THE EFFECTIVENESS OF A CENTRE-BASED EARLY INTENSIVE BEHAVIOURAL INTERVENTION IN A YOUNG CHILD WITH AUTISTIC DISORDER.

By

Nikki Lyn Simons

(200267905)

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SOCIAL SCIENCES IN CLINICAL PSYCHOLOGY

In the School of Psychology

Faculty of Humanities

at the University of KwaZulu Natal

Howard College Campus

SUPERVISOR: Prof. S. Collings

Date Submitted: March 2008

ACKNOWLEDGEMENTS

My sincere gratitude and appreciation goes to the following persons who have played an important role in this project:

- TRIAD (Therapy and Research in Autistic Disorders), and in particular, Mrs. Melanie Harding and Ms. Paola Reggiani, for their consent to be involved in the study and their willing cooperation at all times, as well as the rest of the staff at TRIAD for their hard work.
- The participant's parents for giving their consent for their child to take part in the study and for their time and participation in the caregiver interview.
- Professor Steven Collings, my supervisor, for all his wisdom and support.
- Jason Simons, my husband, for his prayers, unfailing love, and support.
- My family and friends for their prayers, continuing love, care, and belief in me.
- God, my Father and Lord for guiding this research from the very start and walking with me all the way.

DECLARATION

Submitted in partial fulfillment of the requirements for the degree of Masters in Psychology, in the Graduate Programme in Social Sciences, University of KwaZulu-Natal, Durban, South Africa.

I declare that this dissertation is my own unaided work. All citations, references and borrowed ideas have been duly acknowledged. It is being submitted for the degree of Masters in Psychology in the Faculty of Humanities, Development and Social Sciences, University Of KwaZulu-Natal, Durban, South Africa. None of the present work has been submitted previously for any degree or examination in any other university.

_____

Mrs. Nikki Lyn Simons

March 2008

NOTE ON ACCESS TO CONTENTS

I hereby declare that with effect from the date that this dissertation is deposited in the library of the University of KwaZulu Natal, I permit the librarian of the university to allow the dissertation to be copied in whole or in part without reference to me on the understanding that such authority applies to the provision of single copies for study purposes or for the inclusion within the stock of another library.

It is a condition of use of this dissertation that anyone who consults it must recognise that the copyright rests with the author and that no quotation from the dissertation and no information derived from it may be published unless the source is properly acknowledged.

ABSTRACT

While there is considerable evidence that applied behaviour analysis (ABA) is an efficacious treatment for Autistic Disorder (AD) in a controlled research setting, the effectiveness of current applications of ABA in the South African context have not yet been established. The aim of the present study was to evaluate the effectiveness of an intensive ABA programme for a young child with AD. A single case study was conducted using a within-subject, repeated measures, evaluation design. The ABA treatment, an applied verbal behaviour version of ABA (AVB/ABA), was implemented by behaviour consultants and technicians at TRIAD (Therapy and Research in Autistic Disorders): a private centre in Durban, KwaZulu-Natal, that specialises in the behavioural treatment of children with AD. The subject was a young boy, who was diagnosed with AD at the age of 21 months, initiated treatment at TRIAD at 22 month of age, and underwent 20 hours of treatment per week over a 22 month period. Cumulative outcome data across all learning domains was obtained using the standard outcome measure at the centre: the Assessment of Basic Language and Learning Skills (ABLLS). The ABLLS was administered by a senior behaviour consultant on five occasions, namely at baseline (i.e., at 0 months); at various intervals throughout the intervention (at 2, 3, and 14 months); and in the final week of the study period (at 22 months). Results were tabulated and converted into linear graph format by the researcher. In addition, the caregiver was asked to rate the child's progress on a five point Likert scale as a means of establishing the social validity of the behaviour change. Visual inspection of the linear graphs revealed that the subject improved considerably across all ABLLS domains over the 22 month period and the child's caregiver rated that his behaviour had "significantly improved" since the onset of the intervention. In addition, at the end of the 22 month treatment period, the subject was enrolled in a mainstream school with the assistance of an aide and was engaging with same-age peers. The present study thus provides support for the effectiveness of the AVB/ABA programme at TRIAD, contributes to the existing ABA outcome literature, and provides further evidence for the efficacy of the AVB approach to ABA. Furthermore, results confirm the role of predictor variables, such as age at onset, hours of treatment, skill acquisition rates, and parental involvement. Finally, given the gains made in the present study, it is suggested that the initial cost of intensive treatment may be economical in the long term.

TABLE OF CONTENTS

CHAPTER ONE: INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

Autistic disorder (AD) is a lifelong disorder that includes severe social, communicative, and behavioural deficits (American Psychiatric Association [APA]: 2000). In recent years there has been an increased prevalence of diagnosed cases of AD (Taylor, 2006). Appeals for effective interventions for children with AD are related, at least in part, to this increase in prevalence. As a result, numerous interventions have arisen, many of which have limited empirical evidence of efficacy and others that could be harmful to the child (Simpson, 2005). When choosing an intervention for a child with AD, it is essential, not only that an efficacious intervention be employed, but also that the intervention be tailored to cater for the individual needs of the child, and implemented correctly by a team of skilled professionals, in collaboration with the child's parents and family. For this reason, an efficacious treatment is not necessarily effective (i.e., the result are often not generalised to different settings) (Perrson, Perrson, & Sivberg, 2006). Applied behaviour analysis (ABA) has been recognized as having significant and convincing empirical efficacy and support (Simpson, 2005). Although there is considerable evidence that ABA is an efficacious treatment for AD in a controlled research setting, the effectiveness of current applications of ABA in the South African context have not yet been established.

1.2 Purpose of the Study

This research aimed to address two essential problems. First, available treatments for Autistic Disorder (AD) vary considerably in a number of respects, namely: theoretical underpinning (relational, behavioural, or sensory), context (school, centre, or home), implementation (parent or professional), and the intensity of the intervention. Thus referring professionals and parents of children with AD are faced with difficult choices when deciding on the most appropriate treatment for individual children. In South Africa, there is a dearth of centres specialising in the exclusive treatment of children with AD. Most centres or schools provide services for children with a wide variety of disorders diagnosed in infancy, childhood, or adolescence. In such contexts, the approach is not necessarily tailored to the individual child or even to the specific disorder. Furthermore, to the author's knowledge there are no published outcome studies reporting on the fidelity or effectiveness of available interventions in South Africa. This poses problems for professionals who wish to refer

patients and are uncertain of the nature or type of intervention that is employed at a site, with such professionals often having to rely on anecdotal accounts of the effectiveness of the programme.

A second problem relates to the fact that although ABA programmes have been found to provide significant benefit as an early and intensive treatment for AD, only one centre in KwaZulu-Natal, TRIAD Behaviour Consultants (hereafter referred to as TRIAD), provides an exclusive ABA programme for children with AD. Notwithstanding the demonstrated efficacy of ABA, many current behavioural interventions have augmented Lovaas's (1981) original ABA treatment protocol by incorporating procedures supported by subsequent research. Similarly, the ABA programme implemented at TRIAD, is an adaptation of the original Lovaas/ABA protocol and includes an applied verbal behaviour (AVB) component, hereafter referred to as an AVB/ABA programme. Although the core features of AVB arise out of more than 35 years of research and have empirically demonstrated efficacy (Cautilli, 2006), there is a dearth of outcome studies which have assessed the effectiveness of AVB/ABA programmes as a treatment package in producing significant improvements akin to those demonstrated using Lovaas's programmes (Carr & Firth, 2005).

