school provision for children with autism. *Research in Autism Spectrum Disorder, 6*, 798-805. doi: 10.1016/j.rasd.2011.10.014

Grindle, C. F., Hastings, R. P., Saville, M., Hughes, J. C., Huxley, K., Kovshoff, H., . . . Remington, B. (2012). Outcomes of a behavioral education model for children with autism in a mainstream school setting.*Behavior Modification, 36*(3), 298-319. doi:10.1177/0145445512441199

Grow, L., & LeBlanc, L. (2013). Teaching receptive language skills: Recommendations for instructors. *Behavior Analysis in Practice, 6*(1), 56-75. doi:10.1007/BF03391791

Hagopian, L. P., Fisher, W. W., Sullivan, M. T., Acquisto, J., & LeBlanc, L. A. (1998). Effectiveness of functional communication training with and without extinction and punishment: A summary of 21 inpatient cases. *Journal of Applied Behavior Analysis, 31*(2), 211-235. doi:10.1901/jaba.1998.31-211

Hagopian, L. P., Rooker, G. W., Jessel, J., & DeLeon, I. G. (2013). Initial functional analysis outcomes and modifications in pursuit of differentiation: A summary of 176 inpatient cases. *Journal of Applied Behavior Analysis, 46*(1), 88. doi:10.1002/jaba.25

References

Hagopian, L.P., Wilson, D.M., & Wilder, D.A. (2001). Assessment and treatment of behavior maintained by escape from attention and access to tangible items. *Journal of Applied Behavior Analysis, 34.* 229-232. doi: 10.1901/jaba.2001.34-229

Hanley, G. P., Iwata, B. A., & Thompson, R. H. (2001). Reinforcement schedule thinning following treatment with functional communication training. *Journal of Applied Behavior Analysis, 34*(1), 17-38. doi:10.1901/jaba.2001.34-17

Hanley, G. P., Piazza, C. C., Fisher, W. W., & Maglieri, K. A. (2005). On the effectiveness of and preference for punishment and extinction components of function-based interventions. *Journal of Applied Behavior Analysis, 38*(1), 51-65. doi:10.1901/jaba.2005.6-04

Hardan, A. Y., Gengoux, G. W., Berquist, K. L., Libove, R. A., Ardel, C. M., Phillips, J., . . . Minjarez, M. B. (2015). A randomized controlled trial of pivotal response treatment group for parents of children with autism. *Journal of Child Psychology and Psychiatry, 56*(8), 884-892. doi:10.1111/jcpp.12354

Hastings, R., & Johnson, E. (2001). Stress in UK families conducting intensive home-based behavioral intervention for their young child with autism. *Journal of Autism and Developmental Disorders, 31*(3), 327-336. doi:10.1023/A:1010799320795

Hayward, D. W., Gale, C. M., & Eikeseth, S. (2009). Intensive behavioural intervention for young children with autism: A research-based service model. *Research in Autism Spectrum Disorders, 3*(3), 571-580. doi:10.1016/j.rasd.2008.12.002

Hayward, D., Eikeseth, S., Gale, C., & Morgan, S. (2009). Assessing progress during treatment for young children with autism receiving intensive behavioural interventions. *Autism, 13*(6), 613-633. doi:10.1177/1362361309340029

References

Healy, O., & Lydon, S. (2013). *Early Intensive Behavioural Intervention in Autism Spectrum Disorders, Recent Advances in Autism Spectrum Disorders* (Volume I). Prof. Michael Fitzgerald (Ed.). ISBN: 978-953-51-1021-7, InTech, DOI: 10.5772/54274. Retrieved July 26, 2014 from: https://www.intechopen.com/books/recent-advances-in-autism-spectrum-disorders-volume-i/early-intensive-behavioural-intervention-in-autism-spectrum-disorders

Heward, W. L. (2003). Ten faulty notions about teaching and learning that hinder the effectiveness of special education. *The Journal of Special Education, 36*(4), 186-205. doi:10.1177/002246690303600401

Horner, R. H., Todd, A. W., Lewis-Palmer, T., Irvin, L. K., Sugai, G., & Boland, J. B. (2004). The school-wide evaluation tool (SET): A research instrument for assessing school-wide positive behavior support. *Journal of Positive Behavior Interventions, 6*(1), 3-12. doi:10.1177/10983007040060010201

Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A comparison of intensive behavior analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities, 26*(4), 359-383. doi:10.1016/j.ridd.2004.09.005

Howard, J. S., Stanislaw, H., Green, G., Sparkman, C. R., & Cohen, H. G. (2014). Comparison of behavior analytic and eclectic early interventions for young children with autism after three years. *Research in Developmental Disabilities, 35*(12), 3326-3344. doi:10.1016/j.ridd.2014.08.021

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1982). Toward a functional analysis of self-injury. *Analysis and Intervention in Developmental Disablities, 2*(1), 3-20. doi:10.1016/0270-4684(82)90003-9

References

Iwata, B.A., Dorsey, M.F., Slifer, K.J., Bauman, K., E. & Richmand, G.S. (1994). Towards a functional analysis of self-injury. *Journal of Applied Behavior Analyis, 27,* 197-209. (Reprinted from *Analysis and Interventions in Developmental Disabilities, 2,* 3-20*,* 1982)

Kasari, C., & Smith, T. (2013). Interventions in schools for children with autism spectrum disorder: Methods and recommendations. *Autism, 17*(3), 254-267. doi:10.1177/1362361312470496

Keenan, M., Dillenburger, K. (2001). When all you have is a hammer …: RCTs and hegemony in science author links open overlay panel. *Research in Autism Spectrum Disorders, 5*(1), 1-13. doi:https://doi.org/10.1016/j.rasd.2010.02.003

Keenan, M., Keenan, M., Dillenburger, K., Dillenburger, K., Röttgers, H., Röttgers, H., . . . Martin, N. (2015). Autism and ABA: The gulf between North America and Europe. *Review Journal of Autism and Developmental Disorders, 2*(2), 167-183. doi:10.1007/s40489-014-0045-2

Kelley, M. E., Lerman, D. C., & Van Camp, C. M. (2002). The effects of competing reinforcement schedules on the acquisition of functional communication. *Journal of Applied Behavior Analysis, 35*(1), 59-63. doi:10.1901/jaba.2002.35-59

Kendall, T., Megnin-Viggars, O., Gould, N., Taylor, C., Burt, L. R., & Baird, G. (2013). Management of autism in children and young people: Summary of NICE and SCIE guidance. *BMJ : British Medical Journal, 347*(aug28 2), f4865. doi:10.1136/bmj.f4865

Klintwall, L., Eldevik, S., & Eikeseth, S. (2015). Narrowing the gap: Effects of intervention on developmental trajectories in autism. *Autism, 19*(1), 53-63. doi:10.1177/1362361313510067

References

Kodak, T., Campbell, V., Bergmann, S., LeBlanc, B., Kurtz-Nelson, E., Cariveau, T., . . . Mahon, J. (2016). Examination of efficacious, efficient, and socially valid error-correction procedures to teach sight words and prepositions to children with autism spectrum disorder. *Journal of Applied Behavior Analysis, 49*(3), 532-547. doi:10.1002/jaba.310

Kodak, T. & Grow, L. L. (2011). Behavioral Treatment of Autism. In Fisher, W.W., Piazza, C.C., & Roane, H. S., *Handbook of Applied Behavior Analysis* (pp. 402-416). New York, NY: The Guilford Press.

Kodak, T., Northup, J., & Kelley, M. E. (2007). An evaluation of the types of attention that maintain problem behavior. *Journal of Applied Behavior Analysis, 40*(1), 167-171. doi:10.1901/jaba.2007.43-06

Koegel, R. L., & Koegel, L. K. (2019). *Pivotal response treatment for autism spectrum disorders* (2nd ed.). Baltimore, MD: Paul H. Brookes Publishing Co.

Koegel, R. L., O'Dell, M. C., & Koegel, L. K. (1987). A natural language teaching paradigm for nonverbal autistic children. *Journal of Autism and Developmental Disorders,17,* 187–200. doi.org/10.1007/bf01495055

Kovshoff, H., Hastings, R. P., & Remington, B. (2011). Two-year outcomes for children with autism after the cessation of early intensive behavioral intervention. *Behavior Modification, 35*(5), 427-450. doi:10.1177/0145445511405513

Kruger, A. M., Strong, W., Daly, E. J., O'Connor, M., Sommerhalder, M. S., Holtz, J., . . . Heifner, A. (2016). Setting the stage for academic success through antecedent intervention. *Psychology in the Schools, 53*(1), 24-38. doi:10.1002/pits.21886

References

Kurtz, P. F., Boelter, E. W., Jarmolowicz, D. P., Chin, M. D., & Hagopian, L. P. (2011). An analysis of functional communication training as an empirically supported treatment for problem behavior displayed by individuals with intellectual disabilities. *Research in Developmental Disabilities, 32*(6), 2935-2942. doi:10.1016/j.ridd.2011.05.009

Lalli, J. S., Casey, S. D., & Kates, K. (1997). Noncontingent reinforcement as treatment for severe problem behavior: Some procedural variations. *Journal of Applied Behavior Analysis, 30*(1), 127-137. doi:10.1901/jaba.1997.30-127

Lambert-Lee, K. A., Jones, R., O'Sullivan, J., Hastings, R. P., Douglas-Cobane, E., Thomas J, E., . . . Griffith, G. (2015). Translating evidence-based practice into a comprehensive educational model within an autism-specific special school. *British Journal of Special Education, 42*(1), 69-86. doi:10.1111/1467-8578.12090

Lambert, J. M., Bloom, S. E., & Irvin, J. (2012). Trial-based functional analysis and functional communication training in an early childhood setting. *Journal of Applied Behavior Analysis, 45*(3), 579-584. doi:10.1901/jaba.2012.45-579

Långh, U., Cauvet, E., Hammar, M., & Bölte, S. (2017). Cross-cultural validation of the york measure of quality of intensive behavioral intervention. *Behavior Modification, 41*(6), 808-828. doi:10.1177/0145445517719397

Langthorne, P., McGill, P., & Oliver, C. (2014). The motivating operation and negatively reinforced problem behavior. *Behavior Modification, 38*(1), 107-159. doi:10.1177/0145445513509649

Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis, 36*(3), 407-414. doi:10.1901/jaba.2003.36-407

References

Laraway, S., Snycerski, S., Olson, R., Becker, B., & Poling, A. (2014). The motivating operations concept: Current status and critical response. *The Psychological Record, 64*(3), 601-623. doi:10.1007/s40732-014-0080-5

Lazaratou, H., MD, Economou, M., MD, & Dikeos, D., MD. (2016). The necessity of early intervention in autism. *Journal of Pediatrics, The, 184*, 240-241. doi:10.1016/j.jpeds.2016.12.030

Leaf, J. B. (2011). An experimental approach for selecting a response-prompting strategy for children with developmental disabilities: A reply to gast. *Evidence-Based Communication Assessment and Intervention, 5*(4), 226-233. doi:10.1080/17489539.2012.674808

Leaf, J. B., Cihon, J. H., Townley-Cochran, D., Miller, K., Leaf, R., Mceachin, J., & Taubman, M. (2016). An evaluation of positional prompts for teaching receptive identification to individuals diagnosed with autism spectrum disorder. *Behavior Analysis in Practice, 9*(4), 349.

Leaf, J. B., Leaf, J. A., Alcalay, A., Dale, S., Kassardjian, A., Tsuji, K., . . . McEachin, J. (2014). Comparison of most-to-least to error correction to teach tacting to two children diagnosed with autism. *Evidence-Based Communication Assessment and Intervention,* , 1-10. doi:10.1080/17489539.2014.884988

Leaf, J., Leaf, J., Leaf, R., Leaf, R., McEachin, J., McEachin, J., . . . Weiss, M. (2016). Applied behavior analysis is a science and, therefore, progressive. *Journal of Autism and Developmental Disorders, 46*(2), 720-731. doi:10.1007/s10803-015-2591-6

Leaf, R., & McEachin, J., (1999). *A Work In Progress: Behavior Management Strategies and a Curriculum for Intensive Behavioral Treatment of Autism*, New York: DRL Books

References

Leaf, J.B., Misty, L., Oppenheim-Leaf, Dotson, W. H., Johnson, V. A., Courtemanche. B., Sheldon, J. B., & Sherman, J. A. (2011). Effects of no-no prompting on teaching expressive labeling of facial expressions to children with and without a pervasive developmental disorder. *Education and Training in Autism and Developmental Disabilities, 46*(2), 186-203. Retrieved from http://www.jstor.org/stable/23879690

Leaf, J. B., Sheldon, J. B., & Sherman, J. A. (2010). Comparison of simultaneous prompting and no-no prompting in two-choice discrimination learning with children with autism. *Journal of Applied Behavior Analysis, 43*(2), 215-228.

