TruePotential PLLC

Home-Based Therapy for Individuals with Autism Spectrum Disorder

Basic Training Manual

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The Intervention Plan

Building an evidence-based intervention programme

The following is a description of the basic components of EBI programme design for individuals diagnosed with ASD. For many years professionals have used these tools and procedures within these components to build individualised EBI programmes by collecting and analyzing all relevant information under specific theoretical frameworks (i.e. developmental, operant theory). As a result, in the context of ASD intervention an EBI programme is a collection of EBIs which addresses personal (i.e. developmental levels, manifestation of ASD symptoms) and environmental factors (i.e. parent training, availability of opportunities for meaningful interaction) influential to areas of impairment. Selection, prioritization and individualisation of EBIs is the result of the application of the selected theoretical frameworks to the processes of information gathering, clinical reasoning, intervention design and finally implementation.

During the first and information gathering phase of programme design, the specialist aims to identify the specific personal and environmental factors responsible for areas of impairment, as well as additional factors crucial to the development of highly individualised and socially valid EBIs. Such factors include the individual's activities and participation within the family and community (), their communication needs () and short, medium and long-term personal goals (). Information gathering usually takes place over a series of appointments during which specialists employ tools and processes for information gathering including but not limited to the collection of a case history, direct and indirect observations, direct assessment of specific learning and developmental domains, interviews, reviews of documentation, medical and psychological assessments, and assessments by professionals in fields of allied health fields including speech-language, occupational and physical therapists (). EBI intervention programmes are also effective at using the input of a knowledgeable multidisciplinary team in order to include a comprehensive repertoire of EBIs relevant to individuals's needs, priorities, values and culture (). Due to the evolving nature of both the symptoms of ASD across the lifespan and individual needs and circumstances(), effective and socially valid intervention plans are designed, implemented and continuously assessed in collaboration with individuals diagnosed with ASD, their families and intervention teams ().

After relevant information is collected and during the subsequent clinical reasoning phase, the specialist analyses and interprets the collected information in order to define areas of clinical need and select adequate EBIs to address them. In order to do this, areas of clinical need (i.e. inability to imitate or engage in joint attention) are evaluated in the context of a risk analysis, as well as consideration of all relevant ethical implications in order to individualize EBIs for their

administration under safe and least-restrictive conditions (). This clinical reasoning phase of development results in a collection of individualised versions of EBIs part of a comprehensive EBI programme.

Once specific EBIs have been selected to target identified clinical needs, they are individualised through a process which involves adapting the features of interventions to best fit the personal and environmental factors which influence corresponding areas. Features of such individualisation include adaptations to the delivery pattern of EBIs (i.e. parent and/or clinician delivered, individualised or group-based instruction, consultation, intensity/frequency, materials, environment) as well as specific means and methods for outcome measurement (i.e. data collection) and continued assessment (i.e. formal re–assessment, frequency of supervision by expert).

The Interventions

Evidence-based interventions (EBIs) and EBI models for individuals with ASD
EBI programmes are available to the general public through a variety of evidence-based models*, which use specific EBI repertoires and processes to derive and implement individualised versions of such EBIs. Examples of parent-delivered EBI models include the () which falls under the category of behavioural intervention models (), and the DIR-Floortime and Early Start Denver Model (ESDM)() which fall under the category of naturalistic developmental behavioural, play-based interventions models (NDBIs). Within the context of EBI intervention programmes available to school-age children diagnosed with ASD in educational and healthcare settings, these are often available around the world in industrialized countries through documents with titles such as Individualised Education Plan (IEP) and Individualised Service Plan (ISP) in parts of the United States, Education Health and Care Plan (EHCP) in the United Kingdom and Plan Educativo Individualizado [Individualised Education Plan] in Mexico. EBIs are also delivered in many clinical sites in the form of specific EBIs directed at specific outcomes (), and in the form of replication of established EBI models of assessment and intervention design and implementation ().

	Other interventions it includes	Other interventions which include it
Antecedent-based strategies		
Behavioural momentum		

Errorless teaching	Prompting and fading Reinforcement Delayed contingencies	
Incorporating student interest	Reinforcement Choices	DTT FCT ESDM DIR-Floortime
Priming	Modeling	DTT
Task interspersal		DTT
TIme delay		DTT
Visual prompts	Prompting and fading	Delayed contingencies Contingency contracting DTT
Instructional strategies		
Chaining	Task analysis Prompting and fading Reinforcement	DTT
Discrete trial training (DTT)	Chaining Shaping Priming Extinction Task Analysis Task Interspersal Prompting and fading Choice Visual prompts	
Functional communication training (FCT)	Prompting and fading Choices Differential reinforcement Extinction	
Incidental teaching	Differential Reinforcement Prompting and fading Shaping	DIR-Floortime PRT PCIT

	Modeling	ESDM JASPER
Modeling	Prompting	DTT DIR-Floortime PRT PCIT ESDM JASPER
Pivotal Response Training (PRT)	Incidental teaching Prompting and fading Differential reinforcement	
Prompting and fading	Delayed contingencies	Response interruption DTT DIR-Floortime PRT PCIT ESDM JASPER
Shaping	Differential reinforcement	DTT
Task analysis		Chaining DTT DIR-Floortime PRT PCIT ESDM JASPER
Consequence-based strategies		
Contingency contracting	Prompting Delayed contingencies	PCIT
Delayed contingencies	Prompting Reinforcement	Errorless learning
Differential reinforcement	Reinforcement	DTT DIR-Floortime PRT PCIT

		ESDM JASPER FCT Incidental teaching Contingency contracting Prompting and fading RIRD
Extinction	Differential reinforcement	FCT
Response interruption	Prompting and fading	RIRD
Reinforcement		DTT DIR-Floortime PRT PCIT ESDM JASPER FCT Incidental teaching Contingency contracting Prompting and fading Shaping Chaining Differential reinforcement RIRD
Token Economy	Delayed contingencies Prompting	
EBI Intervention models		
Early Intensive Behavioural Intervention (EIBIs) models	DTT Incorporating student interest Choice Task Analysis Differential reinforcement Shaping Prompting and fading	
DIR-Floortime	Incorporating student interest Choice Task Analysis	

	Differential reinforcement Shaping Prompting and fading
Early Start Denver Model (ESDM)	Incorporating student interest Choice Task Analysis Differential reinforcement Shaping Prompting and fading
Parent-Child Interaction Therapy (PCIT)	Incorporating student interest Choice Task Analysis Differential reinforcement Shaping Prompting and fading Punishment
Joint attention, symbolic play, engagement and regulation intervention (JASPER)	Incorporating student interest Choice Task Analysis Differential reinforcement Shaping Prompting and fading

This framework of antecedent-based, instructional and consequence-based strategies was based on the systematic identification and categorisation of ABA interventions by Boutot and Hume (2012). It was expanded in this work to include EBI models and their relationship with specific EBIs, as well as relationships between EBIs and EBI models. Due to their foundational role in the development and research of a growing number of subsequent intervention models and interventions (i.e. NDBIs, FCT), the author first outlines the definition, origin, development and history of application of behavioural interventions in the context of treating school-age children with ASD.