This study aims to address both of these problem areas by providing a detailed case study of the implementation and effectiveness of the ABA programme at TRIAD for a child with AD. Thus, not only is a detailed account of TRIAD's behavioural intervention provided, but the overall treatment effects for a specific child with AD is examined and documented. As a result, parents and professionals are likely to be better informed regarding what can be expected from the service offered at TRIAD, in terms of both the nature of the intervention and its potential treatment effects. Furthermore, this study aims to contribute to the current literature on the use of the AVB/ABA approach (Carr & Firth, 2005).

1.3 Study Design

Given the rapid dissemination and consumer interest in the AVB/ABA approach to the treatment of AD and the absence of published outcome research, in-depth evaluations of treatment effects are required (Carr & Firth, 2005). Carr and Firth recommend additional outcome data in the form of (a) published case studies, (b) published outcome data for multiple cases, and/or (c) experimental or quasi-experimental treatment comparisons. Green, Brennan, and Fein (2002) point out that, although controlled studies provide the most

rigorous and generalisable account of treatment effects, valuable information can be obtained from non-experimental or quasi-experimental evaluations. As this case study was conducted in a clinical setting, it is possible to provide information on treatment effectiveness (i.e., the extent to which the efficacious treatment procedures can be exported from a research to a "real life" setting and combined to form an effective treatment package). The case study design, utilised in the present study, therefore allows for the provision of detailed information on the overall programme and procedures as well as cumulative outcome data across all skills areas for the child under investigation. In addition, unlike experimental designs, treatment is not withheld from the child for purposes of control or extended baseline.

1.4 Research Objective and Hypothesis

The *objective* of the study was to evaluate the effectiveness of the ABA programme at TRIAD on a child with AD in terms of the following six learning domains: a) language; b) social and play; c) academic; d) self-help; e) motor, and f) additional. The main *hypothesis* of the study was that a child undergoing the ABA programme at TRIAD would show continued progress across all learning domains throughout the programme (a period of 22 months) and that this change would be socially valid for the child's caregivers.

1.5 Operational Definitions

For purposes of clarity the main concepts underlying this research are operationalised below:

- *Pervasive Developmental Disorder (PDD)* is the collective term used in this study to refer to the five developmental disorders described in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition,* (*DSM-IV-TR*; APA, 2000).
- *Autistic Disorder (AD)* is one of the PDDs and is characterised by a "markedly abnormal or impaired development in social interaction and communication and a markedly restricted repertoire of activity and interests" (APA, 2000, 70).
- *Behaviour Analysis* is the science of behaviour as revealed through laboratory procedures. This science is based on the principles of operant theory and/or the experimental analysis of behaviour (Baer, 1978).
- *Applied behaviour analysis* (ABA) is the process of systematically applying interventions based on the principles of behaviour analysis to change behaviours of social significance. Although ABA programmes vary somewhat, they include several fundamental principles in that: (a) they attempt to integrate behavioural and developmental approaches; (b) they include the manipulation of stimuli and reinforcers to increase and decrease specific

behaviours; (c) there is an emphasis on positive reinforcement procedures in teaching; (d) they incorporate a functional analysis of behaviour whereby functional relations between environmental events and behaviours are identified; (e) goals and instructional procedures are individualised for each child; and (f) there is a gradual, systematic progression from simple to more complex skills.

- *Lovaas/ABA* refers to the primary ABA programme used by Ivar Lovaas and his colleagues in the original landmark trial of ABA in children with AD (Lovaas, 1987) and was adapted in 2003 to remove the aversive elements used in the original protocol.
- *Discrete Trial Therapy/Instruction (DTT/DTI)* is a subset of ABA that was introduced by Lovaas (1981) and refers to the basic teaching unit that is delivered in one-to-one instruction.
- *Applied verbal behaviour (AVB)* is Michael and Sundberg's (2001) application of Skinner's (1957) classification of verbal behaviour to teaching language acquisition to children with AD.
- *AVB/ABA*: AVB/ABA refers to ABA programmes with a predominant focus on Skinner's classification of language, using behavioural principles and techniques, with a combination of discrete trial instruction and natural environment teaching (NET) (Kates-McElrath & Axelrod, 2006).
- *Early Intensive Behavioural Intervention (EIBI)* is a general term referring to all ABA-based interventions for AD. Current research reveals that best results from behavioural interventions are found if the onset of the intervention is *early* i.e., between the ages of two and three years and if the intervention is *intensive* i.e., between 20 and 40 intervention hours per week.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This literature review aims to introduce the reader to the Pervasive Developmental Disorders (PDDs), namely Autistic Disorder (AD), Aspergers Disorder (AS), Childhood Disintegrative Disorder, Rett's Disorder, and PDD Not Otherwise Specified (PDD NOS). A discussion of the respective diagnostic criteria and defining features of each PDD with particular emphasis on AD will be provided. Probable aetiologies for AD and common interventions are discussed. As the focus of this study is ABA, the remainder of the review will expand on behavioural interventions for AD and will include a discussion of general behavioural theory, the application of behavioural theory to behaviours of social significance (ABA), and the behavioural theory of AD. The fundamental trials of ABA in AD will be reviewed including the factors that influence an ABA intervention as well as some critiques of ABA research.

2.2 Pervasive Developmental Disorders

The DSM IV-TR (APA, 2000) uses PDD as the umbrella term to describe a group of developmental disorders that "are characterised by severe and pervasive impairment in several areas of development: reciprocal social interaction skills, communication skills, or the presence of stereotyped behaviours, interests, and activities" (APA, 2000, 69). Autistic Disorder (AD) is the best recognised and most frequently occurring form of the PDDs along with AS, Rett's Disorder, Childhood Disintegrative Disorder, and PDD NOS (Siegel, 1996). Many parents and professional organisations have preferred to use the collective term, Autistic Spectrum Disorder (ASD) to describe the above five diagnostic categories, suggesting that instead of distinct and separate diagnoses they lie somewhere along a continuum of autistic behaviours (Corsello, 2005). Essentially, ASD and PDD refer to the same five disorders (Siegel, 1996).

2.2.1 Autistic Disorder

Autistic Disorder was first described by Leo Kanner, in 1943, in his case studies of 11 children who he said were basically normal but had withdrawn into their own world (Corsello, 2005). He classified these children as Autistic and provided specific diagnostic criteria (Freeman, Cronin, & Candela, 2002). Since then, a substantial research base has developed, yielding an improved understanding of AD, albeit deficient in a number of areas. According to the APA (2000), a diagnosis of AD is made when an individual presents with

impairments in three broad areas of functioning. First, qualitative impairments are found in reciprocal social interactions as seen by a marked impairment in the use of multiple nonverbal behaviours; a failure to develop peer relationships appropriate to developmental level; a lack of spontaneous seeking to share enjoyment, interests or achievements with others; and/or a lack of social or emotional reciprocity. Second, qualitative impairments in communication evidenced by a delay in, or lack of, the development of spoken language; marked impairment in the ability to initiate or sustain a conversation despite adequate speech; stereotyped or repetitive use of language or idiosyncratic language; and/or a lack of varied spontaneous make-believe play or social imitative play appropriate to developmental level. Third, a restricted, repetitive, and stereotyped pattern of behaviour, interests, or activity that is characterised by an encompassing preoccupation with one or more stereotyped, and restricted patterns of interest that are abnormal either in intensity or focus; an apparently compulsive adherence to specific non-functional routines or rituals; stereotyped and repetitive motor mannerisms; and/or a persistent preoccupation with parts of objects. Impairment should be evidenced prior to age three in social interaction, language, or symbolic or imaginative play. Lord (1995) demonstrated that children as young as two years can be reliably diagnosed but often are not diagnosed due to the variability in behaviours of two year olds who have AD and the frequent onset of repetitive behaviour after three years of age.