Leaf, J., Leaf, J., Leaf, R., Leaf, R., McEachin, J., McEachin, J., . . . Weiss, M. (2016). Applied behavior analysis is a science and, therefore, progressive. *Journal of Autism and Developmental Disorders, 46*(2), 720-731. doi:10.1007/s10803-015-2591-6

Leaf, J., Leaf, R., McEachin, J., Taubman, M., Ala'i-Rosales, S., Ross, R., . . . Weiss, M. (2016). Applied behavior analysis is a science and, therefore, progressive. *Journal of Autism and Developmental Disorders, 46*(2), 720-731. doi:10.1007/s10803-015-2591-6

Ledford, J. R., Barton, E. E., Severini, K. E., Zimmerman, K. N. (2019). A primer on single-case research designs: Contemporary use and analysis. American Journal on Intellectual and Developmental Disabilities, 124, 35-56. doi:10.1352/1944-7558-124.1.35

Linstead, E., Dixon, D. R., French, R., Granpeesheh, D., Adams, H., German, R., . . . Kornack, J. (2017). Intensity and learning outcomes in the treatment of children with autism spectrum disorder. *Behavior Modification, 41*(2), 229-252. doi:10.1177/0145445516667059

Loman, S. L., & Horner, R. H. (2014). *Examining the efficacy of a basic functional behavioral assessment training package for school personnel*. Austin, Tex. : doi:10.1177/1098300712470724

References

Lord, C., Wagner, A., Rogers, S., Szatmari, P., Aman, M., Charman, T., . . . Yoder, P. (2005). Challenges in evaluating psychosocial interventions for autistic spectrum disorders. *Journal of Autism and Developmental Disorders, 35*(6), 695-708. doi:10.1007/s10803-005-0017-6

Lotfizadeh, A. D., Kazemi, E., Pompa-Craven, P., & Eldevik, S. (2020). Moderate effects of low-intensity behavioral intervention. *Behavior Modification, 44*(1), 92-113. doi:10.1177/0145445518796204

Lovaas, I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*(1), 3-9. Retrieved from https://search.proquest.com/docview/77496822

Mace, F. C., & Nevin, J. A. (2017). Maintenance, generalization, and treatment relapse: A behavioral momentum analysis. *Education and Treatment of Children, 40*(1), 27-42. doi:10.1353/etc.2017.0001

MacNaul, H. L., & Neely, L. C. (2018). Systematic review of differential reinforcement of alternative behavior without extinction for individuals with autism. *Behavior Modification, 42*(3), 398-421. doi:10.1177/0145445517740321

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. doi:10.1111/j.1469-7610.2007.01756.x

Makrygianni, M. K., Gena, A., Katoudi, S., & Galanis, P. (2018). The effectiveness of applied behavior analytic interventions for children with autism spectrum disorder: A

meta-analytic study. *Research in Autism Spectrum Disorders, 51*, 18-31. doi:10.1016/j.rasd.2018.03.006

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*(4), 577-593. doi:10.1016/j.rasd.2010.01.014

Markham, V., Giles, A., & May, R. (2020) A systematic evaluation of prompt fading methods during conditional discrimination training, *European Journal of Behavior Analysis*, doi: 10.1080/15021149.2020.1719335

Marwick, H., Dunlop, A. W., Mackay, T. (2005). *National centre for autism studies literature review of autism for HM inspectorate of education.* Glasgow: National Centre for Autism Studies. Retrieved from https://www.scie-socialcareonline.org.uk/national-centre-for-autism-studies-literature-review-of-autism-for-hm-inspectorate-of-education/r/a11G00000017w5DIAQ

Matson, J. L., Taras, M. E., Sevin, J. A., Love, S. R., & Fridley, D. (1990). Teaching self-help skills to autistic and mentally retarded children. *Research in Developmental Disabilities, 11*(4), 361-378. doi:10.1016/0891-4222(90)90023-2

Matson, J. L., & Williams, L. W. (2015). The curious selection process of treatments for autism spectrum disorders. *Research in Autism Spectrum Disorders, 9*, 21-25. doi:10.1016/j.rasd.2014.10.004

Maurice, C. (2008). *Behavioral intervention for young children with autism* (Reprint ed.). Austin, Tex: Pro-Ed.

References

McComas, J. J., Thompson, A., & Johnson, L. (2003). The effects of presession attention on problem behavior maintained by different reinforcers. *Journal of Applied Behavior Analysis, 36*(3), 297-307. doi:10.1901/jaba.2003.36-297

McGarrell, M., Healy, O., Leader, G., O'Connor, J., & Kenny, N. (2009). Six reports of children with autism spectrum disorder following intensive behavioral intervention using the preschool inventory of repertoires for kindergarten (PIRK ®). *Research in Autism Spectrum Disorders, 3*(3), 767-782. doi:10.1016/j.rasd.2009.02.006

McGhan, A. C., & Lerman, D. C. (2013). An assessment of error-correction procedures for learners with autism. *Journal of Applied Behavior Analysis, 46*(3), 626-639. doi:10.1002/jaba.65

McIntosh, K., Mercer, S., Hume, A., Frank, J., Turri, M., & Mathews, S. (2013). Factors related to sustained implementation of schoolwide positive behavior support. *Exceptional Children, 79*(3), 293-311.

McMahon, J., & Cullinan, V. (2016). Exploring eclecticism: The impact of educational theory on the development and implementation of comprehensive education programmes (CEP's) for young children with autism spectrum disorder (ASD). *Research in Autism Spectrum Disorders, 32*, 1-12. doi:10.1016/j.rasd.2016.07.005

McPhilemey, C. & Dillenburger, K. (2013). Parents' experiences of applied behaviour analysis (ABA)-based interventions for children diagnosed with autistic spectrum disorder. *British Journal of Special Education, 4,* 154-161. doi: 10.1111/1467-8578.12038

McVilly, K., Webber, L., Paris, M., & Sharp, G. (2013). Reliability and utility of the behaviour support plan quality evaluation tool (BSP- QEII) for auditing and quality development in services for adults with intellectual disability and challenging

behaviour. *Journal of Intellectual Disability Research, 57*(8), 716-727. doi:10.1111/j.1365-2788.2012.01603.x

Morris, J., & Maynard, V. (2009). The feasibility of introducing an evidence based practice cycle into a clinical area: An evaluation of process and outcome. *Nurse Education in Practice, 9*(3), 190-198. doi:10.1016/j.nepr.2008.06.002

Naber, F., Swinkels, S. H. N., Buitelaar, J. K., Bakermans-Kranenburg, M. J., IJzendoorn, M. H. v., Dietz, C., . . . Engeland, H. M. v. (2007). Attachment in toddlers with autism and other developmental disorders. *Journal of Autism and Developmental Disorders, 37*(6), 1123-1138. doi:10.1007/s10803-006-0255-2

National Institute for Health and Care Excellence (2011). Autism diagnosis in children and young people. Retrieved February 17, 2014 from: http://www.nice.org.uk/nicemedia/live/13572/56428/56428.pdf

Newcomer, L. L., Freeman, R., & Barrett, S. (2013). Essential systems for sustainable implementation of tier 2 supports. *Journal of Applied School Psychology, 29*(2), 126-147. doi:10.1080/15377903.2013.778770

North-Bates, C. (2016). Applied behaviour analysis requests under freedom of information requests. Retrieved from https://www.whatdotheyknow.com/user/cameron_north_bates?page=2

O'Connor, A. B., & Healy, O. (2010). Long-term post-intensive behavioral intervention outcomes for five children with autism spectrum disorder. *Research in Autism Spectrum Disorders, 4*(4), 594-604. doi:10.1016/j.rasd.2009.12.002

O'Callaghan, P. M., Allen, K. D., Powell, S., & Salama, F. (2006). The efficacy of noncontingent escape for decreasing children's disruptive behavior during restorative

dental treatment. *Journal of Applied Behavior Analysis, 39*(2), 161-171. doi:10.1901/jaba.2006.79-05

Odom, S. L., Collet-Klingenberg, L., Rogers, S. J., & Hatton, D. D. (2010). Evidence-based practices in interventions for children and youth with autism spectrum disorders. *Preventing School Failure: Alternative Education for Children and Youth, 54*(4), 275-282. doi:10.1080/10459881003785506

O'Neill, S. (2016). Preparing preservice teachers for inclusive classrooms: Does completing coursework on managing challenging behaviours increase their classroom management sense of efficacy? *The Australasian Journal of Special Education, 40*(2), 117-140. doi:10.1017/jse.2015.10

O'Reilly, M. F. (1999). Effects of presession attention on the frequency of attention-maintained behavior.*Journal of Applied Behavior Analysis, 32*(3), 371-374. doi:10.1901/jaba.1999.32-371

O'Reilly, M. F., Edrisinha, C., Sigafoos, J., Lancioni, G., & Andrews, A. (2006). Isolating the evocative and abative effects of an establishing operation on challenging behavior. *Behavioral Interventions, 21*(3), 195-204. doi:10.1002/bin.215

O'Reilly, M., Edrisinha, C., Sigafoos, J., Lancioni, G., Cannella, H., Machalicek, W., & Langthorne, P. (2007). Manipulating the evocative and abative effects of an establishing operation: Influences on challenging behavior during classroom instruction. *Behavioral Interventions, 22*(2), 137-145. doi:10.1002/bin.226

Parsons, S., Guldberg, K., MacLeod, A., Jones, G., & Prunty., A. & Balfe, T. (2009). *International review of the literature of evidence of best practice provision in the education of persons with autistic spectrum disorders.* Co. Meath: The National Council

for Special Education. Retrieved from https://www.birmingham.ac.uk/Documents/college-social-sciences/education/acer/ncse-report.pdf

Parsons, S., Charman, T., Faulkner, R., Ragan, J., Wallace, S., & Wittemeyer, K. (2013). Commentary – bridging the research and practice gap in autism: The importance of creating research partnerships with schools. *Autism, 17*(3), 268-280. doi:10.1177/1362361312472068

Partington, J., W. (2006). *Assessment of basic language and learning skills-revised (ABLLS-R)*. Pleasant Hill, CA: Behavior Analysts, Inc.

Perry, A., & Condillac, R. (2003). *Evidence-based practices for children and adolescents with autism spectrum disorders: Review of the literature and practice guide*. Ontario, Canada: Children's Mental Health Ontario.

Perry, A., Koudys, J., Prichard, A., & Ho, H. (2017). Follow-up study of youth who received EIBI as young children. Behavior Modification, 43, 181-201. doi:10.1177/0145445517746916

Peters-Scheffer, N., Didden, R., Mulders, M., & Korzilius, H. (2010). Low intensity behavioral treatment supplementing preschool services for young children with autism spectrum disorders and severe to mild intellectual disability. *Research in Developmental Disabilities, 31*(6), 1678-1684. doi:10.1016/j.ridd.2010.04.008

Peters-Scheffer, N., Didden, R., Mulders, M., & Korzilius, H. (2013). Effectiveness of low intensity behavioral treatment for children with autism spectrum disorder and intellectual disability. *Research in Autism Spectrum Disorders, 7*(9), 1012-1025. doi:10.1016/j.rasd.2013.05.001

References

Pettersson, L., Olsson, I., & Ala'i-Rosales, S. (2016). Bridging the research to practice gap: A case study approach to understanding EIBI supports and barriers in swedish preschools. *International Electronic Journal of Elementary Education, 9*(2), 317-336. Retrieved from https://search.proquest.com/docview/1967314043

Phillips, C. L., Iannaccone, J. A., Rooker, G. W., & Hagopian, L. P. (2017). Noncontingent reinforcement for the treatment of severe problem behavior: An analysis of 27 consecutive applications. *Journal of Applied Behavior Analysis, 50*(2), 357-376. doi:10.1002/jaba.376

Phillips, L., Wilson, L., & Wilson, E. (2010). Assessing behaviour support plans for people with intellectual disability before and after the victorian disability act 2006. *Journal of Intellectual and Developmental Disability, 2010, 35; Vol.35*(1; 1), 9; 9-13; 13. doi:10.3109/13668250903499090

Pitts, L., Gent, S., & Hoerger, M. L. (2019). Reducing pupils' barriers to learning in a special needs school: Integrating applied behaviour analysis into key stages 1–3. *British Journal of Special Education, 46*(1), 94-112. doi:10.1111/1467-8578.12251

Pritchard, D., Hoerger, M., Dyer, T., Graham, N., Penney, H., and Mace, F.C. (2013). Sodium valproate withdrawal correlates with reduced aggression. *British Journal of Learning Disabilities, 42,* 62-167. doi:10.1111/bld.12019