Applied behavior analysis (ABA) interventions

ABA interventions are defined as a “set of behavioural tools, programmes or processes that are applied, behavioural, analytic, technological, conceptually systematic, effective and generalisable” (Baer, Wolf and Risley, 1968). They leverage our understanding of behavioural phenomena in order to teach “socially important behavior” (Skinner, 1957), and for many years have been researched alone or in combination in the context of

treatment of symptoms associated with conditions including ASD, depressive disorder, anxiety disorder, addiction and behavioural disorders (Hamers, Festen and Hermans, 2018; Simpson, Lehavot and Petrakis, 2017).

The concept of ABA interventions was born in the United States as a child of behaviorism, a field in psychology that emerged in the first years of the 20th century through the work of researchers such as James Watson and Ivan Pavlov (Kirkham, 2017), who were among many researchers then and subsequently studied *operant conditioning** but mostly limited to research into animal behavior (). In 1953 B.F. Skinner published *Science and Human Behavior*, and in it the application of concepts including *operant behaviour*, *shaping*, *operant discrimination* and *punishment* in the context of experiments of human behaviour (). Subsequently Charles B. Fester,–a former student of B.F. Skinner–proposed in 1957 the creation of a journal which welcomed this type of research, and in 1958 the *Journal of Experimental Analysis of Behaviour (JEAB)* published its first edition, including studies such as those describing the study of the effect of *extinction* in the behavior of young children (Bijou1958), the effect of different *reinforcement* schedules on response rates (Hearst1958) and the application of the relationship between *discriminative stimulus* (SD)* and *reinforcement* to *stimulus control** of behavior (Skinner1958). Over the next decade research into the study of applied behavioural analytic interventions to human populations flourished and included the work of more researchers (). Subsequently many of those involved in the creation of the JEAB prompted in 1967 the creation of the *Journal of Applied Behaviour Analysis* (JABA), which in its first edition in 1968 included studies on the efficacy of *punishment** to suppress behavior (Risley1968), an explanation on the differences between behavioural and applied behavioural research (Baer1968), and on the use of reinforcement strategies in the home by parents in order to eliminate “undesired” behaviors (). Dr. Sidney Bijou, who in the University of Washington in the United States had been researching operant conditioning in children with developmental disabilities, had as a graduate student Ivar O. Lovaas. During this period Lovaas became interested in the application of behavioural analytic interventions to populations of children with developmental delays, and subsequently published from the University of California at Los Angeles (UCLA) the first study on the systematic use of applied behaviour analytic interventions for autistic children ().

Since the first early autism intensive-intervention studies in Washington and California (Bijou, 1961; Lovaas, 1987), parallel efforts arose in Latin American countries such as Mexico (Ribes), Brazil, Chile, Venezuela and Colombia (Ardila, Pérez-Acosta & Gutiérrez, 2005) and Argentina (López López, W., Vera-Villarroel, P., Pérez-Acosta, A., Aguilar Bustamante, M., Hurtado-Parrado, C., Valenzuela,P., 2011), and European countries such as Spain and the United Kingdom (Lambert-Lee et al., 2015; Trudgeon & Carr, 2007). Despite social, political, cultural and economic differences that influenced the growth of ABA in different parts of the world these efforts lead to the worldwide

establishment of graduate programs, research groups and parent-lead support and advocacy efforts (Hawkins, Chase, & Scotti, 1993).

Currently ABA interventions have been since the 1980s and continue to be employed in a wide array of intervention *models**,* including the first intensive-intervention ABA model published by Ivar Lovaas in *The Me Book* (Lovaas19?) after the publication of an initial controlled study of 38 children diagnosed with autism (1987). Subsequent to this and over the years, different models which use ABA interventions have been developed and studied across different groups of school-age children with ASD, including studies which replicated the model described by Lovaas (). Additional models which also apply ABA interventions include naturalistic, developmental behavioural interventions (NDBIs) models, in which interventions are delivered in the context of play-based, child-led activities.

This is a summary of ABA interventions identified through the research in this work and based on the initial framework of ABA interventions provided by Boutot and Hume (2012). Under this framework interventions were categorized as antecedent-based, instructional or consequence-based. Their description includes their theoretical underpinnings, operational procedures, evidence of relevant clinical application and when appropriate, its application in the context of the training and implementation phases of the SEC-ETP Project.

ABA interventions

Identified antecedent-based interventions include *behavioural momentum*, choice, *environmental modification*, *errorless teaching*, *incorporating student interest*, *priming*, *task interspersal*, *time delay* and *visual prompting*. Instructional interventions include *chaining*, *discrete trial training*, *functional communication training*, *incidental teaching*, *modeling*, *pivotal response treatment*, *prompting*, *shaping*, *task analysis.* Consequence-based interventions include *contingency contracting*, *delayed contingencies*, *differential reinforcement*, *extinction*, *overcorrection*, *response interruption*, *redirection*, *reinforcement*, *token economies*. Their description includes their theoretical underpinnings, operational procedures, evidence of relevant clinical application and when appropriate, its application in the context of the training and implementation phases of the SEC-ETP Project.

Functional analysis of behavior

An adequate functional analysis of behavior is the conduit for their proper selection and adaptation of ABA technologies in order to teach specific skills (Kennedy, 2004). It facilitates an understanding of moments of interaction, during ‘structured’ learning or otherwise, such that the implementer of interventions can analyze changes in behavior by identifying its relevant antecedents and consequences. This understanding allows implementers to develop hypotheses about the origin of specific behaviors, as well as potential avenues for their shaping, encouragement or mitigation.