2.2.2 Aspergers Disorder (AS)

Ten years after Kanner's description of AD, Asperger described a group of four boys who had problems with social interaction, communication, and idiosyncratic patterns of interest. Although they did not display delayed speech, these boys had social deficits that appeared later, intense absorption, stereotyped interests, clumsy motor movements, and odd postures (Freeman et al., 2002). Unlike Kanner, Asperger did not delineate specific diagnostic criteria for AS, which has resulted in more than fifty years of dissention over the prototypical presentation of AS. Descriptions of children with similar deficits to those described by Asperger include: AD, schizoid personality disorder, and nonverbal learning disorder (Freeman et al., 2002). It was only following the field trials for the DSM-IV that AS was included as one of the PDDs (Freeman et al., 2002).

According to the most recent edition of the *DSM*-IV, like AD, a diagnosis of AS is made when qualitative impairments in social interaction are present as well as a restricted repetitive and stereotyped pattern of behaviour, interests, and activities (APA, 2000). However, for a

diagnosis of AS to be made there should be no clinically significant delay in language, cognitive development, the development of age appropriate self-help skills, adaptive behaviour, and curiosity about the environment (APA, 2000). Although individuals with AS develop language, their speech tends to lack content and is often stereotyped and monotonous (APA, 2000). Socially, these individuals tend to lack common-sense and often display over-sensitivity to criticism frequently resulting in inappropriate temper outbursts when corrected or reprimanded (Sadock & Sadock, 2003). Adaptive functioning is typically within normal limits but there is often an associated motor clumsiness or motor delay (Sadock & Sadock, 2003) with a frequent comorbid Attention-Deficit Hyperactivity Disorder (Freeman et al., 2002). As intelligence is generally in the normal range, individuals with AS can actually complete their schooling and often excel at certain tasks, like memory games and music (Sadock & Sadock, 2003) and are often hyperlexic (i.e., exceptionally good readers at an early age) (Heilbroner & Castaneda, 2006). Aspergers is found in a ratio of ten males to one female (Taylor, 2006).

In spite of AD and AS being regarded as two distinct disorders in the *DSM-IV-TR* (APA, 2000), the distinction is challenged by a number of researchers who propose a dimensional spectrum approach to the disorders that consists of subgroups rather than categorically distinct diagnoses (Freeman et al., 2002). Freeman et al. highlight that research on the differences between AS and AD has been diverse. They show that some studies have revealed that AS and AD have similar deficits in terms of nonverbal communication, nonverbal cognition, motor development, imagination, imitation, awareness of social rules, spontaneity, and the ability to accommodate change. In addition, both AS and AD individuals display stereotypic movements, a figurative understanding of language, and language and communication problems of varying degrees (Freeman et al., 2002). However, other studies have pointed out differences in cognitive development, severity of PDD symptoms, adaptive behaviour deficits, language competencies, imagination impairment, and incidence of co-morbid ADHD. It has been argued that although these differences do exist they are more prominent early in development as AD individuals appear to have more severe symptoms during childhood and AS individuals tend to have fewer significant delays, or milder symptoms, that are often identified later in development (Freeman et al., 2002). Whether AS and AD exist along the same spectrum or whether they are separate diagnostic categories with their own separate spectrums is still an interesting research debate. However

for purposes of diagnostic conformity and consistency, the specification of two distinct diagnostic categories by the *International Classification of Diseases-10th Edition* (ICD-10; World Health Organisation [WHO], 1993) and *DSM-IV-TR* (APA, 2000), will be utilised in this research project.

2.2.3 Rett's Disorder

Rett's disorder is a fatal degenerative disorder that is described in the *DSM-IV-TR* as the development of multiple specific deficits following a period of normal functioning for the first two to four years of life (APA, 2000). A period of normal functioning - as manifested by normal prenatal and perinatal development, normal psychomotor development, and normal head circumference - is followed by all of the following: (a) deceleration of head growth; (b) loss of previously acquired purposeful hand skills and the subsequent development of stereotyped hand movements; (c) early loss of social engagement; (d) appearance of poorly coordinated gait and trunk movements; and (e) severely impaired expressive and receptive language development with severe psychomotor retardation (APA, 2000). Children with Rett's disorder therefore rapidly deteriorate neurologically, develop seizures, and become severely or profoundly mentally retarded, spastic, and ataxic (Heilbroner & Castaneda, 2006). Rett's Disorder has only been observed in females (Sadock & Sadock, 2003) with diagnosed individuals having a life expectancy of approximately 20 years (Heilbroner & Castaneda, 2006). Cheadle et al. (2000) found that a specific gene is linked to Rett's Disorder (cited in Corsello, 2005). For this reason, Heilbroner and Castaneda posit that Rett's Disorder has nothing to do with AD and suggest that it should not be included as a PDD in the DSM-IV-TR and should not be considered to be part of the autistic spectrum of disorders.

2.2.4 Childhood Disintegrative Disorder

Childhood Disintegrative Disorder is characterised by a prolonged period of apparently normal development for at least two years that is followed by a developmental regression of previously acquired skills such as language (expressive and receptive), social skills or adaptive behaviour, bowel and bladder control, play, or motor skills (APA, 2000). In addition, deficits in areas of social interaction and communication develop as well as the presence of restricted and repetitive behaviours and interests (APA, 2000). This is a very rare disorder with reported prevalence rates of 0.6 per 100 000 (Corsello, 2005).

2.2.5 Pervasive Developmental Disorder Not Otherwise Specified

According to the APA (2000), the term PDD-NOS is used to describe individuals with a severe and pervasive impairment in the development of reciprocal social interaction. This impairment is usually associated with impairment in either verbal or nonverbal communication skills as well as the presence of restricted and repetitive behaviour. In addition, the associated features of a PDD are present. However, the criteria are not met for a specific PDD (i.e., AD, Aspergers Disorder, Childhood Disintegrative Disorder, or Rett's Disorder). PDD-NOS is more common than AD but often differs in terms of the age of onset of the symptoms or a loss of a specific skill may be deviant to what is required from a PDD (APA, 2000). There is some controversy about this diagnosis regarding whether it is "almost autism" or "atypical autism" (Corsello, 2005).

2.3 Epidemiology of Autistic Disorder

A review of epidemiological studies by Taylor (2006) revealed that AD has been shown to affect men more than women in a ratio of approximately four males to one female. This prevalence is reduced somewhat when there are associated cognitive impairments. Approximately 70% of AD cases are associated with learning difficulties or mental retardation. The most recent population-based survey by Fombonne in 2003 (cited in Taylor, 2006) showed a prevalence of 40 to 60 cases per 10 000 children which is substantially higher than earlier rates of only four to ten affected individuals per 10 000. In 2004, the extrapolated prevalence rate for AD in South Africa was 88 896 individuals with an incidence of 490 new cases every year (Statistics by country for autism, n.d.). Although there appears to be an increasing prevalence of the disorder this is likely to be the result of previous under-diagnosis of the disorder, an increase in public awareness of the disorder, and improved diagnostic tools which have resulted in an earlier age at diagnosis, fewer missed diagnoses, and diagnostic substitution or transfer (Taylor, 2006). For these reasons, and based on a number of incidence studies over recent years, it appears that although the prevalence rates of AD are increasing this does not necessarily represent an increase in the incidence of AD (Taylor, 2006).