Pritchard, D., Hoerger, M., & Mace, F. C. (2014). Treatment relapse and behavioral momentum theory. *Journal of Applied Behavior Analysis, 47*(4), 814-833. doi:10.1002/jaba.163

Reichow, B. (2011). Overview of meta-analyses on early intensive behavioral intervention for young children with autism spectrum disorders. *Journal of Autism and Developmental Disorders. 42,* 512-520

doi:101007/s10803-011-1218-9

Reichow, B., Barton, E. E., Boyd, B. A., & Hume, K. (2012). Early intensive behavioral intervention (EIBI) for young children with autism spectrum disorders (ASD). *The Cochrane Database of Systematic Reviews, 10*, CD009260. doi:10.1002/14651858.CD009260.pub2

Reichow, B., Hume, K., Barton, E. E., & Boyd, B. A. (2018). Early intensive behavioral intervention (EIBI) for young children with autism spectrum disorders (ASD). *The Cochrane Database of Systematic Reviews, 5*(5), CD009260. doi:10.1002/14651858.CD009260.pub3

Reichow, B., & Wolery, M. (2009). Comprehensive synthesis of early intensive behavioral interventions for young children with autism based on the UCLA Young Autism Project model. *Journal of Autism and Developmental Disorders, 39*, 23–41. doi: 10.1007/s10803-008-0596-0

Remington, B., Hastings, R. P., Kovshoff, H., degli Espinosa, F., Jahr, E., Brown, T., . . . Ward, N. (2007). Early intensive behavioral intervention: Outcomes for children with autism and their parents after two years. *American Journal of Mental Retardation: AJMR, 112*(6), 418. doi:10.1352/0895-8017(2007)112[418:EIBIOF]2.0.CO;2–Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/17963434

Richman, D. M., Barnard-Brak, L., Grubb, L., Bosch, A., & Abby, L. (2015). Meta-analysis of noncontingent reinforcement effects on problem behavior. *Journal of Applied Behavior Analysis, 48*(1), 131-152. doi:10.1002/jaba.189

Richman, D. M., & Hagopian, L. P. (1999). On the effects of "quality" of attention in the functional analysis of destructive behavior. *Research in Developmental Disabilities, 20*(1), 51-62. doi:10.1016/S0891-4222(98)00031-6

References

Rispoli, M., Neely, L., Healy, O., & Gregori, E. (2016). Training public school special educators to implement two functional analysis models. *Journal of Behavioral Education, 25*(3), 249-274. doi:10.1007/s10864-016-9247-2

Ritter, W., Barnard-Brak, L., Richman, D., & Grubb, L. (2018). The influence of function, topography, and setting on noncontingent reinforcement effect sizes for reduction in problem behavior: A meta-analysis of single-case experimental design data. *Journal of Behavioral Education, 27*(1), 1-22. doi:10.1007/s10864-017-9277-4

Rivard, M., Morin, M., Mello, C., Terroux, A., & Mercier, C. (2018). Follow-up of children with autism spectrum disorder 1 year after early behavioral intervention. *Behavior Modification, 43*(4), 490-517. doi:10.1177/0145445518773692

Roane, H. S., Fisher, W. W., & Sgro, G. M. (2001). Effects of a fixed-time schedule on aberrant and adaptive behavior. *Journal of Applied Behavior Analysis, 34*(3), 333.

Roane, H. S., Fisher, W. W., & Carr, J. E. (2016). Applied behavior analysis as treatment for autism spectrum disorder. *The Journal of Pediatrics, 175*, 27-32. doi:10.1016/j.jpeds.2016.04.023

Roantree, C. F., & Kennedy, C. H. (2006). A paradoxical effect of presession attention on stereotypy: Antecedent attention as an establishing, not an abolishing, operation. *Journal of Applied Behavior Analysis, 39*(3), 381-384. doi:10.1901/jaba.2006.97-05

Rodriguez, B. J. (2013). *Test review for preschool-wide evaluation tool (PreSET) manual: Assessing universal program-wide positive behavior support in early childhood* doi:10.1177/0734282912462671

Rogers, S. J., Dawson, G. (2009). *Early Start Denver Model for Young Children with Autism: Promoting Language, Learning, and Engagement*. New York: The Guildford Press.

References

Rogers, S. J., & Dawson, G. (2010). *Early start denver model for young children with autism*. New York: Guilford Press. Retrieved from http://bvbr.bib-bvb.de:8991/F?func=service&doc_library=BVB01&local_base=BVB01&doc_number=027175148&sequence=000001&line_number=0001&func_code=DB_RECORDS&service_type=MEDIA

Rosenthal, T. L. (1983). Outcome research: Isn't sauce for the goose sauce for the gander? *Behavioral and Brain Sciences; Behav Brain Sci, 6*(2), 299-300. doi:10.1017/S0140525X00016046

Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal of Mental Retardation: AJMR, 110*(6), 417. doi:10.1352/0895-8017(2005)110[417:IBTFCW]2.0.CO;2

Schlichenmeyer, K. J., Roscoe, E. M., Rooker, G. W., Wheeler, E. E., & Dube, W. V. (2013). Idiosyncratic variables that affect functional analysis outcomes: A review (2001–2010. *Journal of Applied Behavior Analysis, 46*(1), 339-348. doi:10.1002/jaba.12

Schoen, A. A. (2003). What potential does the applied behavior analysis approach have for the treatment of children and youth with autism? *Journal of Instructional Psychology, 30*(2), 125. Retrieved from https://search.proquest.com/docview/1416363684

Schopler, E., & Van Bourgondien, M.E, Wellmand, G. J., & Love, S.R. (2010). *Childhood autism rating scales (2nd ed)* . Los Angeles, CA: Western Psychological Services. doi:101177/0734282911400873

Scott, T. M., Liaupsin, C., Nelson, C. M., & McIntyre, J. (2005). Team- based functional behavior assessment as a proactive public school process: A descriptive analysis of

current barriers. *Journal of Behavioral Education, 14*(1), 57-71. doi:10.1007/s10864-005-0961-4

Shafer, E. (1999). A review of sundberg and partington's teaching language to children with autism or other developmental disabilities. *The Analysis of Verbal Behavior, 16*(1), 45-48. doi:10.1007/BF03392946

Shook, G.L. & Johnston, J. M. (2011). Training and Professional Certification in Applied Behaviour Analysis. In Fisher, W.W., Piazza, C.C., & Roane, H. S., *Handbook of Applied Behavior Analysis* (pp. 498 - 510). New York, NY: The Guilford Press.

Skinner, B. F. (1938). *The Behavior of Organisms*. New York: Appleton-Century-Crofts

Slocum, T., Detrich, R., Wilczynski, S., Spencer, T., Lewis, T., & Wolfe, K. (2014). The evidence-based practice of applied behavior analysis. *The Behavior Analyst, 37*(1), 41-56. doi:10.1007/s40614-014-0005-2

Smith, D. P., Hayward, D. W., Gale, C. M., Eikeseth, S., & Klintwall, L. (2019). Treatment gains from early and intensive behavioral intervention (EIBI) are maintained 10 years later. *Behavior Modification.* doi:10.1177/0145445519882895

Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal of Mental Retardation :AJMR, 105*(4), 269. doi:10.1352/0895-8017(2000)105<0269:RTOIEI>2.0.CO;2

Smith, T. (2001). Discrete trial training in the treatment of autism. *Focus on Autism and Other Developmental Disabilities, 16*(2), 86-92.

Smith, T., & Iadarola, S. (2015). Evidence base update for autism spectrum disorder. *Journal of Clinical Child & Adolescent Psychology, 44*(6), 897-922. doi:10.1080/15374416.2015.1077448

Smith, T., Klorman, R., & Mruzek, D. (2015). Predicting outcome of community-based early intensive behavioral intervention for children with autism. *Journal of Abnormal Child Psychology, 43*(7), 1271-1282. doi:10.1007/s10802-015-0002-2

Smith, T., Mruzek, D. W., Wheat, L. A., & Hughes, C. (2006). Error correction in discrimination training for children with autism. *Behavioral Interventions, 21*(4), 245-263. doi:10.1002/bin.223

Smith, T., Smith, T., Scahill, L., Scahill, L., Dawson, G., Dawson, G., . . . Wagner, A. (2007). Designing research studies on psychosocial interventions in autism. *Journal of Autism and Developmental Disorders, 37*(2), 354-366. doi:10.1007/s10803-006-0173-3

Sparrow, S. S., Balla, D. A., & Cicchetti, D. V. (1984). *The Vineland Adaptive Behavior Scale* (Interview edition survey form). Circle Pines, MN: American Guidance Service.

Stahmer, A. C., Rieth, S., Lee, E., Reisinger, E. M., Mandell, D. S., & Connell, J. E. (2015). Training teachers to use evidence-based practices for autism: Examining procedural implementation fidelity. *Psychology in the Schools, 52*(2), 181-195. doi:10.1002/pits.21815

Starr, E., Popovic, S., & McCall, B. (2016). Supporting children with autism spectrum disorder at primary school: Are the promises of early intervention maintained? *Current Developmental Disorders Reports, 3*(1), 46-56. doi:10.1007/s40474-016-0069-7

Steiner, A., Steiner, A., Gengoux, G., Gengoux, G., Klin, A., Klin, A., . . . Chawarska, K. (2013). Pivotal response treatment for infants at-risk for autism spectrum disorders: A

pilot study. *Journal of Autism and Developmental Disorders, 43*(1), 91-102. doi:10.1007/s10803-012-1542-8

Stenberg, N., Bresnahan, M., Gunnes, N., Hirtz, D., Hornig, M., Lie, K. K., . . . Stoltenberg, C. (2014). Identifying children with autism spectrum disorder at 18 months in a general population sample. *Paediatric and Perinatal Epidemiology, 28*(3), 255-262. doi:10.1111/ppe.12114

Strickland-Cohen, M., & Horner, R. H. (2015). Typical school personnel developing and implementing basic behavior support plans. *Journal of Positive Behavior Interventions, 17*(2), 83-94. doi:10.1177/1098300714554714

Sullivan, K., Stone, W. L., & Dawson, G. (2014). Potential neural mechanisms underlying the effectiveness of early intervention for children with autism spectrum disorder. *Research in Developmental Disabilities, 35*(11), 2921-2932. doi:10.1016/j.ridd.2014.07.027

Sundberg, M., L. (2008). *Verbal behavior milestones assessment and placement program*. CA: AVB Press.

Thabane, L., Ma, J., Chu, R., Cheng, J., Ismaila, A., Rios, L. P., . . . Goldsmith, C. H. (2010). A tutorial on pilot studies: The what, why and how. *BMC Medical Research Methodology, 10*(1), 1. doi:10.1186/1471-2288-10-1

Thorndike, R. L., Hagen, E. P., & Sattler, J. M. (1986). *The Stanford–Binet Intelligence Scale* (4th ed.). Chicago, IL: Riverside.

Thornicroft, G., Lempp, H., & Tansella, M. (2011). The place of implementation science in the translational medicine continuum. *Psychological Medicine, 41*(10), 2015-2021. doi:10.1017/S0033291711000109

References

Townley-Cochran, D., Leaf, J., Leaf, R., Taubman, M., & McEachin, J. (2017). Comparing error correction procedures for children diagnosed with autism. *Education and Training in Autism and Developmental Disabilities, 52*(1), 91-101.