The term *functional analysis* was first applied to the analysis of human behavior in Skinner's *The Behavior of Organisms* (Schlinger & Normand, 2013; Skinner, 1938). It refers to the process of collecting and sorting through all variables in the process in order to identify those responsible for significant behavioural change. This is done by analyzing these variables through a *first*, *then* and *after* sequence. This sequential model of analysis begins with the antecedent to the target behavior followed the behavior itself and finally the events observed after the behavior. This type of analysis allows for the systematic arrangement of antecedents and consequences of specific behaviors in order to target socially important change (Schlinger Jr., 2017; Skinner, 1938). After using this information to make determinations on the efficacy of the intervention employed, the cycle of ABA is completed and a new one begins by analyzing and interpreting data from previous implementation, generating gradually improving and adaptive forms of individualised interventions which adapt to the changing learning needs of the individual().

The functional analysis portion of ABA is necessary in order to satisfactorily meet each need as it is relevant to family and community life (McPhilemy and Dillenburger, 2013). By employing these types of analyses to specific behavior patterns (i.e. imitation skills for the nonverbal child, selecting appropriate conversation topics for the high-functioning teenager with ASD), intervention teams aim to increase in form, complexity or frequency desired behaviors as well as shape or decrease the incidence of behaviors which cause a significant impediments to the individual's ability to learn or make possible use of their environment. As far as learning and otherwise developmental skills and milestones, ABA interventions have been used to teach key elements to the process of learning itself such as eye contact, turn taking, sustained attention, imitation, language processing (), and are often targeted before higher-level, complex social communication skills are targeted. By a process of individualised intervention design, preschool and school-age children with ASD target a wide variety of skills and knowledge which range from complex social communication skills to those fundamental to learning and basic communication. It is this model of intervention design which may determine the use of certain ABA technologies for some children and not others, even though the same underlying principles behind its use and implementation are still in action.

Antecedent-based strategies

Environmental modification is the act of "changing conditions in the environment or activity to increase the likelihood that appropriate behavior will occur, and decreasing the likelihood that interfering behavior is reinforced"(). It involves the rearrangement of spaces and materials in manners derived from a thorough functional analysis of target behaviors. Other important aspects of the student's environment include parent and educator training (), as these were responses from the environment that were shaped in order to effect purposeful behavioural change. In the context of the Project, parents and

educators were trained on the use of environmental modifications at times simultaneously with other interventions (i.e. environmental control and extinction in order to curve challenging behavior), in order to increase the likelihood of success in teaching adaptive behavior, by decreasing the number of available opportunities to practise undesired behaviors (). Research on the training of those around the individual (Långh, Hammar, Klintwall, & Bölte, 2017) has proven a significant factor to effective intervention delivery over the years. Specifically, parent training has garnered much of the attention from the research and clinical community over the last few decades with early studies describing it as a necessary component to effectively delivery of interventions with intensive schedules (McConachie & Diggle, 2007; Oono, Honey, & McConachie, 2013; Shire et al., 2015; Wallace & Rogers, 2010). As far as educator training, research published over the last few decades has also suggested it as an essential ingredient of effective interventions in the school-age child (Hess, Morrier, Heflin, & Ivey, 2008; Parsons, Miller, & Deris, 2016). Adequate environmental arrangements and context of delivery (Bruni et al., 2017), and frequency of time spent in environments rich in opportunities for adequately guided social interaction (Tanner, Hand, O'Toole, & Lane, 2015) have also been identified as influential environmental variables to effective delivery of ASD-related interventions, and are also the target of individualised interventions through a variety of delivery formats including those taking place in naturalistic scenarios and provided by parents and caregivers.

Errorless learning is a manner of delivering instruction that “reduces the likelihood or incorrect responding”, and includes mechanisms such as *stimulus fading*, *delayed prompting* and *response prevention* (). It was used with younger or students less experienced in specific learning areas, often to target basic imitation and receptive language skills (i.e. following basic directions), as it provides ample opportunities for practice of target behaviors () and association with positive reinforcement ().

Incorporating student interest involves the use of “highly preferred activities or items during instruction to increase student engagement” (). Much like incorporating student and parent choices related to content delivery format and materials, student interests were included by means of reinforcement and activity selection. Parent participants were guided to identify stimuli preferred by students in order to build an inventory of reinforcers to use during structured and incidental instruction. For students with limited communicative abilities, opportunities for reinforcement selection were based on parent and supervisors’ observations during play-based routines, and selecting those toys, objects or otherwise stimuli which appeared to be of their interest. During structured teaching routines (i.e. discrete-trial teaching), reinforcing stimuli would be presented in order for the student to select between two or three choices by reaching for a preferred stimulus. For students able to voice or otherwise indicate their preferences, verbal requests were elicited in order to identify preferences as adequate before teaching moments, and spontaneous requests were acknowledged and granted as appropriate.

Priming is “previewing the student’s future task or activity” (). Mostly used in the context of structured learning, priming was used by *modeling* or prompting target behaviors from once to a few times in a row in order to leverage practice effect before the corresponding instruction was given.

Task interspersal involves “interspersing mastered tasks with new or unknown tasks during instruction”(). This was most frequently used during moments of structured teaching. Such a process was modeled after Lovaas’ description of *mass* and *random rotation* trials (), through which, respectively, targets were initially established in isolation, and subsequently introduced in the context of other previously acquired targets in the context of discrete-trial teaching. Targets acquired through this process were subsequently practiced and recorded in the *review section* for the corresponding intervention goal, and reviewed at set frequencies (i.e. daily) in order to maintain and generalize their application to novel contexts or routines. Appendix () outlines the process of mastery of targets within intervention goals, including required percentages of independent responses to be obtained in order to move a target from isolation to rotation with other mastered targets, and subsequently to the review, generalization and maintenance phases.

Time delay is “providing a brief delay between the instruction and any additional prompting or instructions” (). During structured teaching delays were used after target skills had been seen applied by students during previous teaching moments/drills, in order to provide students to demonstrate such skills in the absence of additional prompting. *Time delay* strategies were crucial to target skill acquisition. In order to be included in task interspersal formats (i.e. random rotation), target skills were most often substantially cued over many trials, followed by a period where prompts were faded, which presented opportunities for time delays to be used in order to elicit independent responses.