2.4 The Aetiology of Autistic Disorder

2.4.1 Genetic factors

A substantial amount of research suggests that there is a strong genetic component to AD, but that the mode of inheritance seems to be relatively complex, involving the interaction of three to more then fifteen genes (Lauritsen, Pedersen and Mortensen, 2004). Studies have shown that PDDs, especially AD, AS and PDD-NOS, are more commonly found in probands than in the general population (Robertson, 1996). The rate of PDDs in monozygotic twins is between 36% and 96%, in dizygotic twins between 0% and 27%, and in siblings between 2% and 4% (Sadock & Sadock, 2003). These statistics are approximately 50 times higher than in the general population. In addition, many studies have revealed that siblings of individuals diagnosed with PDD may also exhibit various language and cognitive impairments, but that these are less severe than those of the affected individual (Sadock and Sadock, 2003). Lauritsen et al. (2004) state that a child's risk of AD is almost twice as high if the child's mother has been diagnosed with a psychiatric disorder.

2.4.2 Neurological Factors

A child diagnosed with AD may have innate neurological dysfunction usually related to limbic and/or cerebellar dysfunction (Lee, Lopez-Alberola, & Bhattacharjee, 2006). Animal models indicate that lesions in the hippocampus, medial temporal lobe, and amygdala can lead to a number of typically autistic behaviours such as increased passivity, tantrums, fewer social contacts, active withdrawal; emotionally expressionless faces, as well as more self-directed behaviour and motor stereotypies (Lee et al., 2006). These symptoms have also been observed in individuals with limbic system damage (Lee et al., 2006). Similarly, animal studies have revealed that defects in cerebellar functioning are linked to language disorders and autistic behaviours (Lee et al., 2006). Further to the link between autistic symptoms and the cerebellum and limbic lobe, Lee et al. demonstrate that the cerebellolimbic pathway is abnormal in individuals with AD. In addition, it has been observed in some children with AD that there are certain biochemical abnormalities, such as an elevation of their serotonin and dopamine levels. A South African study concluded that individuals with AD have a higher frequency of the S allele in their genotype which points towards higher serotonin levels (Esau, Kaur, Adonis, & Arief, 2006). However, despite much research over the past few years, the exact neurobiological mechanisms causing PDD still remain unclear.

2.4.3 Congenital, Prenatal and Perinatal Factors

Hyde and Hooper (1992) suggest that a range of prenatal and perinatal complications are associated with AD. Changes have been described in the brains of some children with AD that could only have occurred in the first trimester of pregnancy. Some imaging studies have shown a probable increase in white matter and a possible myelin abnormality together with other abnormalities from the early embryonic stage of development (Taylor, 2006). There have been cases where maternal bleeding and meconium have been observed in the amniotic fluid and there are many cases where the pregnant mothers have experienced physical or psychological traumas which could affect the development of the foetus. In addition, a high incidence of substance abuse and medication usage have been recorded in mothers with children diagnosed with AD which are believed to result in neonatal respiratory distress syndrome and anaemia (Sadock and Sadock, 2003). There is also a high incidence of complications at birth such as anoxia in individuals with AD (Sadock & Sadock, 2003). The disorder has also been associated with a number of medical conditions which include Fragile X, Tuberose Sclerosis, and congenital Rubella (Hyde & Hooper, 1992), but it is important to note that these medical conditions are associated with no more than 5% to 6% of AD cases (Taylor, 2006).

2.4.4 Post-natal Factors

Despite strong evidence of prenatal abnormality, post-natal environmental agents have also been implicated in the cause of AD (Taylor, 2006). In recent years, vaccines, and in particular the MMR vaccine (against measles, mumps, and rubella), have been postulated to play a role in triggering AD by bringing about a dysfunction in the immune system although interacting with a genetic susceptibility at a critical phase of development (Taylor, 2006). Additionally, the mercury preservative in vaccines, thiomersal, has been hypothesised to cause, or prime, an individual for AD (Taylor, 2006). As numerous studies have disproved the links between AD and the MMR vaccine and thiomersal, little credence is currently given to these theories in the scientific community (Taylor, 2006). Ash (2006) showed that AD could be an immune mediated inflammatory disorder as many individuals with AD have an altered cytokine balance and a history of gastrointestinal problems, both of which point towards a loss of immunological tolerance. This area does, however, require further investigation (Ash, 2006)

2.5 Interventions for Autistic Disorder

The uniqueness of children with AD, and their inherent heterogeneity, has given rise to the development of a myriad of interventions, many of which are supported by mere anecdotal evidence at best, with minimal empirical evidence of efficacy. Moreover, several of these theories and approaches to intervention have displayed a significant deficiency of benefit and others have been confirmed detrimental to the child (Sicile-Kira, 2003). Notwithstanding these findings, several well established and empirically substantiated interventions have arisen and evolved, and children with AD, diagnosed early and exposed to some of these consistent and structured intervention programs, can be expected to make significant progress (Simpson, 2005). Some of the more popular treatments, in particular those that are presently available in the South African context, will be discussed briefly.

2.5.1 Psychodynamic Therapy

Psychodynamic theorists posit that AD arises as a result of a defective self-structure or an attachment disruption between mother and child which results in an autistic defense (Lovaas & Smith, 1989). The most common psychodynamic treatments for AD include relationship therapy and holding therapy. Relationship therapists posit that a defective self-structure can be normalised by refraining from placing demands on the *sick* child, by accepting the child unconditionally and using fantasy and play as a means of reaching out to the child. In this way the self is expected to emerge and through relating with this healthy part of the child growth is encouraged (Bettleheim, 1967, cited in Lovaas & Smith, 1989). Another form of psychodynamic therapy; Holding Therapy, is based on the theory that AD results from a broken symbiotic bond between mother and infant and (a) propagates that body contact and physical contact must be re-established with the child who is refusing to make eye contact with the parent and (b) aims to improve the attachment between mother and child by having the mother forcibly hold the child to convey the message to her child that she is available (Lovaas & Smith, 1989). This action is assumed to alleviate the child's rage and terror, repair the severed bond, and break down the autistic defense (Sicile-Kira, 2003). Few studies have shown success with this approach and some critics even suggest that detrimental effects may occur (Sicile-Kira, 2003).

2.5.2 Sensory Motor Treatments/Sensory Integration

Govender (2006) reported that 95% of children with AD have sensory modulation difficulties and note that several authors have suggested that sensory processing problems are a primary

deficit underlying AD. Sensory processing difficulties include (a) the inadequate registration of stimuli, which leads to the child ignoring relevant aspects of the environment; (b) faulty modulation resulting in perceptual distortions such as hypo- and hyper-reactivity; and (c) failure of sensory input to trigger positive affective responses, which causes the child to avoid new sensori-motor activities because mastery of those tasks is not intrinsically pleasurable (Govender, 2006). In addition to sensory difficulties, many children with AD have motor performance difficulties that include fine motor difficulties; generalised hypotonia with hyper-extensibility of some joints; poor postures; uneven gait; and poor execution of activities requiring bilateral movements (Govender, 2006). Both sensory integration and sensory-motor treatments aim to address these deficits. Schaaf and Miller (2005) state that the theory of sensory integration holds that (a) sensori-motor development is an important platform for learning; (b) the interaction between the individual and the environment shapes brain development; (c) the nervous system is capable of change (plasticity); and (d) meaningful sensory-motor activity is a powerful mediator of plasticity. According to Govender, the primary goal of sensory integration is to facilitate adaptive behaviour by providing appropriate, graded sensory experiences for the child. In spite of more than 80 studies measuring some aspect of the effectiveness of sensory integration, controversy still exists as empirical consensus has not yet been reached about the effectiveness of the approach (Schaaf & Miller, 2005). Schaaf and Miller report that meta-analyses of sensory integration outcome studies conclude that about half of the studies demonstrate some treatment effectiveness and some have shown it to be equally effective to other approaches.