Trump, C. E., Ayres, K. A., Quinland, K.K., & Zabala, K. A. (2010). *Differential Reinforcement Without Extinction: A Review of the Literature*. Behaviour Analysis: Research and Practice. 20 (20) 94-107. doi.org/10.1126/science.185.4145.78

Turan, M. K., Moroz, L., & Croteau, N. P. (2012). Comparing the effectiveness of error-correction strategies in discrete trial training. *Behavior Modification, 36*(2), 218-234. doi:10.1177/0145445511427973

Vietze, P., & Lax, L. E. (2018). Early intervention ABA for toddlers with ASD: Effect of age and amount. *Current Psychology,* , 1-11. doi:10.1007/s12144-018-9812-z

Virues-Ortega, J., Iwata, B. A., Fahmie, T. A., & Harper, J. M. (2013). Effects of alternative responses on behavior exposed to noncontingent reinforcement. *Journal of Applied Behavior Analysis, 46*(3), 603-612. doi:10.1002/jaba.61

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. doi:10.1016/j.cpr.2010.01.008

Virues-Ortega, J., Rodríguez, V., & Yu, C. T. (2013). Prediction of treatment outcomes and longitudinal analysis in children with autism undergoing intensive behavioral intervention. *International Journal of Clinical and Health Psychology, 13*(2), 91-100. doi:10.1016/S1697-2600(13)70012-7

References

Vollmer, T. R., Iwata, B. A., Zarcone, J. R., Smith, R. G., & Mazaleski, J. L. (1993). The role of attention in the treatment of attention-maintained self-injurious behavior: Noncontingent reinforcement and differential reinforcement of other behavior. *Journal of Applied Behavior Analysis, 26*(1), 9-21. doi:10.1901/jaba.1993.26-9

Wacker, D. P., Lee, J. F., Dalmau, Y. C. P., Kopelman, T. G., Lindgren, S. D., Kuhle, J., . . . Waldron, D. B. (2013). Conducting functional analyses of problem behavior via telehealth. *Journal of Applied Behavior Analysis, 46*(1), 31. doi:10.1002/jaba.29

Waters, C. F., Amerine Dickens, M., Thurston, S. W., Lu, X., & Smith, T. (2018). Sustainability of early intensive behavioral intervention for children with autism spectrum disorder in a community setting. *Behavior Modification, 44*(1), 3-26. doi:10.1177/0145445518786463

Waugh, R. E., Alberto, P. A., & Fredrick, L. D. (2011). Effects of error correction during assessment probes on the acquisition of sight words for students with moderate intellectual disabilities. *Research in Developmental Disabilities: A Multidisciplinary Journal, 32*(1), 47-57. doi:10.1016/j.ridd.2010.08.007

Weiss, M. J. (2005). Comprehensive ABA programs: Integrating and evaluating the implementation of varied instructional approaches. *The Behavior Analyst Today, 6*(4), 249-256. doi:10.1037/h0100077

Welsh Government. (2019). Statistics for Wales. Retrieved from https://gov.wales/sites/default/files/statistics-and-research/2019-12/local-authority-budgeted-expenditure-schools-april-2019-march-2020.pdf;

References

Whiteford, S., Blacklock, K., & Perry A. (2012). BRIEF REPORT: Reliability of the york measure of quality of IBI (YMQI). *Journal on Developmental Disabilities, 18*(3), 63. Retrieved from https://search.proquest.com/docview/1326738748

Wolery, D. L., Gast., D. L., & Ledford, J. R. In Ledford, J. R. , & Gast., D. L. Single Case Research Methodology Applications in Special Education and Behavioral Sciences (pp. 365-392). NY: Routledge.

Worsdell, A. S., Iwata, B. A., Hanley, G. P., Thompson, R. H., & Kahng, S. W. (2000). Effects of continuous and intermittent reinforcement for problem behavior during functional communication training. *Journal of Applied Behavior Analysis, 33*(2), 167-179. doi:10.1901/jaba.2000.33-167

Worsdell, A. S., Iwata, B. A., Dozier, C. L., Johnson, A. D., Neidert, P. L., & Thomason, J. L. (2005). Analysis of response repetition as an error-correction strategy during sight-word reading. *Journal of Applied Behavior Analysis, 38*(4), 511-527. doi:10.1901/jaba.2005.115-04

Wright, D. B., Mayer, G. R., Cook, C. R., Crews, S. D., Kraemer, B. R., & Gale, B. (2007). A preliminary study on the effects of training using behavior support plan quality evaluation guide (BSP-QE) to improve positive behavioral support plans.(report). *Education & Treatment of Children, 30*(3), 89. doi:10.1353/etc.2007.0017

References

TABLE OF APPENDICES

Appendix A: Consent from the BJSE to use a published paper as part of dissertation

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Appendix B.

Using applied behaviour analysis as standard practice in a UK special needs school.

Abstract

This article describes how applied behaviour analysis (ABA) can be implemented effectively and affordably in a maintained special needs school in the UK. Behaviour Analysts collaborate with classroom teachers to provide early intensive behaviour education for young children with autism spectrum disorder (ASD), and function based behavioural interventions for children between the ages of three and 18 years. Data are presented that show how the model is effective. Children with ASD under the age of seven made significant gains on intelligence quotient and on a range of skills including language, social and play, and academic skills following three academic terms of intervention. Case study data for two children reveal a marked decrease in challenging behaviour following a function based behavioural intervention. These interventions have led to greater independence, integration and access to curricular activities. These data show that children are making significant gains within this cost-effective model.

Key words: applied behaviour analysis, early intensive behavioural intervention, maintained special needs school, school based intervention, function based behavioural intervention

Appendices

There is significant evidence to support the use of interventions based on the principles of Applied Behaviour Analysis (ABA) with children who have autism spectrum disorders (ASD) and other intellectual disabilities (ID). Children with ASD who receive an education based on the principles of ABA make greater gains on social, language, and cognitive measures than children who receive standard treatments (Eldevik et al., 2009; Grindle et al., 2012; Reichow, 2009; Reichow & Wolery, 2009; Virués-Ortega, 2010).

ABA is the clinical application of scientific knowledge about behaviour and learning to socially significant behaviours. Behaviour analysts use the principles of behaviour to teach a range of skills that make a meaningful difference to lives of the individual and to his or her family (Fisher, Piazza & Roane, 2011).

Board Certified Behaviour Analysts (BCBA) typically deliver ABA. In order to qualify as a BCBA, a behaviour analyst completes a Masters degree in ABA that covers 270 hours of training based on a specified curriculum task list, accrues 1500 hours of supervised professional behaviour analytic fieldwork, and passes an exam that is set by the Behaviour Analyst Certification Board (BACB) (Behaviour Analyst Certification Board, 2013). BCBAs are qualified to carry out and supervise behavioural assessments and interventions within their area of expertise (Shook & Johnston, 2011). BCBA-D is Doctoral level credential, which can be obtained by a BCBA who was educated to doctoral level in ABA. Certified behaviour analysts participate in ongoing professional development with specific emphasis on ethics and professional development.

Two applications of ABA that will be discussed in this paper are Early Intensive Behaviour Intervention (EIBI) and behavioural interventions based on functional analysis.

Appendices

Early Intensive Behaviour Intervention

EIBI is an educational model based on ABA used to teach young children with ASD. EIBI is provided intensively (20 – 40 hours per week), to young children (two to six years of age), either in the child's home or in specialist centres (Grindle et al., 2012). A team of therapists, often including parents, deliver the intervention. EIBI has been recommended as the intervention of choice for children with ASD and is widely used in the USA (McPhilemy & Dillenburger, 2013; Healy & Lydon, 2013) where 37 states and the District of Columbia have legislated to provide ABA-based interventions to children with ASD (Healy & Lydon, 2013; Dillenberger, 2011). EIBI services are also available for all children diagnosed with ASD in parts of Canada (Perry & Condillac, 2003). Such legislation does not exist in the UK and only small proportion of children with ASD access ABA-based interventions (Griffith, Fletcher & Hastings, 2011).

There is significant evidence to support the use of an EIBI intervention package for young children with autism. Children who receive EIBI outperform those who receive treatment as usual (TAU) on measures of intelligence quotient (IQ), adaptive behaviour and language skills (Lovaas, 1987; Remington et al, 2007; Green, Brennan & Fein, 2002; Eldevik, Eikeseth, Jahr, & Smith, 2006; Eldevik et al., 2009; Dawson et al., 2010). Parents report improvements in communication, behaviour, independence and overall quality of life following EIBI (McPhimley & Dillenburger, 2013).

EIBI is based on scientific principles of learning and behaviour, which state behaviour is learned through interaction between the individual and the environment. Three components are necessary for learning to occur. Firstly, a stimulus must cue the child's response (antecedent), secondly the child responds (behaviour), and thirdly, there is a consequence that will with increase (reinforce) or decrease (punish) the future frequency of that behaviour

(Skinner, 1938). This antecedent – behaviour – consequence framework is used to teach a range of skills, e.g. imitation, communication, social skills, that are essential for further learning and development.

Early research on EIBI measured the efficacy of high intensity – 20–40 hours of intervention per week over a period of two to three years. Lovaas (1987) demonstrated that children 47% of children who received 40 hours of EIBI made significant gains in IQ and attended mainstream education without support; only 2% of the control group achieved such outcomes. The efficacy of 20-40 hours a week of EIBI has since been demonstrated in a number of studies, including meta-analysis and systematic reviews.

Recent studies have found that children also make significant gains in lower intensity, school-based ABA programmes (Eldevik et al., 2006; Peters-Scheffer, Didden, Mulders & Korkiluis, 2010). Peters-Scheffer and colleagues (2010) measured the efficacy of 6.5 hours of 1:1 teaching that supplemented preschool/elementary school education with children with ASD. Children who received low intensity ABA-based teaching made significantly greater gains on measures of IQ, adaptive behaviour, and social and communication skills than peers who received TAU. In the first UK school-based evaluation of an ABA classroom, Grindle and colleagues (2012) compared the outcomes of children who received an average of 15 hours of 1:1 ABA teaching each week to a group who received TAU. Following one year of treatment, the intervention group significantly outperformed the control group on measures of IQ, adaptive behaviour and language, and continued to make significant gains during the second year of treatment. The children who received ABA were enrolled in an ABA specific classroom in a maintained primary school that was staffed at approximately 1:3: 1 staff: student ratio. These findings indicate that children with ASD can make significant progress in

lower intensity, school-based ABA programmes when compared those who receive TAU within the UK.

EIBI programmes are based on detailed assessments of skills, such as the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) (Sundberg, 2008) or The Assessment of Basic Learning and Language Skills - Revised (ABLLS-R) (Partington, 2006). Skills taught include imitation, language, social and play skills, following instructions, and academic skills such as literacy and maths. Skills are taught in developmental sequence; basic skills are taught first before moving onto complex skills. EIBI programmes are based on individual assessments and while EIBI programmes focus on specific skills each child's programme is unique as is the rate of progress.

Discrete Trial Training (DTT) is one of the many teaching methods used in EIBI. In DTT, skills are broken down into small targets that are taught in a graduated fashion. Smaller skills are easier for the child to learn and can be learnt at a quicker pace (Healy & Lydon, 2013; Rogers & Dawson, 2009). These small skills build up to form more complex behavioural repertoires. Skills are taught in mass and clear mastery criteria are set. Once a skill is mastered in one setting, e.g. a table with a teacher, it is generalised to other people and settings, e.g. in a small group or on the playground. DTT is typical carried out on a 1:1 basis but it can also be used for teaching small groups (Lovaas, 1987; Grindle et al., 2012; Remington et al., 2007; Peters-Scheffer et al., 2010).

Natural Environment Training (NET) is another teaching method used in EIBI. NET is a less structured that DTT; the child's moment-to-moment motivation and interest is used to create learning opportunities. It can be used to generalise skills taught in DTT and to teach new skills. Because it uses naturally occurring events as teaching opportunities NET can carried out in any setting. Requesting, joint attention and other social skills are big focus of

NET. EIBI programmes often use a combination of DTT and NET (Rogers & Dawson, 2009).

Function Based Behaviour Interventions

The use of functional analysis to identify the function of problem behaviour is a well-documented area of ABA (Betz & Fisher, 2011). Iwata et al. (1994) conducted a landmark study on the functional analysis of self-injurious behaviour (SIB). In this study nine participants were repeatedly exposed to a control condition (play) and three test conditions (social disapproval, academic demand, being alone) in order to identify the variables that maintained their SIB. The results showed that six out of nine participants reliably engaged in SIB under specific conditions. This methodology has been extended to identify the function of various response topographies (Betz & Fisher, 2011; Beaver, Iwata, Lerman, 2013). By identifying the function of problem behaviour, behaviour analysts can teach alternative communicative responses to replace the challenging behaviour. Interventions are more successful at increasing appropriate behaviour and decreasing inappropriate behaviour when they are based on the results of a functional analysis (Beaver et al., 2013).

ABA in UK Schools

Despite the evidence of their effectiveness, interventions based on the principles of ABA are seldom used in maintained special needs schools or ASD units in the UK school system. ABA is often only provided in specialist ABA schools or home programmes. A 2011 UK census of ABA provision identified only 14 dedicated ABA schools catering for 258 children in the UK (Griffith, Fletcher & Hastings, 2011). These schools teach only a small proportion of the ASD population, which is approximately one in every 100 children (National Institute of Health and Clinical Excellence, 2011). One possible reason for the

limited number of school based ABA programmes in the UK, particularly in the current economic climate, may be that the short-term cost of providing these interventions is prohibitive to local education authorities. ABA schools have high staff-child ratios; the mean ratio for ABA staff to children in these settings was 1.4:1. The majority of staff members at ABA schools possessed at least a bachelors' degree (67%), and many had a postgraduate qualification (Griffith et al., 2012). These staffing costs may make it expensive to fund ABA programmes in schools.

Increased access to teaching methods based on the principles of ABA ought to be provided to children who would benefit from it, but in order to facilitate this, ABA will need to be provided in a cost effective way. To increase the availability of interventions based on the principles of ABA, educational models where behaviour analysts collaborate with teaching staff should be considered.