Visual prompts are “tools that are presented visually which support students across settings or curricular areas” (). Such prompts took the form of pictures, symbols and written words used to facilitate basic language-based instruction, completion of daily living routines and deliver social communication content. During language-based instruction administered via DTT, visual prompts were used for students who targeted basic language comprehension skills such as following directions, by first introducing targets which included visual supports such as gestures. For example, targets such as “pick up”, “hug me” and “sit down” were often respectively accompanied by pointing at an object placed on the floor next to the student, opening and stretching out the parent’s arms towards the student and gently pointing or signaling towards a chair next to the student. Once a few auditory instructions with visual cues were established as mastered, gradual introduction of non-cued instructions (i.e. “touch your head”, “raise your hand”) followed in order to fade out the use of visual prompts, therefore requiring students to rely solely on the auditory cue in order to perform the target skill.

Instructional strategies

Chaining involves the reinforcement of "individual responses occurring in a sequence to form a complex behavior" (). After identifying complex skill components through a process *task analysis* and subsequently acquired, *chaining* was used to bring these components together in the context of a more complex skill. This often occurred in the context of students with no evidenced use of verbal behavior, who were first taught to imitate, follow directions, sustain attention and engage reciprocally before targeting verbal imitation skills.

Discrete trial training (DTT) is a teaching method that focuses on "small units of instruction where clear cues, prompts and consequences are provided after a student's response" (). It involves the presentation of instructions, followed responses and parent's reactions to such responses in a planned antecedent-behavior-consequence format. After the first study of ABA interventions with a group of autistic children (), Lovaas published *The Me Book: Working with Developmentally Disabled Children*. Since these initial publications the methodology described in these and subsequent works have been used around the world to design individualised intervention programmes for children with ASD. In this work Lovaas describes a model of intervention design which includes task analysis and programme design. Under this model, he outlines how the principles of behavior analysis can be used to teach complex behaviors by first teaching either simpler versions of the target behavior (at times in strictly controlled environments) or by targeting multiple single behaviors required for the fruitful delivery of higher-level interventions (). In the context of play-based intervention could be seen in cases where basic gross motor imitation skills were first taught in order to later target imitation in naturalistic, play-based scenarios. In the context of basic language-based programming a DTT programme may target verbal behaviour by first targeting developmental milestones such as attention, imitation and basic language discrimination skills.

Additional considerations crucial to the effective delivery of DTT interventions () as well as the delivery of behavioural interventions in general () include the manner and timing in which these interventions are delivered. In the case of DTT intervention factors such as latency periods, measured in time between the SD and the response (), spacing between teaching episodes or drills (), and the amount of language included in verbal "instructions" or SDs (), all of which have been studied and identified as factors relevant to learning. These considerations continuously influence interventions from their onset, as they evolve through adaptation of teaching delivery in order to meet learning needs as they evolve, or when teaching proves ineffective ().

Functional Communication Training (FCT) refers to the "replacement of inappropriate behavior that has a communicative function with more appropriate and effective communicative behavior" (Boutot2012, Carr1985). This process incorporates the ABA

technologies functional analysis, *differential reinforcement* and *extinction*. First, through a functional analysis of the target inappropriate communicative behavior, the circumstances under which such behavior is likely to occur are identified. Such *circumstances* refer to stimuli (i.e. visual presentation of a desired object, presentation of a challenging task) which evoke the inappropriate communicative behavior (i.e. nonverbal behavior such as crying). Once the relevant stimuli are identified, the inappropriate communicative behavior is placed on *extinction*, by removing stimuli which reinforces the target behavior. Finally, through a process of *differential reinforcement,* the reinforcing stimuli is "reassigned" (Tiger2008) to the target appropriate communicative behavior. Individualised FCT interventions were designed for students enrolled in the SEC-ETP Project as needed. These interventions were developed through the process previously described, resulting in individualised forms of FCT which applied to student's needs concerning communicative behavior. They were included as *protocols** in each student's IEP, and made available for parents via the *protocols* section of the electronic platform (see chapter four). Through this platform parent participants were able to collaboratively review and update FCT interventions with the guidance and support of their assigned supervisors, by targeting communicative behaviors as they presented during the initial assessment and evolved during the course of intervention.

Incidental teaching refers to that which occurs "in the natural environment using the student's interests, selected reinforcers and natural consequences" (Boutot2012). It has been researched in the context of interventions targeting reading (McGee1986) and expressive language skills in children with ASD (McGee1985, Laski1968), and systematically compared to other ABA interventions such as *discrete-trial training* (Charlop-Christy2020). Incidental teaching interventions were collaborative and individually designed by the parents and supervisors, and included in students' IEPs as *protocols.* Common examples of these interventions include those where implementer's verbal productions were paired with stimuli of the student's interest according to the language level of target verbal productions (i.e. single words vs phrases), or interventions aimed at the generalization of acquired skills during structured learning to contexts of interest to the student (i.e. use of rehearsed conversation questions during opportunities for conversation in naturalistic environments).

Modeling interventions are those which "demonstrate a desired behavior in order to produce an imitative response by the student" (Boutot2012). Their use is based on Bandura's Social Learning Theory (1977) which assumes that imitation is a product of processes of *attention*, *retention, production* and *motivation*, and that behavior is acquired from the environment through observational learning (Bandura1986). The symptomatology of ASD has been long documented to include difficulties in attention (Kasari2006, Sinzig2014), retention (Southwick2011, Kanner1943), production (Manjiviona1995, Cossu2012), motivation (Chevallier2012, Clements2018) and ultimately imitation (Vivanti2014, Edwards2014). Consistent with this, acquisition of

these skills was often a high-priority target for student participants in the SEC-ETP Project who rated low on readings of imitation skills in both structured and naturalistic settings. All of these students were at the preverbal stage of language development (did not use symbolic means of communication), and targeted imitation through the design of *discrete trial* teaching and play-based aimed at difficulties in retention, production, motivation and imitation through interventions such as *discrete trial training*, *errorless teaching*, *child-led play-based interactions*.