2.5.3 Picture Exchange Communication System (PECS)

The Picture Exchange Communication System (PECS) is a practical communication system, co-developed twenty years ago by Andy Bondy (clinical psychologist) and Lori Frost (speech and language therapist), which allows a child to express needs or desires without being prompted, using a picture-exchange system (Baker & Frost, 2006). The first PECS training workshop was held at the Vera School in Cape Town in 2004 and PECS is currently used in a number of special education and behavioural programmes around South Africa. The system is based on Bondy's ABA approach and makes use of behaviourally based instructional techniques to implement the programme, such as prompting, shaping, and fading (Baker & Frost, 2006). It has been shown that this alternative form of communication does not affect the child's ability to acquire and use speech, as many children who began with PECS go on to develop verbal language (Sicile-Kira, 2003). In essence, it provides a means of

communication for children who have no or limited verbal language. As the child learns the benefits of communicating their needs, there is an expectation that there will be a shift to more verbal forms of communication over time.

2.5.4 TEACCH

The Treatment and Education of Autistic and related Communication Handicapped Children (TEACCH) is a classroom-based model which was developed by Eric Schropler, in the early 1970s, at the University of North Carolina at Chapel Hill (Sicile-Kira, 2003). There are few sites in South Africa that make exclusive use of a TEACCH approach. One such site is the Vera School in Cape Town, which is the oldest of only five government schools in South Africa catering for learners with AD. It involves the teaching of functional skills, especially vocational preparation, and employs a number of visual materials, aligning the therapy more with the visual learner rather than the auditory (Sicile-Kira, 2003). This approach is also dependant on a strong parent-professional collaboration. A significant difference between TEACCH and other ABA approaches is the adaptation of the environment to facilitate the needs of the individual in order to create a stress free environment. Many natural stressors are removed which elicits the criticism that the therapy is unnatural and may prevent generalisation of skills. According to Sicile-Kira, it may be more about making it easier for the teacher. The effectiveness of TEACCH has been validated in a number of studies although there is a lack of research in terms of individual gains (Sicile-Kira, 2003). It was rated as a promising practice as an intervention for PDDs by Simpson (2005).

2.5.5 Special Education

In South Africa, there are numerous special schools that cater for children with various disorders usually diagnosed in childhood and infancy, including PDDs, mental retardation, learning disorders, and ADHD. Very few of these schools have specialist units for children with AD and even less specialise exclusively in the treatment of children with AD. As the special education model of service delivery often involves the integration of children with varying disorders or deficits in a classroom type format, with several children to one adult, it is argued that this context often fails to meet the educational needs of some children with AD due to limited direct instruction, insufficient generalisability of treatment effects from the classroom to the home, and a failure to sufficiently train and include parents in the treatment (Anderson, Avery, DiPietro, Edwards, & Christian, 1987). Furthermore, in order to cater for the variety of needs in each classroom, intervention is often generalised and eclectic.

Limitations of eclectic treatment are highlighted by Eldevik, Eikeseth, Jahr, and Smith (2006) who compared a group of children with AD receiving eclectic treatment with a similar group of children receiving behavioural intervention. The eclectic intervention group showed a decline in IQ, language, and adaptive behaviour after two years compared to the behavioural intervention group who made significant gains in intellectual functioning, language comprehension, expressive language, and communication (Eldevik et al., 2006). It is therefore possible that many special education contexts are unable to provide the individualised, exclusive, and intensive treatment required to bring about change in children with AD.

2.5.6 Psychopharmacological Treatment

Since the 1960s a broad literature base has developed regarding the psychotropic treatment of individuals with AD. Posey and McDougle (2000) provide a review of numerous trials that have been conducted with a wide range of commonly prescribed psychoactive medications. Low-potency antipsychotics have been demonstrated to reduce motor hyperactivity and aggression in children and adults with AD, but have strong sedating effects at high doses. The high potency antipsychotic, haloperidol, has proven efficacy for reducing hyperactivity, aggression, and stereotypies, in children with AD, but is commonly associated with extrapyramidial side-effects and is yet to be researched in adults. Newer atypical antipsychotics, such as risperidone, have been shown to be effective in reducing aggression, irritability, and repetitive phenomena in adults with AD. In addition, they are less likely to cause dyskinesias than haloperidol but have been associated with weight gain. Fluvoxamine (a Selective-Serotonin Reuptake Inhibitor) has been shown to be safe and effective for adults with AD in treating irritability, aggression, repetitive behaviour, and possibly some aspects of social behaviour. However, further studies are needed to demonstrate similar efficacy in children with AD. Clonidine has also been shown to have a significant advantage over a placebo in improving hyperactivity and irritability. Psychostimulants such as methylphenidate have been shown to reduce hyperactivity in AD but the possibility of AD specific adverse effects need to be researched further (Posey & McDougle, 2000). In spite of the numerous studies available, there is still no cure or first line medication for AD. Instead psychopharmacological intervention has been found to be useful for symptomatic treatment and as an adjunct to other interventions for treating AD. By reducing the severity of problematic behaviours, medication is able to provide a platform for other interventions to proceed more effectively (Posey & McDougle, 2000).

2.5.7 Behavioural Interventions

Interventions based on behavioural principles are arguably the most widely known and sought after interventions for AD (Corsello, 2005) and the efficacy of behavioural intervention programmes has been confirmed through a large number of empirical investigations (Kates-McElrath & Axelrod, 2006). Behavioural interventions are grounded in behaviourism and its application to behaviours of social significance (ABA). As the focus of this study is the effectiveness of an ABA programme, it is essential to elaborate further on the foundations of this approach to treating individuals with AD. Thus, a discussion of behaviour analysis and ABA ensues. In addition, the ABA programme used in this study will be elaborated on in some detail. Finally, a review is provided of outcome research for ABA as an intervention for AD.

2.6. Behaviour Analysis

The present study is rooted in the behaviourist approach as its theoretical framework. Lovaas (1981) likened the area of behaviourist research to pyramid building, whereby all new research adds another stone to the pyramid. Each researcher or "pyramid builder feels that knowledge can best be gained by several persons working together, where each piece of information is sought to compliment or strengthen other pieces of information, where higher levels are built after lower levels are secured" (Lovaas, 1981, xii). The foundations of the behavioural pyramid are based on more than 50 years of empirical study, and continue to evolve, as other stones are added (Maurice, Green, & Luce, 1996). This pyramid however, is far from complete. The firm foundations of ABA are found in B.F. Skinner's (1957, 1974) scientific philosophy of radical behaviourism, operant conditioning, and verbal behaviour. However, before a discussion of Skinner's theoretical standpoint can be provided it is essential to acknowledge the influence of J.B. Watson and I.P. Pavlov on Skinner's thinking.

2.6.1 Pavlov

Pavlov's contribution to the field of ABA lies in his work on conditioning. Although working on a digestive study, Pavlov noticed that dogs salivated not only before meat was given, but also on hearing the footsteps of the attendant bringing the meat (Watson, 1979). Pavlov thus initiated a study whereby he repeatedly paired the presentation of food with a tone. After repeated pairing of the tone and food, the dogs became conditioned to salivate on hearing the tone alone (Nye, 1992). The way in which a neutral stimulus (tone) became a conditioned stimulus became known as classical (Pavlovian) conditioning. Pavlov's

conditioning (stimulus elicits response) focused primarily on reflex responses whereas Skinner's form of conditioning assumes a more active and voluntary role by the subject (Nye, 1992).