The purpose of this paper is to describe a model of how ABA can be provided in cost effective way. Ysgol-y-Gogarth is a maintained special needs school in North Wales that provides interventions based on the principles of ABA to children across the school. At Gogarth, behaviour analysts carry out assessments, develop educational and behavioural interventions, and provide training and support to the staff who implement the interventions on a daily basis. A general description of the school and the model will be provided, followed by an account of the early intervention and function based behavioural intervention domains and some preliminary outcome data.

Ysgol-y-Gogarth

Ysgol-y-Gogarth is a day and residential school that caters to approximately 190 pupils between the ages of three and 19. The children who attend the school have a wide range of physical and intellectual disabilities. Forty-three percent of the students are eligible

for free school meals; which is considerably higher than the 12.7% of children who receive free school meals in dedicated ABA schools in the UK (Griffiths et. al. 2012). There are currently 40 children with a diagnosis of ASD enrolled at school.

The Model

Behaviour Analysts collaborate with teachers to improve the educational provision and behaviour management for children with ASD and intellectual disabilities. Collaborations facilitate the introduction of evidence-based practices. These include: early behavioural intervention for children in the Foundation Phase with the aim of facilitating mainstream integration where appropriate; providing functional skills training for older children; reducing exclusions by developing function-based behavioural interventions; and promoting self-management and independent living for children across the school.

The ABA team is made up of a Consultant Behaviour Analyst – BCBA-D who provides weekly consultation, a full-time Board Certified Behaviour Analyst (BCBA) and a full-time assistant level Behavior Analyst.

The behaviour analysts are responsible for carrying out functional analyses. They work with the teachers to design and implement educational and behavioural interventions, and help to train staff. Teachers and classroom assistants deliver the teaching programmes and behavioural interventions.

Study 1: Implementing early intervention

Early behavioural intervention was provided to children who are in the Foundation Phase (three to seven years old). The staff to child ratio for this group was approximately 0.56:1.

Method

Design

This study employed a pre-test post-test within group design, in which the outcomes of time 1 and time 2 assessments were compared using a paired samples t-test.

Participants

Seven children (six boy and one girl) received ABA-based teaching as described above. Five of these children had a diagnosis of ASD and two engaged behaviours that were consistent with an ASD profile, but did not have a formal diagnosis**.** The average age at the beginning of treatment for children in this group was 61 months (range 47 – 76 months). This was the first group of children to be educated using ABA based teaching within this model and the first for whom data after one school year of intervention is available.

Measures

The Stanford Binet Intelligence Scales – Fourth Edition (Thorndike, Hagen, & Sattler, 1986) was used to measure changes in IQ. The ABLLS-R (Partington, 2006) was used as both an assessment and curriculum guide. The ABLLS-R covers 544 skills areas across 25 skill areas including language, social and play, self-help and academic skills. For analysis, we divided these 25 areas into six meta-domains: learning skills, language, social skills and play, academic self- help and motor skills (Grindle, et al., 2012). Assessments were carried out prior to the intervention, and again after three school terms (approximately nine months) of intervention.

Procedure

Children in this group attend school for 30 hours per week. The children received an average seven hours of one to one discrete trial teaching (DTT) per week. Th**e** intervention

was delivered in a special needs classroom with no special adjustments being made to the classroom; however, partitions were used to reduce possible distractions for some children at the beginning of the intervention. Each child had an individualised programme that was designed by the ABA team. Individualised targets were taught during one-to-one sessions using discrete trial teaching and NET; sessions lasted from 10 minutes, at the beginning of the intervention, to 45 minutes.

Individualised programmes were based largely on the ABLLS-R (Partington, 2006) and the Vinelands Adaptive Behaviour Scales ® (VABS; Sparrow, Balla, & Cicchetti, 1984). The individual programmes emphasised functional communication, skills required for learning (such as imitation, listening skills, and visual skills), self-management, independence skills and academic targets. For some children, access to mainstream education was a target; two children from the early intervention group are currently accessing mainstream education.

Group teaching was a significant part of the programme; before this could happen, children were taught the skills necessary for learning in a group, such as attending and complying with group instructions. Generalising skills taught during one-to-one teaching sessions was a large focus of group teaching sessions. Compulsory curricular activities such as physical education and Welsh language instruction were taught in group sessions.

Behaviour analysts helped teachers design individualised teaching targets and recommended the number of hours of intervention. Teachers organised and managed the classroom, and made the stimuli required for teaching. Teachers and classroom assistants who were trained by the ABA team delivered the intervention. The teachers designed teaching targets for national curriculum subjects.

Appendices

Behavioural principles and their application in the early intervention model

Reinforcement occurs when a stimulus is made available contingent on the occurrence of a specific behaviour, and as a result that behaviour is more likely to happen again in the future (Cooper, Heron, Heward, 2007). Reinforcement based interventions were widely used to increase a range of behaviours, such as functional communication or correct responding during teaching sessions. For example, praise and a preferred activity (such as playing a game or time on the iPad) was provided immediately following a correct response during a teaching session or access to a preferred toy and praise was provided following a pre-determined period of time with no aggression. Praise was provided with these items so that it too, having been paired with preferred tangible items, would function as a reinforcer for these children. Reinforcement was used in all ABA based interventions.

Prompting was used to increase the likelihood that a child will respond correctly and therefore allow for correct responses to be reinforced (Kodak & Grow, 2011). Error correction was used if a child responded incorrectly; the teacher immediately presented the instruction again and prompted the child to respond correctly. The same instruction was then repeated numerous times to allow the child to respond independently; a reinforcer was delivered contingent on correct responding. These procedures eliminated 'trial and error' and increased the chances that the child would succeed.

Task analyses were used to teach a variety of functional and self-help skills. Task analyses involved breaking complex skills down into individual steps, which were be taught separately (Cooper et al., 2007). Prior to teaching, the child was observed carrying out these steps to identify which, if any, were already known. Once this had been established, the skills were taught in a systematic and ordered way, which made the skills easier to learn.

Appendices

DTT was used to teach individual targets. During DTT sessions the child worked alone at a desk with a teacher. Each discrete trial (or teaching target) had a clear instruction, a target behaviour and consequence; teacher presented the instruction, the child then responded (behaviour), and finally a specific consequence was provided depending on the child's response. A number of skills were targeted in each DTT session and each skill was presented a number of times across sessions. Skills were taught until they reached mastery criteria (80% correct with at least two teachers over three consecutive days) – after which a new was introduced. A mixture of mastered and acquisition targets were taught to ensure that sessions were not too difficult and that mastered skills maintained.

NET was to teach children to request and to generalise across the day. NET occurred during unstructured activities such as playtime and during group activities such as art and craft or cooking; the children's motivation was used to create ongoing requesting or other learning opportunities.

Results

A paired samples *t*-test was used to compare the mean group scores between baseline and year 1 assessments (Table 1). Pearson's correlation coefficient, *r*, was used to calculate effect size. There was a statistically significant difference in group IQ scores, $t(6) = -2.59$, $p = 0.020$, following nine months of intervention; these improvements were of medium effect size. The group made statistically significant gains in total ABLLS-R score, $t(6) = -7.43$, $p < .001$ between baseline and year 1 assessments. Detailed analysis showed that the group made significant gains in learning skills, $t(6) = -7.24$, $p < 0.001$, self-help, $t(6) = -3.05$, $p < 0.05$, social and play, $t(6) = -2.66$, $p < 0.05$ and motor skills, $t(6) = -5.78$, $p < 0.05$, over the intervention period. Gains in academic skills were marginally significant, $t(6) = -2.31$, $p =$

0.60. The ABLLS-R total score, learning, language, social and play and motor skill score changes were large in effect size. Academic and self-help scores were medium in effect size. The group made gains of more than 20% for learning skills (26.3%), language skills (20.4%), self-help skills (27.9%) and motor skills (25.3%) between baseline and year 1 assessments. Group, social, and play and academic skills increased by 10% over the intervention period (see Figure 1). These preliminary data show that children are making consistent and significant progress, as assessed by the Stanford Binet and ABLLS, within this model.

Study 2: Function-based behavioural interventions

The majority of children with whom the ABA team were involved had individualised behaviour plans. Behaviour plans were function based. Either direct observation (antecedent, behaviour, consequence) recording, or functional analysis was used to identify the function of challenging behaviour.

During the functional analysis a number of situations were contrived to establish whether challenging behaviour was maintained by positive social reinforcement (attention from others or access to tangibles), negative social reinforcement (escape), or sensory stimulation. When a clear responding pattern was observed in a particular situation it was hypothesised that the individuals challenging behaviour served that particular function (Fisher et al., 2011) and a suitable behaviour plan was put in place. An example would be if higher rates of challenging behaviour were observed in the attention condition, we considered that he/she might have engaged in challenging behaviour to obtain attention. The behaviour plan would teach him to access attention more appropriately, and reduced the attention given in response to challenging behaviours. Ongoing data collection and collaboration with the teachers allowed the team to monitor the effects of behavioural interventions.

Appendices

Table 1.

Mean Stanford Binet and ABLLS group scores after three academic terms of intervention.

		Baseline	Year 1		
Skills	N	M (SD)	M (SD)	P	ES
IQ	7	48.85 (10.09)	55.42 (12.2)	0.020*	0.30
ABLLS total	7	16.23 (11.66)	36.79(17.8)	<0.001*	0.56
Learning skills	7	25.87 (17.20)	52.16 (21.56)	<0.001 *	0.56
Language	7	13.77 (11.76)	34.15 (18.96)	0.001 *	0.54
Social/play	7	7.72 (10.29)	18.59 (20.95)	0.037 *	0.31
Academic	7	8.42 (9.02)	18.67 (18.13)	0.060	0.34
Self-help	7	15.81 (16.34)	43.53 (27.85)	0.023 *	0.52
Motor	7	25.06 (12.64)	50.37 (18.61)	0.001 *	0.62

Note. IQ = Intelligence Quotient. ABLLS = Assessment of Basic Language and Learning Skills; ES= Effect size; * p represents a statistically significant difference (<.05)

Case study outcomes

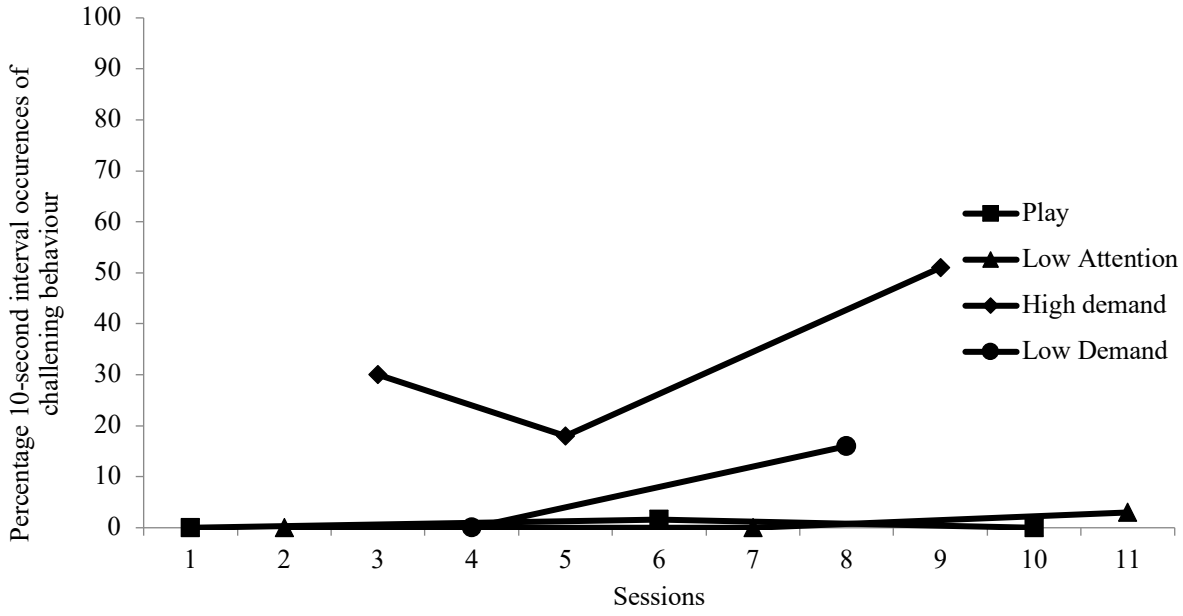
Case study 1 – Cian

Cian was a 10-year old boy who engaged in high levels of challenging behaviour (aggression and property damage). Prior to assessment and intervention, Cian had been excluded from his class and was being educated alone in a room with two or three staff members. He engaged in challenging behaviour during 18% of 15-minute intervals across the day.