Acquisition of increasingly gradual imitation skills allowed the use of *modeling* interventions as prompting strategies during structured and play-based routines, by providing students with a visual example of the target behavior after a particular instruction/SD in order to elicit target behaviors. During structured teaching they were used by parents to prompt responses by demonstrating the expected behavioural responses. Examples of this include the demonstration of gross, fine, facial and oral motor actions to provide the student with an example of a specific verbal (oral or sign language) or social (i.e. providing a verbal example of the expected response after asking a conversation question) behavior after providing an instruction/SD. During play-based and otherwise unstructured routines *modeling* interventions were used to demonstrate target play behaviors (i.e. playing with toy animals in a manner representative of the animals' particular behavior) and generalize application of acquired language and social behaviors to relevant environments (i.e. elicit specific vocalizations when requesting desired items or activities during daily living routines).

Pivotal Response Training (PRT) interventions focus on "family interactions between individuals with autism and their parents and siblings" (Koegel1989) by "targeting pivotal behavioural areas that create collateral changes across skill areas" (Boutot2012). It was developed by Koegel (1989) as a product of research of the delivery of instructions, prompts and reinforcers during naturalistic, child-led interactions (Koegel1987). They are implemented by presenting "questions, instructions or opportunities to respond" in such a manner that a) they clear and appropriate to the task the child is attending; b) they are interspersed with acquired tasks for maintenance and generalization of acquired targets; c) the task is chosen by the child; and d) instructions or otherwise verbalisations include multiple "components", which are the characteristics of the stimulus object of the child's attention (i.e. responding to "here is your big yellow cup" while handing the cup after the child independently brought his attention to it) (Koegel1989). For students in the SEC-ETP Project these were implemented as *protocols*, usually in a generic format which encompassed categories of behaviors; for example, "respond verbally describing the object using 2-3 word phrases" would be included as the *protocol* and "whenever handing (the student) a desired item or activity".

Prompting is the act of "providing help to students that assists in using specific skills" (Boutot2012). *Prompting* interventions have been found effective in teaching a range of skills in multiple contexts. In school settings, combinations of social reinforcement and

prompting procedures have been found effective in increasing social initiations towards peers (Gena2007). Most-to-least and least-to-most prompting hierarchies have been found effective in the context small studies of children diagnosed with ASD learning sports such as tennis and swimming (Yanardağ2011, Yilmaz2010), and studies of these two types of hierarchies have also been compared between small groups of children (Cengher2016, Leaf2016b). *Prompting* interventions can take several forms; they are student and context dependent (Schnell2019) and aim to ultimately elicit independent behavioural responses by the process of *prompt fading* (MacDuff2001). Examples of prompting interventions studied in the context of small groups of children include *positional prompting* used to teach receptive language identification skills (Leaf2016), physical *prompting* (Sabielny2014), *prompting* through the use of visual supports including printed symbols (Johnston2003), *prompting* through video *modeling* (Gardner2013, Kellems2018). Individualised cueing hierarchies have also been studied in the context of teaching daily living skills (Ford2020). In the context of students in the SEC-ETP Project, individualised prompting strategies and cues were designed according to the target behavior, context and student characteristics. Examples of cueing hierarchies include those used during DTT instruction to prompt responses, which was most often recommended on variably flexible most-to-least or least-to-most hierarchies, along with *prompt fading* strategies in order to elicit independent responses (i.e. starting with full hand-over-hand physical prompt for basic imitation tasks).

Shaping is “reinforcing the student for exhibiting gradually closer approximations of a desired behavior” (Boutot2012). It uses *differential reinforcement* by providing versions of the target behavior in order to eventually shape them into intended versions of increasingly complex behaviors. The difference between *shaping* and *prompting*, is that when a behavior is shaped, approximations to the target behavior are reinforced as they are produced independently (without prompting) by the child and when prompted, the responses are elicited based on an instruction or otherwise stimulus produced by the implementer. Shaping has been used to teach discrete behaviors such as eye contact (Fonger2019, Strömberg2021), increase dietary choices (Hodges2017), improve AAC use (Ogletree2007) and shaping stereotypical behaviors into behaviors with purposeful communicative intent (Kahveci2019). *Shaping* interventions for students in the SEC-ETP Project were recommended for use during play-based routines to gradually increase the complexity of play actions. In the context of discrete-trial teaching, shaping was used to reinforce gradually approximating versions of specific target skills during DTT interventions (i.e. differentially reinforcing increases in extension of the arms upwards when targeting “raise your arms” in receptive language/instructions tasks).

Task analysis is a process through which “complex behavior is broken down into its component steps” (Boutot2012). It is used in conjunction with interventions such as with *backwards** and *forward chaining** techniques, *prompt* and *prompt fading* (Hayward2012) with two main purposes: break down complex behaviors into teachable sub-components which can be subsequently chained together, and evaluate an

individual's ability to learn a complex behavior by first evaluating the individual's ability to learn each sub-component (Reeves2013). It has been identified as an important part of *incidental teaching* (Hayward2012), and used to teach specific skills such as sequences of play-based activities (Machalicek2009), toilet training (Lee2014), menstrual care skills through social story interventions (Klett2012), discrete job-related tasks taught via video modeling (Ganz2011) including specific behaviors job-related behaviors such as using word processor functions (Kagohara2012). It has also been researched in the context of teaching functional skills and verbal interaction (Parker2011), classroom related behavior (Reeves2013) and vocal and nonvocal conversation skills such as waiting for a conversation turn, making a statement, looking at the other's face, saying a greeting (Nuernberger2012). *Task analysis* was a critical step in the process of IEP design for students in the SEC-ETP Project; it was used to break down complex tasks such as speaking, having a conversation or written language into smaller steps individually targeted through specific interventions. For example, for a student whose long-term goal was writing down the answers to questions presented after reading a short passage, goals may have been targeted first to develop fine motor skills, teach letter receptive and expressive identification skills and subsequently comprehension and expression of written words, phrases, sentences and paragraphs, and any resulting sub-component may have required further interventions (i.e. letter identification skills may have first required basic shape discrimination skills and auditory discrimination skills). In this manner task analysis was a bridge between parent and parents' expressed needs and concerns and specific interventions designed to target different skills or sub-components of skills, and how it was individually explained to parents before and during the course of intervention during the implementation phase of the project.