2.6.2 Watson

Watson, the founder of Behaviourism, demonstrated that human behaviour could be classically conditioned and that some human problems could be established or cured through the use of conditioning procedures (O'Donohue & Ferguson, 2001). In his controversial study with a young infant named Albert, Watson paired a loud fearful noise with a white rat and succeeded in conditioning Albert to fear the rat. Although Skinner's radical behaviourism will be discussed in further detail below, it is important to mention that it differed from Watson's methodological behaviourism in the following critical ways: (a) Watson ignored the role of genetics in defining an individual; (b) Watson relied upon the theory of classical conditioning and, like Pavlov's stimulus-response psychology, did not address emitted behaviour; (c) Watson assumed that humans have no or few distinguishing characteristics; and (d) Watson focused primarily on overt actions and ignored covert behaviours in his psychological theory (O'Donohue & Ferguson, 2001).

2.6.3 Skinner's Radical Behaviourism

Skinner designated his psychological philosophy *radical behaviourism* and proposed that the proper subject matter of psychology is behaviour and one should look to both genetics and the environment for the causes of behaviour (O'Donohue & Ferguson, 2001). Skinner proposed that although genes influence behaviour, each person's environmental experiences shape and maintain many of his/her characteristic behaviours (Nye, 1992). Skinner's definition of behaviour included both overt behaviour (behaviour that can be seen by others) and covert behaviour (behaviour that cannot be seen by others, such as cognitions). His basic premise was that all behaviour is determined or caused by something and that the role of psychology is to discover cause-and-effect relationships (otherwise known as functional relationships) between environmental events and behaviour (O'Donohue & Ferguson, 2001). According to Skinner's radical behaviourism, psychology is a branch of biological science that should be studied and tested scientifically. For this reason he termed the science of radical behaviourism the experimental analysis of behaviour. According to Skinner, behaviour can be analysed experimentally by identifying general laws of conditioning through studying an individual's responses under controlled conditions, and he suggested that

behaviour should be studied by manipulating environmental variables that precede and follow it to attempt to identify functional relationships between the variable and the behaviour (O'Donohue & Ferguson, 2001). His experiments thus consisted of an independent variable that was purposefully manipulated whereas all other variables were held constant as a means of assessing if manipulation of the independent variable brought about changes in the dependent variable.

Although Skinner's focus was psychology and human behaviour, for ethical reasons most of his studies were conducted with rats and pigeons, and were based on the assumption that findings could to some extent be generalised to humans due to a degree of universality between the behaviours of animals and humans (O'Donohue & Ferguson, 2001). Skinner studied the behaviour of animals in what he called an operant chamber or what has become more widely known as the Skinner box. This boxlike structure contained one or two features that the animal could manipulate as well as a mechanism to provide reinforcers or punishers. This controversial method of studying behaviour has received much criticism over the years. Nonetheless, the theory and techniques brought about as a result of Skinner's research have proved indispensable to the field of ABA; and current behaviour analysts almost exclusively lean towards his philosophy of radical behaviourism (O'Donohue & Ferguson, 2001). The essential aspects of Skinner's work, namely his theories of operant conditioning and verbal behaviour will be explicated in more detail.

2.6.3.1 Operant Conditioning

Although Skinner's work was informed by Pavlov's theory of classical conditioning, Skinner focused less on innate behaviour (where the behaviour and its controlling variables originate in the history of the species) or reflexive behaviour (behaviour that can reliably be elicited by some stimulus) and more on the conditioning of what he called operant behaviour. Skinner's use of the term operants refers to behaviours that "operate" or act on the environment to produce consequences; and the changes in behaviours (operants) due to their consequences refers to operant conditioning (O'Donohue & Ferguson, 2001). Operant behaviour differs from innate or reflexive behaviour in that it is voluntary or learned behaviour that is strengthened or controlled by its consequences (Skinner, 1974). Therefore, unlike Pavlov's classical conditioning, where a stimulus is followed by a response, Skinner's theory of operant conditioning requires a response to be emitted before it can be reinforced.

Skinner highlighted a number of behavioural phenomena that occur regularly and play a role in operant conditioning. These occurrences include reinforcement, reward, punishment, aversive control, generalisation, discrimination, and shaping. Skinner and many other behaviourists who followed him have successfully applied these phenomena to improving undesirable human behaviours and they form the cornerstone of ABA. For this reason it is necessary to provide a brief overview of these essential behavioural phenomena.

2.6.3.1.1 Reinforcement

Reinforcement occurs when environmental consequences serve to increase, decrease, or maintain the behaviour they follow. Positive reinforcement strengthens any behaviour that produces it and negative reinforcement strengthens any behaviour that reduces it (Skinner, 1974). Positive reinforcement will increase the behaviour by adding a positive reinforcer to the individual's environment and negative reinforcement achieves the same aim but through removing the negative reinforcer from the environment. Positive reinforcement occurs when behaviour is increased because its resulting consequence is desired by the individual and negative reinforcement occurs when behaviour is increased in order to escape or avoid an undesirable consequence.

2.6.3.1.2 Positive reinforcement and reward

Positive reinforcement, unlike reward, does not necessarily suggest a positive experience for the individual, as often a neutral albeit desired response is sufficient to reinforce behaviour, for example, when pushing a pen on a page of paper, the ink mark produced reinforces the action, which results in continued writing. Rewards can be but are not always reinforcers, for example; a father spending quality time with his son could reinforce the son's desirable behaviour far more than simply giving him expensive clothes.

2.6.3.1.3 Negative reinforcement, punishment, and aversive control

Negative reinforcement differs from punishment as it is not necessarily a negative experience for the individual but instead the behaviour is reinforced through the removal of the consequence. The term *positive* thus denotes the addition of the consequence and *negative* the removal of the consequence. Similarly, positive punishment refers to the addition of a punisher and negative punishment denotes the removal of a positive consequence (O'Donohue & Ferguson, 2001). A further distinction between reinforcement and punishment is that reinforcement aims to strengthen behaviour whereas punishment aims to suppress behaviour (Nye, 1992). In general, Skinner was opposed to the use of punishment for the following reasons: (a) unlike positive reinforcement, punishment often does not have a

permanent effect; (b) punishment frequently results in oppositional behaviours that are equally undesirable such as running away, retaliation, or complaining; and (c) punishment can result in emotional responses such as fear, guilt, or shame (Nye, 1992). However, although Skinner argued strongly against the use of punishment and promoted the use of positive reinforcement as an alternative, he did acknowledge that in extreme and exceptional circumstances punishment may be necessary (Nye, 1992). Skinner also opposed the use of aversive control which refers to getting others to do something by threatening explicitly or implicitly that aversive consequences will occur if they don't do as asked. He stated that aversive control has unpredictable outcomes that often include hostility, apathy, anxiety, or stubbornness (Nye, 1992).

2.6.3.1.4 Primary reinforcers and conditioned reinforcers

Skinner differentiated between primary reinforcers and conditioned reinforcers (Nye, 1992). Primary reinforcers are related to our basic biological functioning and include positive reinforcers such as food, water, or sexual contact and negative reinforcers such as pain, heat, or discomfort. A conditioned reinforcer is a stimulus that is originally neutral but develops the power to reinforce when it is consistently paired with one or more primary reinforcers.