A functional analysis was conducted. Four conditions were included: attention, escape (easy and difficult), tangible and a play condition. Each condition lasted 10 minutes and was

presented two to three times. The assessment was carried out in a single morning. The FA was supervised by a BCBA-D. A familiar teaching assistant and learning disability nurse from the National Health Service were both present during the assessment. During the 'attention' condition, the therapist asked Cian to play quietly while she read a book. If Cian engaged in challenging behaviour, the therapist told him to stop. Two different escape conditions were included to measure the effects of task difficulty on Cian's challenging behaviour. In the 'easy work' condition, he was given work he found easy to complete and in the 'hard work' condition he was given written work, which he typically found more difficult. If the challenging behaviour that Cian engaged in was maintained by escape from educational demands, we would expect to see more challenging behaviour during the escape conditions. In the 'tangible' condition, a preferred toy was visible but out of reach. The data from functional analysis showed that Cian's behaviours were maintained by escape from difficult academic activities (see Figure 1).

Figure 1. Percentage of 10-second partial interval occurrences of challenging behaviour across functional analysis conditions

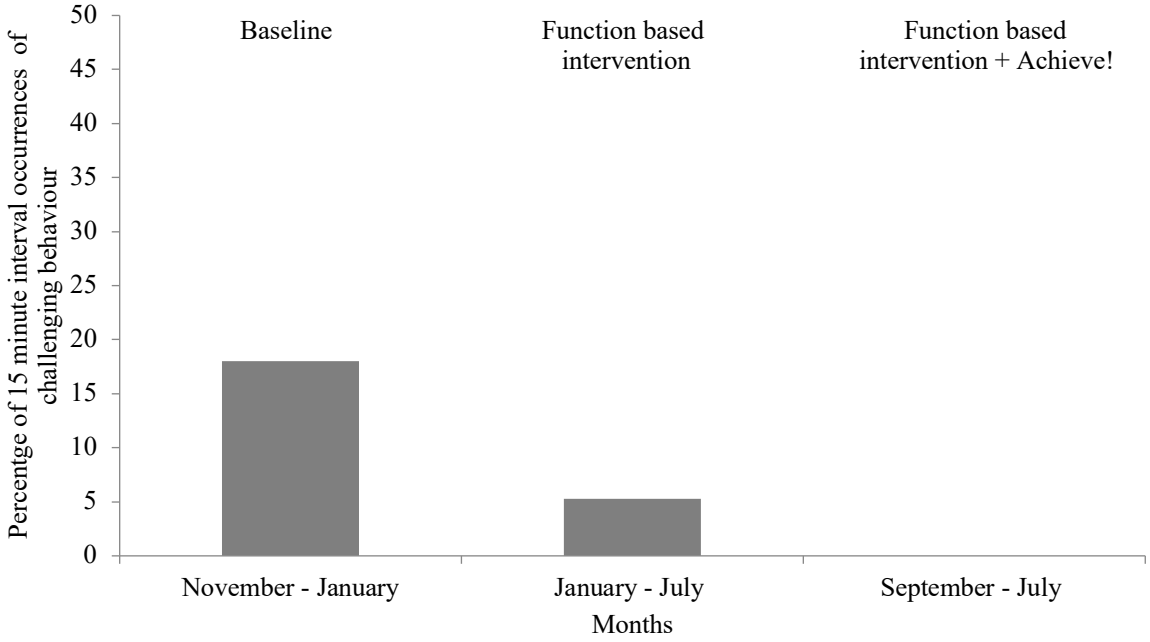


Appendices

The first intervention was a function-based intervention whereby Cian could request a break from work and earn points for complying with certain rules (e.g. safe actions, do work) during specified periods of time. At the end of each day, Cian could choose from specified activities or toys depending on the number of points earned (for example, if he earns 17 points he could play with the train set). He was also reintegrated into a class with his peers. Although Cian's challenging behaviours reduced in frequency, the reductions were not clinically significant, as he continued to engage in challenging behavior frequently. Therefore, a second intervention was implemented. The second intervention was a function-based intervention, the Achieve! programme, and an individualised learning plan. Achieve! is a level system that reinforces specific behaviours (for example, safe actions, completing work assigned by teacher) and allowed Cian to progress through the levels once he had fulfilled specified criteria, for example, safe actions during a specified period of time (Pritchard et al., 2013). Achieve! differed from the previous plan in that additional levels of reinforcement were built into the system and there was a clear plan for progression. In addition to Achieve!, Cian was given an individual teaching programme based on ABA which involved increasing task demands gradually and using prompts to help him learn new skills with fewer errors. Figure 2 shows Cian's challenging behaviours at baseline, following the function based intervention, and function based intervention plus Achieve! Baseline data were data that were taken for two months before the first intervention started (November and December). The function based intervention was implemented during the remainder of that academic year (January to July). The function based intervention plus Achieve! was implemented during the subsequent academic year (September – July). The class teacher and classroom assistants implemented the interventions.

Challenging behaviour reduced from 18% of 15-minute interval to an average of 5.25% of 15-minute intervals between baseline and the first intervention. Following the implementation of the second intervention, challenging behaviour decreased to and remained at zero, with the exception of two incidents of challenging behaviours over a nine-month period.

Figure 2. Percentage of 15-minute partial interval occurrences of challenging behaviour at baseline and following function based intervention and function based intervention plus Achieve!

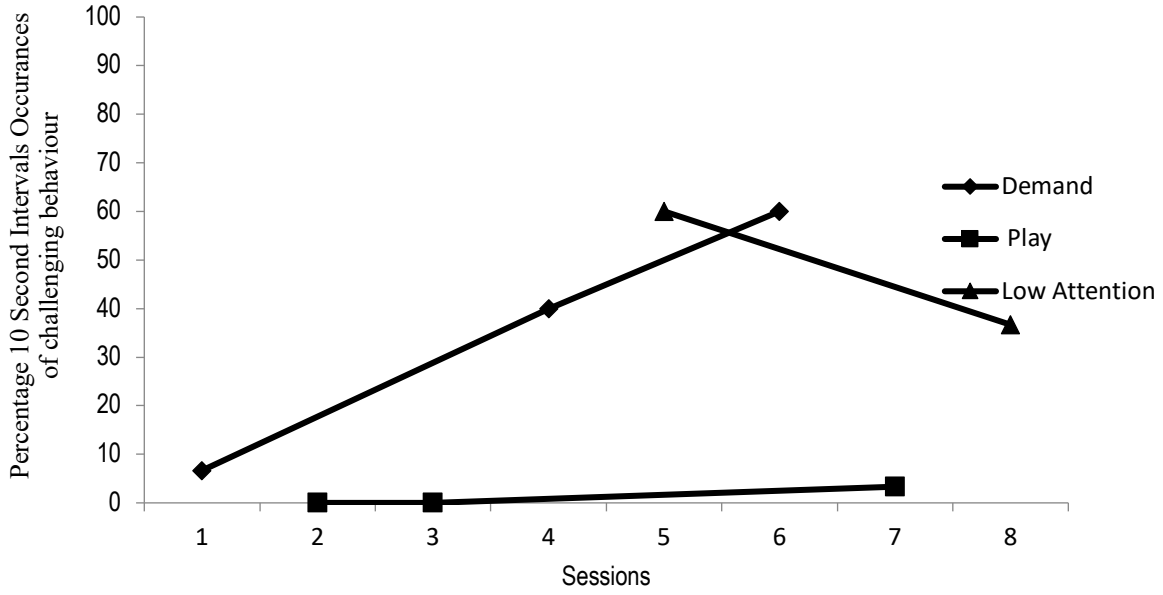


Case study 2 – Lucy

Lucy was a six-year-old girl who engaged in high rates of challenging behaviour across the day (e.g. climbing, absconding, throwing, hitting, pinching, spitting). Lucy could not work independently because of high levels of disruptive behaviour. A functional analysis

showed that Lucy's challenging behaviours were maintained by attention from adults in the form of reprimand and escape from task demand (see Figure 3).

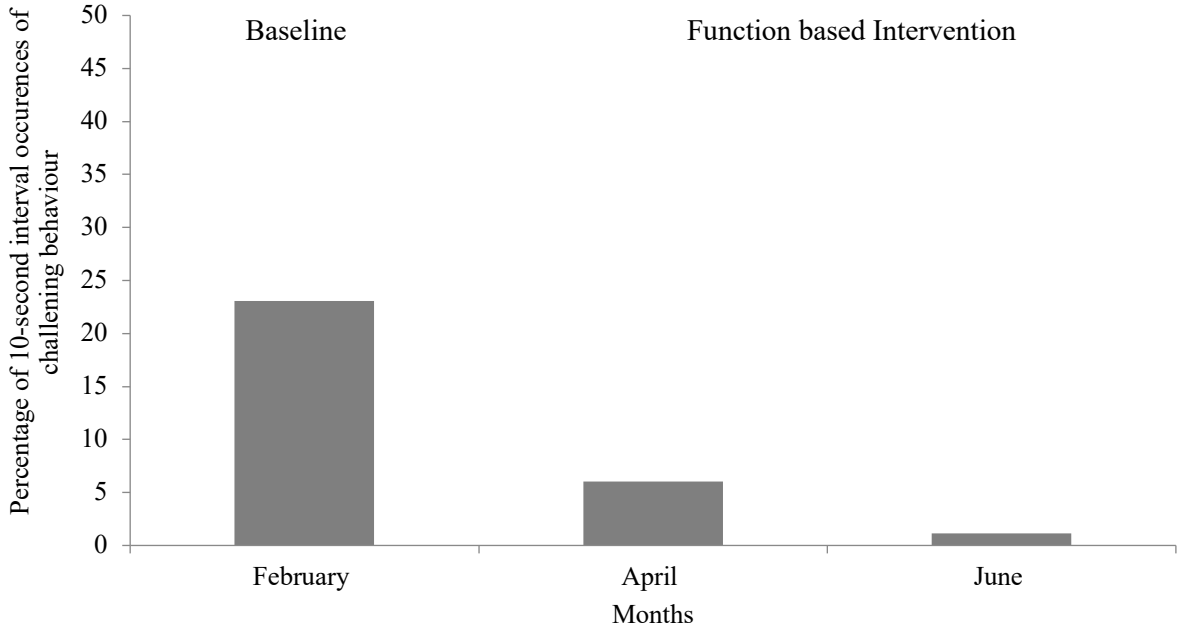
Figure 3. Percentage of 10-second interval occurrences of challenging behaviours across functional analysis conditions



Lucy's behavioural intervention involved redirecting her when she engaged in inappropriate attention seeking behaviours, and providing high levels of attention when she engaged in appropriate attention seeking behaviours (for example, saying hello, play with me or look at this). Lucy also worked on a time based reinforcement schedule during work sessions; at the beginning of the session the rules were explained (sit down, do work, no hitting, no spitting, no pinching) and a timer was set. If Lucy did not engage in the specified behaviours by the end of the interval, she accessed a preferred item or activity. If she engaged in any of the specified behaviours during the interval, the timer was reset. The interval increased to a predetermined interval after three consecutive sessions without challenging behaviours; if Lucy engaged in challenging behaviour during three consecutive sessions the interval decreased by a predetermined interval. Intervals increased from 20 seconds to the

termination criteria (eight minutes) over a period of time (see Figure 4). Teachers now dictate session length and Lucy does not need the rules or the time based schedule. Her inappropriate attention seeking behaviours have been replaced with appropriate behaviours and she now carries out many activities independently, including academic tasks and chores, such as taking the register to the office on a daily basis. Lucy now attends a mainstream school for one day per week.

Figure 1 Percentage of 10-second partial interval occurrences of challenging behaviour at baseline and following function based behavioural intervention



Discussion

This article describes a cost-effective application of ABA in a maintained special needs school in North Wales. Collaboration between behaviour analysts and teaching staff in this setting facilitates the use of evidence-based teaching practices with children who have ASD and intellectual disabilities. Preliminary educational and behavioural data support the view that ABA models can be effectively implemented within maintained schools.

Appendices

Low intensity ABA based interventions led to significant within group gains in language, social and play, and academic skills following eight months of intervention for children in the early intervention model. Function based behavioural interventions designed by behaviour analysts and implemented by teaching staff effectively decreased challenging behaviour.

The children are learning skills that are pre-requisites to many academic, functional, and social skills. Children who engage in challenging behaviours are learning appropriate replacement behaviours, which lead to a reduction in challenging behaviour. These new skills should result in a cohort of children who are better equipped to learn than children with similar profiles who did not have access to early intervention or function based behavioural interventions. Long-term objectives for the children in this group will gradually change as the children who received a behavioural intervention move up through the school. We hope that the number of children that can access and benefit from mainstream education will increase in the future.

This model is a rare example of how interventions based on the principles of ABA can be effectively implemented in a cost effective way in a maintained school in the UK. However, one limitation is that the early intervention group is small and is without a control group. Nevertheless, within group gains between baseline and year 1 assessment were statistically significant, and further research is currently being carried out.