Consequence-based strategies

Delayed contingencies is "providing a response to the student's behavior after a designated period of time has passed rather than immediately following such behavior" (Boutot2012). It has been used to target difficulties in impulse control associated with ASD (Whiting2015, Dixon2001), and more broadly to gradually increment the rate of independent target behaviors by individuals with ASD in school and community settings (Dunlap1987, Harrower2001). It is an intervention which takes the form of systematic increases in the time period between a target behavior and the contingent *reinforcement*. In the context of the SEC-ETP Project, *delayed contingency* interventions were often recommended as *protocols* designed to teach increasingly longer periods of tolerance during naturalistic routines (i.e. by waiting to deliver desired items or activities for periods of increasing number of seconds at a time) and in some cases during structured tolerance DTT interventions where the student was asked to wait for a desired item presented visually and within their reach.

Differential reinforcement was discovered through the generative effects of extinction (Lattal2013). It is the "provision of reinforcement for behaviors as they occur in specific times and places, and not others" (Boutot2012). It is an intervention that focuses on the systematic modifications to the magnitude and schedule of reinforcement (Kodak2015) in order to effect intended changes in target behaviors. In play-based interventions it is usually incorporated as a means to reinforce target play behaviors (i.e. visual attention to task) by providing reinforcement (i.e. completion of desired play-based routines), increasing the likelihood of play-based behaviors which can be subsequently reinforced to grow in frequency or complexity. Examples of child-led, play-based models which include interventions based on principles of differential reinforcement include DIR-Floortime (Greenspan) and Parent-Child Interaction Therapy (Zlomke2017). As far as *behavioural* interventions, *differential reinforcement* has been applied for a variety of purposes including production of unprompted responses (Karsten2013 n=2), in combination with *stimulus fading* to treat needle phobia (Shabani2013) and in conjunction with *extinction* to decrease disruptive behavior (Kimball2020, Kodak2015, MacNaul2018). In the context of the SEC-ETP Project, *differential reinforcement* was used in the context of promoting the use of adaptive behavior and functional communication (i.e. by providing different levels of attention based on students' use of vocal language) during daily living routines as well as during moments play-based and structured learning. During daily living routines, parents were trained and guided to provide reinforcement at different magnitudes and schedules contingent on the absence of inappropriate and presence of appropriate communicative or otherwise behaviors, frequently in the context of previously established behaviors learned with a communicative purpose (i.e. disruptive behavior for the purposes of requesting the adult's attention). During play-based routines, *differential reinforcement* interventions were used to increase the occurrence and complexity of target play behaviors, reinforce adaptive behaviors in place of disruptive ones and gradually increase periods of sustained attention. During structured, discrete-trial teaching, they were used as a means to increase the rate of unprompted responses, rate of responses of higher quality over those of lower quality or complexity, and longer periods of sustained engagement.

Extinction leverages principles of reinforcement by means of withdrawing or ending the reinforcer responsible for maintaining a behavior (Pavlov 1927, Boutot2012, Leaf2020). It is a behavioural phenomenon which can be viewed from the procedural standpoint–by focusing on the act of removing the reinforcer–and from the standpoint of its behavioural effects. These effects can be eliminative (i.e. decrease the target behavior) and generative (i.e. by reinforcing behaviors associated in the process). The eliminative effects of *extinction* are not limited to the target behavior, but have also been detected in elimination or decrease of associated behaviors (). As far as its generative effects, these are an indirect result of the behavioural process of extinction; this process is called the *extinction curve,* and refers to the gradual disappearance of the target behavior (Skinner1956). The *extinction curve* is subject to the potential presentation of

other phenomena including *extinction bursts* and different types of *recurrence*. While the term *extinction burst* refers to the "transient increase in response rate that is purported to occur following the onset of extinction" (Nist2021 p. 131), *recurrence* refers to a category of phenomena characterized by the appearance of the target behavior under different conditions (Lattal2009, p.254), which includes *resurgence* and *reinstatement*. *Resurgence* refers to instances "when a previously learned response recurs following a hiatus from that response, during which time some other response first is reinforced and thereafter extinguished" (Lattal2009, p.254). R*einstatement* or *response reinstatement* (Franks1976) refers to instances where "a previously learned response recurs during a period of response-independent delivery of the reinforcer previously used to maintain the response, but after that response first is extinguished" (Lattal2009, p.254).

Extinction has been researched in combination with and in comparison to other behavioural technologies such as *differential reinforcement* (Trump2020), *stimulus fading* (Bishop2012), *shaping* (Wolff1963) and *positive reinforcement* (Banda2009). It has been researched in the context of interventions to increase food choices (Bui2013), to decrease the frequency of interfering behaviors (Wolff2013, Ducharme1994), and (). Behavioural interventions administered to student participants in the SEC-ETP Project often involved the development of protocols to place avoidance, aggression or otherwise disruptive behaviors on *extinction*. Following a *functional analysis* of the behavior and subsequent identification of stimuli hypothesized to maintain it, recommendations were made in order to safely and effectively withdraw identified reinforcers and safely manage the ensuing *extinction curve*. Parents were

[Response interruption and Redirection (RIRD)

- *Response interruption* is an intervention where "an inappropriate behavior is stopped and the individual is redirected through the use of a distractor to do something more appropriate" (Schindler2019).
- SR of RIRD and stereotypy reporting high levels of variation in study design, and RIRD not administered in naturalistic conditions (Martinez2013
- "RIRD and sound-producing competing items are effective methods to treat vocal stereotypy."(Shawler2020)
- To address public masturbation (Cividini2020)
- In the context of reducing SSB by replacing with motor actions (Casella2011), 2 students, did not sustain
- Vocal stereotypy In the classroom setting (Sloman2017)

]

Reinforcement is a "consequence that is likely to maintain or increase the probability that a behavior will reoccur" (Boutot2012)._Pavlov was one of the first to identify and harness the influence over behavior which comes from manipulating the presence or

absence of reinforcing stimuli through a process called classical conditioning (). A reinforcing stimulus is that which when provided contingent on a specific behavior increases the likelihood of its reocurrence (). While classical conditioning refers to the association or transference of value from a reinforcing to a target stimuli or behavior when presented simultaneously, operant conditioning refers to the behavioural change generated by the introduction of reinforcing stimuli () with one key difference: in operant conditioning the reinforcing stimuli is presented contingent on the target behavior, and as such is analyzed as one of its consequences. Both types of conditioning have been a part of human learning since before humankind existed. There is evidence that the principles of conditioning are present all throughout nature (), and that we have learned to adapt to our environment because of them. It is through this phenomena that humankind developed, through a process of learning behaviors that were increasingly adaptive to their environment. Over the course of our evolution these behaviors grew in complexity through a process which allowed us to learn basic life functions as emerging organisms such as eating for sustenance, to complex behaviors as homo-sapiens such as language for the purposes of social communication ().