2.6.3.1.5 Extinction

Skinner further highlighted that although a behaviour which is continually reinforced is likely to increase, if the reinforcement discontinues, the behaviour is also likely to discontinue. He termed this phenomenon extinction (Nye, 1992).

2.6.3.1.6 Generalisation and discrimination

Skinner further noted that many situations have similar stimuli and in the presence of these stimuli a person is likely to respond in ways that have been reinforced in the past (Nye, 1992). Thus, in a process referred to as generalisation, responses to one stimulus are generalised to other similar stimuli. For example, a child who has learnt to share his toys when playing with his siblings at home is likely to share his toys with friends when playing at school. Conversely, discrimination occurs when an individual becomes aware of subtle differences in similar situations. Continuing the above example, if teachers did not continually reinforce sharing at school, the same child might learn that although he must share at home it is not necessary for him to share with his friends at school.

2.6.3.1.7 Shaping

The process in which small units of behaviour are reinforced and combined to form more complicated behaviours has been termed shaping. Shaping can be useful as a behavioural technique when more intricate or complex behaviours need to be taught. This can be achieved by breaking the behaviour down into simple components and reinforcing each one until the desired response occurs.

2.6.3.2 Verbal Behaviour

Skinner (1957) also applied the environmental principles of behaviour to an analysis of language. Skinner considered language as a type of behaviour which shares characteristics with other behavioural modalities in that it can be reinforced and punished. However, unlike other behaviour modalities, language is reciprocal as it requires the mediation of other persons to have an impact on the world (O'Donohue & Ferguson, 2001). Skinner broke down language into what he defined as total verbal episodes. A total verbal episode consists of a stimulus (something that is spoken), a response (usually by another person), and a consequence (an occurrence that is causally linked to any subsequent change in the probability of that behaviour).

Skinner (1957) proposed that the functions of verbal behaviour could be grouped into seven classes of responding or verbal operants, namely the mand; echoic behaviour; textual behaviour; transcription; intraverbal behaviour; the tact; and the autoclitic. These verbal operants, as described by O'Donohue and Ferguson (2001) will be summarised briefly below, but for a more comprehensive discussion the reader is referred to Skinner's original text: *Verbal Behaviour* (1957):

2.6.3.2.1 Manding

The first type of verbal operant is the *mand.* This term is a derivative of the words command or demand as it denotes the use of language as a request, and typically arises as a result of conditions of deprivation (e.g., hunger, thirst, or lack of attention) or aversive stimulation (e.g., pain, distress, or discomfort). Thus verbal behaviour is reinforced by a stimulus that is responsible for counteracting the condition of deprivation or aversive stimulation and refers specifically to a type of verbal behaviour where a request is followed by a specific reinforcement (usually that which has been requested). The request arises as a result of a stimulus such as deprivation or aversive stimulation. This stimulus is termed the

motivational operation (MO) and effective mand training is accomplished through manipulation of the MO (Kates-McElrath & Axelrod, 2006).

2.6.3.2.2 Echoic behaviour

Echoic behaviour is a verbal operant whereby an individual produces a sound pattern that mimics or echoes the stimulus (i.e., that which immediately precedes it). Echoic behaviour implies that there is a one-to-one correspondence between the stimulus and the response. An *echoic* would therefore include the echolalic speech of a child with AD but would not include a child's answer to a parent's question.

2.6.3.2.3 Intraverbal behaviour

An answer to a question would fall under Skinner's category of *intraverbal behaviour.* Unlike echoic behaviour, intraverbal behaviour does not require one-to-one correspondence with the verbal stimuli that evokes it. Instead, the verbal response is emitted because of an arbitrarily established reinforcement history involving stimulus chains whereby the response has been reinforced in some way on previous occasions.

2.6.3.2.4 Textual behaviour

The third type of verbal operant is *textual behaviour.* Behaviour is textual if the stimulus that produces the behaviour is either written or non-auditory. Importantly, Skinner's definition of textual behaviour includes sound responses to texts that do not include understanding (O'Donohue & Ferguson, 2001). Therefore, a child with AD that is able to read lengthy texts without deciphering meaning from the text (i.e., hyperlexia) would be included in this definition.

2.6.3.2.5 Transcription

Transcription includes instances whereby textual or vocal stimuli produce written responses. As in the case of echoic behaviour, transcription requires a one-to-one correspondence between stimulus and response and refers to two types of behaviours: (1) echoic behaviour in written form (i.e., simply copying text); and (2) taking dictation (i.e., translating an auditory stimulus or spoken word to a visual response or written word).

2.6.3.2.6 Tact

Tacting refers to the verbal response that follows sensory contact (i.e., sight, sound, smell, touch [pain], and taste) with words, objects, people, or events. The strength of the functional relationship between stimulus and response depends on previous reinforcement history (i.e., positive or negative reinforcement is likely to increase or decrease the likelihood of the

response occurring in future occasions). Tacting refers to verbal commenting on private event such as "I have a headache", "I feel angry", or "that hurts".

2.6.3.2.7 Autoclitic

The *autoclitic* is the final verbal operant defined by Skinner and refers to words, phrases, or letters that are added to other verbal operants for grammatical purposes or to better describe that which is being conveyed. For example, a prefix or suffix that changes a word from the singular to plural, or saying *I know* instead of *I guess*.

2.7. Applied Behaviour Analysis

The conceptual framework for the present study is found in ABA. A discussion of the origin and definition of ABA, the initial ABA programme developed by Lovaas (1981), and the AVB version of ABA evaluated in this study, is provided. In addition, the behavioural theory of AD is presented.

2.7.1 Origins of ABA

Applied behaviour analysis arose when a new tier in the behaviourist research pyramid emerged as the above behavioural principles were applied to behaviours of social significance. Skinner initiated the ABA movement by frequently applying his experimental analysis of behaviour to real life situations with real people. An example of his applied interest lies in his argument that traditional teaching methods violated the rules of learning and he wrote extensively on how to apply his theory of operant conditioning to the teaching environment (O'Donohue & Ferguson, 2001). Skinner also provided an operant analysis of self-control as a class of operant behaviour that influenced the probability of other behaviour (O'Donohue & Ferguson, 2001). Most importantly, Skinner began to apply his theoretical premises to improving problematic behaviour in children or adults with mental disorders. His treatment of an electively mute patient with Schizophrenia in the 1950s provided an example that many behaviour analysts have built upon until today (O'Donohue and Ferguson, 2001).

In 1948, Sidney Bijou became the director of the Institute of Child Development at the University of Washington. Having worked with Skinner at Indiana University for two years, Bijou had a keen interest in learning theory, child development, and Skinner's radical behaviourism. Integrating Skinner's natural science approach to behaviour and contemporary research on child development, Bijou and his colleagues conducted a variety of studies of operant behaviour among children and developed numerous methods for managing

problematic behaviour, teaching academic skills to children with MR, training parents to work as therapists with their own children, and conducting research in natural settings (Green, 2001). A colleague of Bijou, behavioural psychologist Montrose Wolf, commenced the Journal of Applied Behavioural Analysis and conceived the very first definition of ABA (Green, 2001). The application of Skinner's science of behaviour to human development, language, education, mental retardation, AD, and other disorders by Bijou, Wolf and their colleagues provided a solid foundation for subsequent research to build upon.