Further research on the use of ABA-based interventions in maintained special needs ought to be carried out. Additional investigation of both low intensity ABA models and functional analysis in maintained schools is needed. The context is crucial - the majority of children with ASD in the UK attend maintained special needs schools, and therefore it is important that research be carried out is these settings. This, and other research (Peters-Foran, D., Hoerger, M.L., Philpott, H., Walker-Jones, E.W., Hughes, J.C., and Morgan, J. 198 (2015). Using Applied Behaviour Analysis as Standard Practice in a UK Special Needs School. *British Journal of Special Education*, 02/2015; DOI: 10.1111/1467-8578.12088

Scheffer et al., 2010; Grindle et al., 2012), supports that children with ASD can make significant gains following low intensity ABA-based intervention; however further research is required. This model could be replicated in other maintained special needs schools across the UK; a control ought to be included. As the functional analysis methodology is well supported future research on functional analysis should focus on identifying the most efficient way of conducting these assessments in maintained schools. Effective behaviour plans may lead to fewer children being excluded from schools; therefore, it is important to focus on how best this assessment can be used in maintained schools. If further research demonstrates that effective ABA-based interventions can be provided in a cost effective way, increased access to this type of intervention may be provided.

It is not common for children with ASD and other intellectual to receive an intervention based on the principles of ABA. This type of model facilitates the use of evidence-based behavioural interventions to a demographic that may otherwise not have access to evidence-based interventions.

Appendix C.

Y·M·Q·I

The York Measure of Quality of Intensive Behavioural Intervention

Adrienne Perry, Ph.D., Helen E. Flanagan, M.A., and E. Alice Prichard, M.A.

Observation/Rating Form

A) Discriminative Stimuli (S^Ds)
1. Attending during S^Ds
2. Varying S^Ds

B) Reinforcement
3. Rapid reinforcer delivery
4. Motivating reinforcers
5. Varying reinforcers
6. Relation of reinforcers to the task
7. Sincere/motivating verbal reinforcement
8. Differential reinforcement

C) Prompting
9. Effectiveness of prompts
10. Fading and augmenting of prompts
11. Lack of prompting errors
12. Follow through
13. Implementation of error correction

D) Organization
14. Clear plan and teaching goals
15. Accessible materials

E) Pacing
16. Length of inter-trial intervals
17. Suitable pace for the child
18. Intensive teaching

F) Teaching level
19. Suitable task difficulty
20. Evidence of skill acquisition

G) Instructional control
21. On-task following requests
22. Maintenance of the child's focus

H) Generalization
23. Varying teaching materials
24. Mixing tasks
25. Teaching away from the table
26. Teaching embedded in naturalistic activities
27. Response generalization
28. Flexible teaching

I) Problem behaviour
29. Result of problem behaviour
30. Reinforcement of appropriate behaviour
31. Use of prevention strategies

Today's Date: [redacted]

Rater: [redacted]

Date of Recording: [redacted]

Child: _____

Therapist: _____

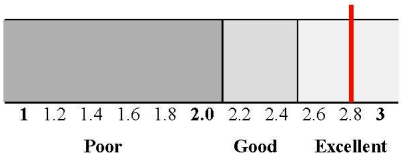
YMQI Scoring Form

Item	Score Segment 1	Score Segment 2
A) S^Ds		
1. Attending	2.5	3
2. Varying S^Ds	3	2
B) Reinforcement		
3. Rapid	3	3
4. Motivating	3	3
5. Varying reinforcement	3	3
6. Relation of reinforcers	3	2
7. Sincere	2.5	2.5
8. Differential	2.5	3
C) Prompting		
9. Effectiveness	3	3
10. Fading	3	3
11. Errors	3	2.5
12. Follow through	3	3
13. Error correction	3	3
D) Organization		
14. Plan and goals	3	3
15. Accessible	3	3
E) Pacing		
16. ITIs	2.5	3
17. Pace	3	3
18. Intensive	3	2
F) Teaching level		
19. Task difficulty	2	3
20. Skill acquisition	2	3
G) Instructional control		
21. On-task	3	2.5
22. Child focus	3	3
H) Generalization		
23. Varying materials	2	2
24. Mixing	1.5	3
25. Away from the table	3	1
26. Embedded teaching	3	2
27. Response gen.	N/A	N/A
28. Flexible	2	2
H) Problem behaviour		
29. Result	3	N/A
30. Appropriate beh.	3	N/A
31. Prevention strategies	3	N/A
Sum of Ratings:	82.5	71.5

	Seg. 1	Seg. 2
Sum of Ratings:	82.5 a_1	71.5 a_2
No. Items rated:	30 b_1	27 b_2
Segment Scores: (a ÷ b)	2.8 c_1	2.7 c_2

Average of c_1 and c_2

TOTAL SCORE: 2.8



YSQA USERS: You will need to calculate a percentage score for entering into the YSQA Summary Scoring Form

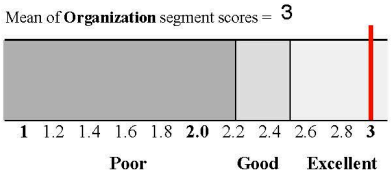
Total Score $\frac{2.8}{3.00}$ = 93 %

Comments:
Segment 1 = minutes 5-10
Segment 2 = minutes 16-21

YMQI Supplemental Scoring Form

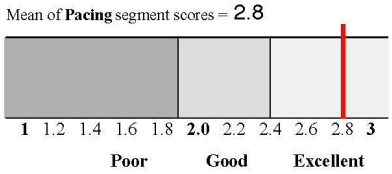
Item	Score Segment 1	Score Segment 2
D) Organization		
14. Plan and goals	3	3
15. Accessible	3	3
Sum of Ratings:	6	6
No. Items Rated:	2	2
Segment Scores:	3	3

Mean of **Organization** segment scores = 3



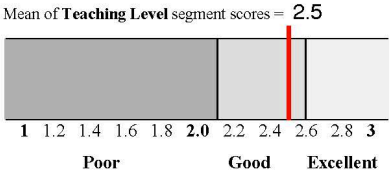
E) Pacing		
16. ITIs	2.5	3
17. Pace	3	3
18. Intensive	3	2
Sum of Ratings:	8.5	8
No. Items Rated:	3	3
Segment Scores:	2.8	2.7

Mean of **Pacing** segment scores = 2.8



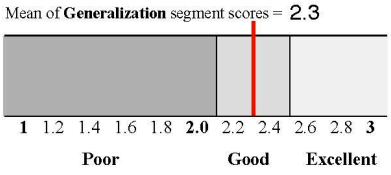
F) Teaching level		
19. Task difficulty	2	3
20. Skill acquisition	2	3
Sum of Ratings:	4	6
No. Items Rated:	2	2
Segment Scores:	2	3

Mean of **Teaching Level** segment scores = 2.5



H) Generalization		
2. Varying S^Ds	3	2
6. Relation of reinforcers	3	2
23. Varying materials	2	2
24. Mixing	1.5	3
25. Away from the table	3	1
26. Embedded teaching	3	2
27. Response gen.	N/A	N/A
28. Flexible	2	2
Sum of Ratings:	17.5	14
No. Items Rated:	7	7
Segment Scores:	2.5	2

Mean of **Generalization** segment scores = 2.3



YMQI Observation/Rating Form – Segment 1

PART I

Teaching Goals
Check the teaching goals that were targeted during the segment.

Attending	☐	Academics	☐
Imitation	☑	Self-help	☐
Receptive Communication	☑	Social skills and play	☐
Expressive Communication	☐	Visual performance	☐
Pre-academics	☐	Independence	☐

Repeated Exemplars
Were there any repeated trials of the same exemplar? YES ☑ NO ☐

Data Recording
Was there any evidence of data recording? YES ☑ NO ☐

Part II

For each of the items below, circle the numbers that represent your ratings.

A. Discriminative Stimuli (S^Ds)

1. Attending during S^Ds (pg. 17)
Requests are given when the child is attending to the task

1	**Poor:** correct for less than half of S^Ds AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of S^Ds and no significant mistakes
(2.5)	
3	**Very good:** no mistakes

Observations

2. Varying S^Ds (pg. 18)
The wording of S^Ds is varied for a particular exemplar
✦ Evidence? ☑
✦ Missed opportunity? ☐

N/A	No repeated trials of the same exemplar
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
(3)	**Very good:** evidence and no missed opportunity

Observations

B. Reinforcement

Was a tangible/activity (t/a) reinforcer used? YES ☑ NO ☐ If No, only complete items 7 & 8.

3. Rapid reinforcer delivery (pg. 19)
Tangible/activity reinforcers are delivered quickly enough for the child to link them with the correct response

N/A	No t/a reinforcers
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
(3)	**Very good:** no mistakes

Observations

4. Motivating reinforcers (pg. 20)
The child appears to enjoy the tangible/activity reinforcer such that he is motivated to work for it

N/A	No t/a reinforcers
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
(3)	**Very good:** no mistakes

Observations
It appears that tickles may be aversive to child

5. Varying reinforcers (pg. 21)
A variety of tangible/activity reinforcers are offered or available to the child
✦ Evidence? ☑
✦ Missed opportunity? ☐

N/A	No t/a reinforcers
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
(3)	**Very good:** evidence and no missed opportunity

Observations

6. Relation of reinforcers to the task (pg. 22)
Tangible/activity reinforcers are related to the child's response
✦ Evidence? ☑
✦ Missed opportunity? ☐

N/A	No t/a reinforcers
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
(3)	**Very good:** evidence and no missed opportunity

Observations

7. Sincere/motivating verbal reinforcement (pg. 23)
The therapist's praise and verbal feedback is enthusiastic, genuine, and varied, and the child appears to be motivated by it

N/A	No verbal reinforcement
1	**Poor:** correct for less than half of trials that are verbally reinforced AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of trials that are verbally reinforced and no significant mistakes
(2.5)	
3	**Very good:** no mistakes

Observations
could vary "good boy" to increase score

8. Differential reinforcement (pg. 24)
Reinforcement intensity is varied based on the child's performance
✦ Evidence? ☑

N/A	Same quality of performance throughout
1	**Poor:** no evidence of variation and two or more significant mistakes
1.5	
2	**Generally good:** evidence of variation and one or two mistakes OR no evidence of variation and no mistakes
(2.5)	
3	**Very good:** evidence of variation and no mistakes

Observations

Reinforcement 1.2

C. Prompting/Error Correction

Was a prompt administered? YES ☑ NO ☐ If No, only complete items 11 & 12.

9. Effectiveness of prompts (pg. 26) Prompts are effective in helping the child make the correct response	
N/A	No prompt
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

10. Fading and augmenting of prompts (pg. 27) On repeated trials of the same task prompting level is varied based on the child's performance ✦ Evidence? ☑	
N/A	No prompt, no repeated trials of the same exemplar
1	**Poor:** no evidence of variation and two or more significant mistakes
1.5	
2	**Generally good:** evidence of variation and one or two mistakes OR no evidence of variations and no mistakes
2.5	
3	**Very good:** evidence of variation and no mistakes
Observations	

11. Lack of prompting errors (pg. 29) The therapist avoids making other common prompting errors	
N/A	No prompt
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

12. Follow through (pg. 31) The therapist follows through on requests	
1	**Poor:** correct for less than half of trials AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of trials and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

13. Implementation of error correction (pg. 32) The therapist implements error correction procedures well	
N/A	No errors
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

D. Organization

14. Clear plan and teaching goals (pg. 33) The therapist demonstrates a clear plan regarding teaching goals and transitions smoothly between tasks	
1	**Poor:** correct less than half of the segment AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct approximately three quarters of the segment and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

15. Accessible materials (pg. 34) Teaching materials, reinforcers, and data sheets are easily and quickly accessed	
N/A	No teaching materials
1	**Poor:** correct for less than half of trials AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct approximately three quarters of trials and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

E. Pacing

16. Length of inter-trial intervals (pg. 36) Inter-trial intervals (ITIs) are discrete, but brief	
1	**Poor:** correct for less than half of ITIs AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of ITIs and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

17. Suitable pace for the child (pg. 37) S^Ds, prompts, reinforcers, and ITIs are given at a pace that seems sensitive to the child	
1	**Poor:** correct for less than half of the segment AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of the segment and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

18. Intensive Teaching (pg. 38) The child is learning for a significant proportion of the time	
1	**Poor:** the child is meaningfully engaged for less than half of the segment (< 150 seconds in a 5 min. segment)
1.5	
2	**Generally good:** the child is meaningfully engaged for approximately three quarters of the segment (approximately 225 seconds in a 5 min. segment)
2.5	
3	**Very good:** the child is meaningfully engaged for the entire segment
Observations	

F. Teaching Level

19. Suitable task difficulty (pg. 39) Tasks are at a level of difficulty which is neither too easy nor too hard for the child	
1	**Poor:** more than one significant mistake
1.5	
2 (circled)	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