Programs and Protocols

Programs

Structured activities with clearly defined components, such as what is said by the adult, what is expected from the child, the materials used, short and long-term targets. It usually takes place in the chair by or on the table, even though most programs are eventually generalized so the skill can be used in novel or naturalistic contexts. Programs can be fall within the following categories:

- Daily living skills
- Social behavior
- Communication and verbal behavior
- Receptive and expressive language
- Academic or pre-academic development

Protocols

Prescribed procedures for reactions to specific situations that may arise. They are used in and outside of the therapy session, and may include situations that need specific, consistent reaction procedures such as:

- Communication interactions
- Behavior episodes

- Play-based routines
- Routines of daily living

Relationship Building - Interactive Play

Circles of Interaction
Interactive play periods are composed of circles of interaction. During this time, the adult continuously presents actions, movements, sounds or other types of stimulation in order to measure the child's response. Trust is slowly built between the child and adult when the following happen consistently:

- The adult repeats the actions the child likes
- The adult ceases the actions the child refuses

This is accomplished through circles of interaction. Understanding their components is vital for reading interaction between the child and adults, and making decisions on whether repeating or ceasing actions:

Adult presents action > Child reacts > Adult repeats or stops

Every time the child signaled desire for repetition, followed by repetition by the adult, is called a circle. A minimum of three circles is required before calling the child to the chair, or to any structured activity. Following this guideline ensures a healthy balance between adult-directed and child-directed interactions. This is vital in maintaining a positive atmosphere where a positive relationship is built between the child and his or her therapeutic context.

Building Reinforcement

Building a solid reinforcement selection and using it wisely is critical to any therapeutic session. Reinforcement can occur in any (but not limited to) of the following:

a) proprioceptive (pressure and resistance)
b) vestibular (motion-based)
c) social (verbal praise)

The two key requirements to building reinforcement are the following:

1) Select a minimum of 7 reinforcers.
2) Maintain the selected reinforcers' value by doing the following:

    a) Rotating them with with other reinforcers to maintain novelty
    b) Not allowing the child to receive such reinforcer for any other purposes than for completing the target behavior (this may involve some of the parents'

Guidelines for reinforcement use

1) Deliver reinforcement immediately after or simultaneously with the desired
2) If it is an edible reinforcement, make sure the quantities are small and the child has a chance to consume before next SD.
3) Rotate reinforcers as much as possible.
4) For children with low attention spans, make sure the time spent consuming or enjoying the reinforcer does not exceed 10-15 seconds.
5) Remember, if the child is not reaching or asking for it, it's not a reinforcer!

Remember, reinforcers can be associated with other things, and those things in turn can become reinforcing. For example, for a child that does not particularly enjoy verbal praise (which is more common than we think), you may want to deliver along with a secondary tangible reinforcer, to create a positive association. With enough practice, this may lead to the simply being reinforced by verbal praise.

Attention, Focus and Context

Even with a standardized treatment and assessment structure, we understand we only control half of the clinical interaction. The other half belongs to the child, and it is mostly affected, among other things, by attention, focus and the context. For the purposes of clinical practice, we will define them as:

1) Attention - The child's ability to attend to relevant stimuli without additional cues.
2) Focus - Usually measured in number of seconds or minutes a child can remain engaged in a single task without any redirection of prompt by the clinician.
3) Context - Place of service, people and objects in the room.

* Avoid verbal "attention getters" such as "look" and "pay attention." as these may increase prompt dependence.

* Provide verbal praise or reinforcement in higher intensity/amount when the child attends to important stimuli on his/her own.

* Do not raise your voice, tone or volume as a means to obtain the child's attention.

* If you don't have the child's attention and you are about to start a drill, simply begin by delivering the SD and either prompting immediately after or delivering a consequence such as "almost" after 3 seconds of unresponsiveness.

* Gradually reinforce longer periods of focus by keeping track an average of the child's attention span during each session.

* Even during difficult days, try to only reinforce activities with the most appropriate

* Allow children to become distracted for periods of 1-3 seconds during any structured tasks, if the child does not redirect to task on his/her own, you may prompt. Reinforce independent redirection of focus to the task at hand, as this is also a vital skill for learning and language development.

* Set up your room or area before the session if possible, to remove unnecessary distractions such as certain toys or objects (watch out, sometimes electronic devices can be either extremely reinforcing or extremely distracting, or both).

* Parents should participate as much as possible. However, if another adult is too distracting, you may ask the adult to wait outside the room and gradually increase the time they spend in the room across several weeks or even a single session.

Structured Teaching - Discrete Trial

A drill followed by interactive play should take between 4-5 minutes. As a general rule, there should be at least as much play as there was work after each drill.

This means that a 53-minute session could consist of repeating the described pattern (work-play) about 10-12 times.

Even though discrete trial procedure is usually standard and follow the same guidelines, some children are recommended "loose discrete trial" which is similar in structure but different in content (e.g. saying "please come sit down" or a different phrase every time instead of saying "come here" consistently when calling the child to the chair). Please ask your supervisor if you need help in making this determination.

The following guidelines are designed to assist in running a typical therapy session. Individual recommendations for each child may be specified by the assigned behavioral consultant or speech-language pathologist. Such recommendations would override guidelines in this packet in the event of differences or discrepancies.

The Therapy Session

The session structure for the child with ASD is designed so it can be easily replicated by parents, educators or therapists. It can be administered in short periods (20-30 minutes) or longer sessions (1-3 hours). The length usually depends on how much time a parent or service provider is dedicating to a therapy session at once. Regardless of the time spent working on a therapy session, the general session structure is the following:

1) Interactive Play (5-10 minutes)
2) Discrete trial teaching, interspersed with interactive play
3) Data collection and other documentation (last 5-10 minutes)

A drill followed by interactive play should take between 6-7 minutes total. As a general rule, there should be at least as much play as there was work after each drill. There can be more play than work, but excessive work periods in contrast to length of play periods is not recommended.