20. Evidence of skill acquisition (pg. 40) There is evidence of skill acquisition during the segment ✦ Evidence? ☐ ✦ Missed opportunity? ☐	
N/A	No repeated trials of the same exemplar
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2 (circled)	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity
Observations	

G. Instructional Control

21. On-task following requests (pg. 41) Requests by the therapist are followed by on-task behaviour	
1	**Poor:** correct for less than half of trials AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of trials and no significant mistakes
2.5	
3 (circled)	**Very good:** no mistakes
Observations	

22. Maintenance of the child's focus (pg. 42) The therapist maintains the child's attention and engagement throughout the session	
1	**Poor:** correct less than half of the segment AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of the segment and no significant mistakes
2.5	
3 (circled)	**Very good:** no mistakes
Observations	

H. Generalization

23. Varying teaching materials (pg. 43)
Materials are varied for a particular exemplar
✦ Evidence? ☐
✦ Missed opportunity? ☐

N/A	No repeated trials of the same exemplar which use materials
1	**Poor:** no evidence and one or more missed opportunity
1.5	
(2)	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

24. Mixing tasks (pg. 44)
Tasks are varied/inter-mixed
✦ Evidence? ☐
✦ Missed opportunity? ☑

1	**Poor:** no evidence and one or more missed opportunity
(1.5)	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

25. Teaching away from the table (pg. 46)
Activities take place away from the table
✦ Evidence? ☑
✦ Missed opportunity? ☐

N/A	All tasks require the surface of the table (e.g., writing, eating)
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
(3)	**Very good:** evidence and no missed opportunity

Observations

26. Teaching embedded in naturalistic activities (pg. 47)
Teaching takes place in the context of activities that children normally encounter
✦ Evidence? ☑
✦ Missed opportunity? ☐

1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
(3)	**Very good:** evidence and no missed opportunity

Observations

27. Response generalization (pg. 48)
The therapist promotes and accepts a variety of verbal responses to the same exemplar
✦ Evidence? ☐
✦ Missed opportunity? ☐

(N/A)	All of the child's responses are non-verbal
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

28. Flexible teaching (pg. 49)
The therapist allows for deviation from the teaching plan and capitalizes on unexpected events
✦ Evidence? ☐
✦ Missed opportunity? ☐

1	**Poor:** no evidence and one or more missed opportunity
1.5	
(2)	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

I. Problem Behaviour

29. Result of problem behaviour (pg. 50) The therapist does not allow the problem behaviour to be reinforced by access to tangibles, attention, escape, or sensory reinforcement	
N/A	No problem behaviour
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

30. Reinforcement of appropriate behaviour (pg. 53) There is evidence of reinforcement of alternative/ appropriate behaviour ✦ Evidence? ☑ ✦ Missed opportunity? ☐	
N/A	No variation in the appropriateness of the child's behaviour or attention to task demands
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity
Observations	

31. Use of prevention strategies (pg. 54) Actions are performed which appear as though they will prevent or reduce the impact of problem behaviour ✦ Evidence? ☑ ✦ Missed opportunity? ☐	
N/A	No variation in the appropriateness of the child's behaviour or attention to task demands
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity
Observations	

YMQI Observation/Rating Form – Segment 2

PART I

Teaching Goals
Check the teaching goals that were targeted during the segment.

Attending	☑	Academics	☐
Imitation	☑	Self-help	☐
Receptive Communication	☑	Social skills and play	☐
Expressive Communication	☐	Visual performance	☐
Pre-academics	☐	Independence	☐

Repeated Exemplars
Were there any repeated trials of the same exemplar? YES ☑ NO ☐

Data Recording
Was there any evidence of data recording? YES ☑ NO ☐

Part II

For each of the items below, circle the numbers that represent your ratings.

A. Discriminative Stimuli (S^Ds)

1. Attending during S^Ds (pg. 17) Requests are given when the child is attending to the task	
1	**Poor:** correct for less than half of S^Ds AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of S^Ds and no significant mistakes
2.5	
(3)	**Very good:** no mistakes
Observations	

2. Varying S^Ds (pg. 18) The wording of S^Ds is varied for a particular exemplar ✦ Evidence? ☑ ✦ Missed opportunity? ☑	
N/A	No repeated trials of the same exemplar
1	**Poor:** no evidence and one or more missed opportunity
1.5	
(2)	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity
Observations	

B. Reinforcement

Was a tangible/activity (t/a) reinforcer used? YES ☑ NO ☐ If No, only complete items 7 & 8.

3. Rapid reinforcer delivery (pg. 19) Tangible/activity reinforcers are delivered quickly enough for the child to link them with the correct response	
N/A	No t/a reinforcers
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
(3)	**Very good:** no mistakes
Observations	

4. Motivating reinforcers (pg. 20) The child appears to enjoy the tangible/activity reinforcer such that he is motivated to work for it	
N/A	No t/a reinforcers
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
(3)	**Very good:** no mistakes
Observations	

5. Varying reinforcers (pg. 21) A variety of tangible/activity reinforcers are offered or available to the child ✦ Evidence? ☑ ✦ Missed opportunity? ☐	
N/A	No t/a reinforcers
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
(3)	**Very good:** evidence and no missed opportunity
Observations	

6. Relation of reinforcers to the task (pg. 22) Tangible/activity reinforcers are related to the child's response ✦ Evidence? ☐ ✦ Missed opportunity? ☐	
N/A	No t/a reinforcers
1	**Poor:** no evidence and one or more missed opportunity
1.5	
(2)	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity
Observations	

7. Sincere/motivating verbal reinforcement (pg. 23) The therapist's praise and verbal feedback is enthusiastic, genuine, and varied; and the child appears to be motivated by it	
N/A	No verbal reinforcement
1	**Poor:** correct for less than half of trials that are verbally reinforced AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of trials that are verbally reinforced and no significant mistakes
(2.5)	
3	**Very good:** no mistakes
Observations	

8. Differential reinforcement (pg. 24) Reinforcement intensity is varied based on the child's performance ✦ Evidence? ☑	
N/A	Same quality of performance throughout
1	**Poor:** no evidence of variation and two or more significant mistakes
1.5	
2	**Generally good:** evidence of variation and one or two mistakes OR no evidence of variation and no mistakes
2.5	
(3)	**Very good:** evidence of variation and no mistakes
Observations	

C. Prompting/Error Correction

Was a prompt administered? YES ☑ NO ☐ If No, only complete items 11 & 12.

9. Effectiveness of prompts (pg. 26) Prompts are effective in helping the child make the correct response	
N/A	No prompt
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3 (circled)	**Very good:** no mistakes
Observations	

10. Fading and augmenting of prompts (pg. 27) On repeated trials of the same task prompting level is varied based on the child's performance ✦ Evidence? ☑	
N/A	No prompt, no repeated trials of the same exemplar
1	**Poor:** no evidence of variation and two or more significant mistakes
1.5	
2	**Generally good:** evidence of variation and one or two mistakes OR no evidence of variations and no mistakes
2.5	
3 (circled)	**Very good:** evidence of variation and no mistakes
Observations	

11. Lack of prompting errors (pg. 29) The therapist avoids making other common prompting errors	
N/A	No prompt
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5 (circled)	
3	**Very good:** no mistakes
Observations most to least used for touch head task	

12. Follow through (pg. 31) The therapist follows through on requests	
1	**Poor:** correct for less than half of trials AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of trials and no significant mistakes
2.5	
3 (circled)	**Very good:** no mistakes
Observations	

13. Implementation of error correction (pg. 32) The therapist implements error correction procedures well	
N/A	No errors
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3 (circled)	**Very good:** no mistakes
Observations	

Prompting 2.3

D. Organization

14. Clear plan and teaching goals (pg. 33) The therapist demonstrates a clear plan regarding teaching goals and transitions smoothly between tasks	
1	**Poor:** correct less than half of the segment AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct approximately three quarters of the segment and no significant mistakes
2.5	
(3)	**Very good:** no mistakes
Observations	

15. Accessible materials (pg. 34) Teaching materials, reinforcers, and data sheets are easily and quickly accessed	
N/A	No teaching materials
1	**Poor:** correct for less than half of trials AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct approximately three quarters of trials and no significant mistakes
2.5	
(3)	**Very good:** no mistakes
Observations	

E. Pacing

16. Length of inter-trial intervals (pg. 36) Inter-trial intervals (ITIs) are discrete, but brief	
1	**Poor:** correct for less than half of ITIs AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of ITIs and no significant mistakes
2.5	
(3)	**Very good:** no mistakes
Observations	

17. Suitable pace for the child (pg. 37) S^Ds, prompts, reinforcers, and ITIs are given at a pace that seems sensitive to the child	
1	**Poor:** correct for less than half of the segment AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of the segment and no significant mistakes
2.5	
(3)	**Very good:** no mistakes
Observations	

18. Intensive Teaching (pg. 38) The child is learning for a significant proportion of the time	
1	**Poor:** the child is meaningfully engaged for less than half of the segment (< 150 seconds in a 5 min. segment)
1.5	
(2)	**Generally good:** the child is meaningfully engaged for approximately three quarters of the segment (approximately 75 seconds in a 5 min. segment)
2.5	
3	**Very good:** the child is meaningfully engaged for the entire segment
Observations	

F. Teaching Level

19. Suitable task difficulty (pg. 39) Tasks are at a level of difficulty which is neither too easy nor too hard for the child	
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

20. Evidence of skill acquisition (pg. 40) There is evidence of skill acquisition during the segment ✦ Evidence? ☑ ✦ Missed opportunity? ☐	
N/A	No repeated trials of the same exemplar
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity
Observations	

G. Instructional Control

21. On-task following requests (pg. 41) Requests by the therapist are followed by on-task behaviour	
1	**Poor:** correct for less than half of trials AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of trials and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

22. Maintenance of the child's focus (pg. 42) The therapist maintains the child's attention and engagement throughout the session	
1	**Poor:** correct less than half of the segment AND/OR two or more significant mistakes
1.5	
2	**Generally good:** correct for approximately three quarters of the segment and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

H. Generalization

23. Varying teaching materials (pg. 43)
Materials are varied for a particular exemplar
✦ Evidence? ☐
✦ Missed opportunity? ☐

N/A	No repeated trials of the same exemplar which use materials
1	**Poor:** no evidence and one or more missed opportunity
1.5	
(2)	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

24. Mixing tasks (pg. 44)
Tasks are varied/inter-mixed
✦ Evidence? ☑
✦ Missed opportunity? ☐

1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
(3)	**Very good:** evidence and no missed opportunity

Observations

25. Teaching away from the table (pg. 46)
Activities take place away from the table
✦ Evidence? ☐
✦ Missed opportunity? ☑

N/A	All tasks require the surface of the table (e.g., writing, eating)
(1)	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

26. Teaching embedded in naturalistic activities (pg. 47)
Teaching takes place in the context of activities that children normally encounter
✦ Evidence? ☐
✦ Missed opportunity? ☐

1	**Poor:** no evidence and one or more missed opportunity
1.5	
(2)	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

27. Response generalization (pg. 48)
The therapist promotes and accepts a variety of verbal responses to the same exemplar
✦ Evidence? ☐
✦ Missed opportunity? ☐

(N/A)	All of the child's responses are non-verbal
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

28. Flexible teaching (pg. 49)
The therapist allows for deviation from the teaching plan and capitalizes on unexpected events
✦ Evidence? ☐
✦ Missed opportunity? ☐

1	**Poor:** no evidence and one or more missed opportunity
1.5	
(2)	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity

Observations

I. Problem Behaviour

29. Result of problem behaviour (pg. 50) The therapist does not allow the problem behaviour to be reinforced by access to tangibles, attention, escape, or sensory reinforcement	
N/A	No problem behaviour
1	**Poor:** more than one significant mistake
1.5	
2	**Generally good:** two or three mistakes and no significant mistakes
2.5	
3	**Very good:** no mistakes
Observations	

30. Reinforcement of appropriate behaviour (pg. 53) There is evidence of reinforcement of alternative/ appropriate behaviour ✦ Evidence? ☐ ✦ Missed opportunity? ☐	
N/A	No variation in the appropriateness of the child's behaviour or attention to task demands
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity
Observations	

31. Use of prevention strategies (pg. 54) Actions are performed which appear as though they will prevent or reduce the impact of problem behaviour ✦ Evidence? ☐ ✦ Missed opportunity? ☐	
N/A	No variation in the appropriateness of the child's behaviour or attention to task demands
1	**Poor:** no evidence and one or more missed opportunity
1.5	
2	**Generally good:** evidence and one or more missed opportunity OR no evidence and no missed opportunity
2.5	
3	**Very good:** evidence and no missed opportunity
Observations	