A one or three hour session would consist of repeating the described pattern one or three times, respectively.

Even though discrete trial procedures are usually standard and follow the same guidelines, some children are recommended “loose discrete trial” which is similar in structure but different in content (e.g. saying “please come sit down” or a different phrase every time instead of saying “come here” consistently when calling the child to the chair).

The Discrete Trial

EO > SD > (P) > R > C

The Discrete Trial is a 3-part teaching unit is a special behavioral sequence used to maximize learning in developmentally disabled persons.

Why use Discrete Trials?
Makes very clear what you are trying to teach and lets child know when he is right or wrong.
Helps teacher maintain consistency.

Makes assessment of progress (and data collection) easier.

The Five Components of a Discrete Trial

EO = Establishing Operation

The motivation or need for reinforcement, manipulated by periods of deprivation and satiation of reinforcement.

- Must occur before the SD is given.
- Varies from moment to moment.
- It is determined by the child

S^D= Discriminative Stimulus (basic instruction corresponding to the target program)

The instruction or question. It signals that reinforcement is available if the child responds correctly.

Make the SD clear, simple, and loud.
Remove excess "noise" by making SD concise, speaking only the most important words.
Say the whole SD without interruption.
Use the exact same wording and use consistently.
Use consistent format of presenting materials.
Do not repeat the SD ("Do this, Do this, Do this!") without consequating the child's response (or lack thereof).
SD should initially be authoritative and louder than your typical speech, and then faded to more natural language.

R= Response

The child's action in response to an SD.

Use consistent criteria to determine what is considered correct.
Be certain extraneous behavior is absent, like self- stimulatory behavior or multiple responses.
Limit the time between the SD and the response to about 3-5 seconds.

C= Consequence (Reinforcement or standard consequence e.g. “good job” for good responses and “almost” for inaccurate responses)

The consequence following the child's response that changes the likelihood with which the behavior will reoccur. Rewards will increase the behavior, and no reward or a punishment will decrease the behavior.

Use a reward for a correct response, and an informational "almost" for an incorrect response.
Deliver reinforcers immediately following a response.
Typical rewards are praise, affection, attention, tickling, acting silly, physical movement, preferred activities, etc.
Make rewards contingent upon correct response
Larger amounts of reinforcement produce stronger effects, but:
Avoid satiation by using smaller amounts and a variety of rewards.
Differentiate your SR'_5: don't say "almost" in the same tone of voice as "good"; don't smile when you say "almost".
Vary your reinforcers: tickle, shout, hug, make it "circus time"--don't monotonously repeat "good" with the same inflection.

P= Prompt

The stimulus that helps the child achieve the correct response. It must be faded over time.

The prompt should occur at the same time as the SD, or as soon as possible after it (within 3 seconds).
In order to keep the drill successful, prompt the child after, at the most, two incorrect responses.
If the skill is new, prompt every trial.
Types of prompts include Hand over Hand, Physical guidance, physically modeling the response, positioning the correct item closer to the child, verbally modeling the response for the child, Phonemic prompts, instructing the child about the desired response, and emphasizing through inflection the important aspect of an SD (e.g., "Stand up").
Use the least intrusive prompt possible while still achieving a success, such as pointing toward the correct item rather than physically guiding the child's hand to it.
Care must be taken to fade prompts, in order to have the child perform the task independently.
Avoid inadvertent prompts, such as glancing at the correct item, or mouthing the correct answer.

Intertrial Interval
This is the pause between each discrete trial

The intertrial interval should be long enough so each trial is distinct, but not so long that the child loses focus or begins alternative behaviors (about 1-3 seconds).

Prompting and Fading

Definitions
Prompt: additional stimulus, which facilitates responding
Fading: systematic reduction of intensity of prompt

Kinds of prompts
Hand over Hand- Full prompt of motoring child through entire response.
Physical - Physical guidance to the correct response
Modeling -imitation of correct response by the teacher
Verbal instruction - directing the child to the correct response through verbal cues. (e.g., "That one", "The one next to you")
Verbal – Instruction of “Say (word/sound)”
Phonemic – Partial verbal prompt of initial sound (e.g. ca for cat)
Indirect Modeling = indirect demonstration (should be peer, rather than teacher)
Nonspecific - gesture/glance/pointing
Voice inflection - "Touch MY nose"
Recency - short latency, no interference (e.g., responds correctly, give that same SD again so the correct response as a prompt)
Position/proximity = placing the target stimuli closer to the child
Priming - Linking to previously learned response (e.g., receptive as prompt for expressive - giving the receptive SD of "Touch car" just prior to giving the expressive SD of "What is it?")

How to do it
1. Select responses, which are a little higher than present level
2. Choose stimuli that facilitate a correct response
3. Establish prompt sequence/hierarchy
4. Use within-stimulus prompt
5. Make sure prompt is fadeable
6. Present prompt simultaneously with (or immediately after) the SD
7. Start with full prompt and 100% reinforcement
8. Gradually fade prompt
9. Use differential reinforcement (e.g., giving mildly reinforcing rewards for prompted trials and using the more powerful reinforcements for unprompted trials)
10. Once a step is learned, do not use primary reinforcers for prompted trials

Important tips:

Systematically fade the use of the prompt
Don't get child hooked on prompts
Don't allow repeated failures. Help the child to be correct at least 80% of the time
Use graduated prompts and continuously monitor the child’s response to prompts.
Use the least amount of prompts necessary (e.g., do not use a physical prompts if a pointing prompt is sufficient)

Watch for unintended prompts (e.g., looking at the apple while giving the SD, "touch apple")

Shaping
The rewarding of successive approximations.

Used to improve the topography of a child's response so that the response topography matched the desired behavior

Important tips
Is only used after a child has already responded correctly
Reinforcement should occur only after the shaping has occurred.

Mastery Criteria
For mastering targets within a Goal/Program
For most goals/programs:
Each target should be mastered until at least one 100% is obtained in Mass Trial (MT)
Such target is then rotated with other mastered targets from the same program until two consecutive 80% have been obtained - Random Rotation (RR)
After each target is mastered (through both MT and RR) it is placed on review at the specified criteria (usually once per day, or once per session)