2.7.2 Definition of ABA

The ABA approach, founded in radical behaviourism, is thus based on the theory that all learned behaviours have an antecedent and a consequence and that all behaviour is shaped by the consequence of our actions. It is therefore possible to change behaviours in others by manipulating the consequences of their actions. Applied behaviour analysts attempt to change problematic behaviour using a strategic combination of behavioural techniques such as positive or negative reinforcement, extinction, generalisation, discrimination and shaping. The term *analysis* refers to the analysis of the functional relationships between the target behaviour and the environmental antecedents and consequences (O'Donohue & Ferguson, 2001). The information provided by this analysis is then useful in planning a behavioural change programme for the respective behaviour. ABA has been applied to a wide variety of behaviours ranging from teaching adults with mental retardation to teaching married couples better communication skills; and for purposes of this study, its use in teaching children with AD is of utmost importance.

2.7.3 Lovaas/ABA

In the 1980s, Ivar Lovaas developed a behavioural model for treating AD that he applied early (i.e., in children under four years of age) and intensively (i.e., 20 to 40 hours of intervention per week) with remarkable results (Lovaas, 1987). This early intensive behavioural intervention model, hereafter referred to as Lovaas/ABA, has formed the core of instructional methodology employed by behaviour analysts today. This method has been comprehensively detailed in Lovaas's teaching manual, *Teaching Developmentally Disabled Children: The Me Book* (Lovaas, 1981); and was updated in 2003 to reflect the removal of the aversive contingencies used in the original protocol. Many successful ABA programmes over the years have successfully applied this method to treating children with AD. Importantly, this method has evolved over the years and many ABA programmes, although

fundamentally similar to the original Lovaas method, have modified the original application somewhat and integrated other behavioural concepts as a means of extending Lovaas's work (Barbera, 2007). These adaptations to Lovaas/ABA have come about as a result of criticisms of the original protocol. Criticisms include arguments that the original protocol was language deficient as it failed to incorporate Skinner's (1957) concepts and principles of verbal behaviour (Sundberg & Michael, 2001); and that discrete trial teaching in isolation fails to ensure generalisation of skills (Carr & Firth, 2005).

2.7.4 AVB/ABA

One such alteration to Lovaas's programme is the version of ABA that is evaluated in this research project: the verbal behaviour approach to ABA hereafter referred to as AVB/ABA. This is a fairly new and popular approach that has emerged within the last 10-15 years (Barbera, 2007). This approach aimed to address the criticisms of Lovaas/ABA by incorporating Skinner's (1957) concepts and principles of verbal behaviour and including natural environment teaching (NET) in combination with discrete trial teaching (DTT) (Sundberg & Michael, 2001). Although Skinner described verbal behaviour in the 1970s, applied behaviour analysts Carbone, Sundberg, and Partington, under the direction of Dr. Jack Michael, outlined a method for applying it (Sundberg & Michael, 2001). This approach is still ABA, (i.e., it is still an application of the science of behaviour) and includes many of the behavioural concepts and techniques of Lovaas/ABA, but in addition contains a predominant focus on the child's verbal behaviour and includes teaching in the child's natural environment. The AVB/ABA method is described briefly below and is detailed in the treatment manual, *Teaching language to children with autism or other developmental disabilities* by Sundberg and Partington (1998).

2.7.5 The Behavioural Theory of Autistic Disorder

Nearing the apex of the behaviourist research pyramid lies the application of behavioural theory to the understanding of behaviours demonstrated by individuals with AD. The behavioural view is "that autism is a syndrome of behavioural deficits and excesses that have a neurological basis, but are nonetheless amenable to change in response to specific, carefully programmed, constructive interactions with the environment" (Maurice et al., 1996, 29). According to Lovaas and Smith (1989), in the 1960s Ferster provided the first documented behavioural theory of children with AD and suggested that their problems could be viewed as a failure to learn, as social reinforcers such as praise and attention had not acquired

reinforcing properties for these children. Although subsequently disproved and no longer part of contemporary behavioural theory, Ferster's initial hypothesis was that their difficulties with learning arose as a result of inadequate parenting (Lovaas & Smith, 1989). Since Ferster's theory, Lovaas and Smith were the first to provide a comprehensive behavioural theory of AD. Lovaas and Smith's behavioural theory of AD is based on the following four tenets.

First, the behaviours displayed by children with AD can be accounted for by the laws of learning. Autistic behaviours remain because they are reinforced by the environment or are in themselves reinforcing in some way. For example, self-stimulatory behaviours such as rocking or hand-flapping provide sensory feedback for the child. This feedback reinforces the behaviour which becomes extinct if the feedback is removed. In addition, self-injurious behaviours and aggression against others have been shown to be either self-stimulatory, negatively reinforcing as they result in escape from aversive situations, or positively reinforcing due to the resulting attention from others. Behavioural theory also shows that, unlike "normal" children; children with AD respond to a very narrow range of reinforcers; typically do not respond to social reinforcers; and are unable to learn through imitation of others.

Second, rather than a central deficit, children with AD are regarded as having many separate behavioural deficits that are best described as a developmental delay. Children with AD are an inherently diverse population with a variety of behavioural deficits and excesses and even an identical behaviour in two children can have different stimuli or reinforcers. Furthermore, gains made in one area are not naturally generalised to other areas or to other similar stimuli. For this reason, behavioural theorists deny the possibility that AD arises as a result of a central deficit. Instead the focus is a number of separate behavioural deficits. It is also presumed that many of these behavioural deficits can be accounted for by a developmental delay as there is considerable similarity between the behavioural deficits of children with AD and younger *normal* children.

Third, children with AD are able to learn once a special environment is constructed for them. For purposes of generalisation of skills this environment should only deviate from their

natural environment enough to make it functional for them. This means that community settings are more suitable than hospital or clinic environments.

Fourth, the deficits evident in children with AD are viewed as a combination of their nervous systems and their environment rather than being viewed as a disease. Applied behavioural analysts therefore do not give credibility to the view that AD is due to an incurable organic disorder or as a result of hostile parenting. Instead it is better accounted for by the interaction between a deviant (but not diseased) nervous system and an average, day-to-day environment, where certain behaviours are inadvertently reinforced.

2.8 Applied Behaviour Analysis Outcome Research

Applied behaviour analysis has been rated as a scientifically based practice that has significant and convincing empirical efficacy and support (Simpson, 2005). A summary of the cumulative ABA outcome evaluations for Lovaas/ABA and AVB/ABA are provided. In addition, factors that play a role in the success of ABA programmes are highlighted and critiques of ABA research are reviewed as a means of identifying qualities that future research should endeavor to include.

2.8.1 Outcome Evaluations

2.8.1.1 Efficacy of Lovaas/ABA

Between the 1960s and 1980s, a significant body of research emerged examining the use of ABA methods in the education of children with AD (Harris & Delmolino, 2002). The *UCLA Young Autism Project* was the first comprehensive treatment study which evaluated the efficacy of Lovaas/ABA. It was initiated at the University of California-Los Angeles (UCLA) Psychology Department's Young Autism Project (YAP) and was published by Lovaas, Koegel, Simmons, and Long in 1973. This study evaluated the effects of 20 children who, following Lovaas's ABA programme, showed a reduction in inappropriate behaviours (self-stimulation and echolalia) and an increase in appropriate behaviours (appropriate speech, play, and social non-verbal behaviour), IQs, and social quotients (Lovaas et al., 1973).

Then in 1987, Lovaas published his landmark study of 59 children diagnosed with AD. Nineteen children, under 42 months of age, were placed in a long-term experimental treatment group, undergoing a minimum of 40 hours per week of EIBI, and the remaining 40

children were allocated to a control group receiving a maximum of 10 hours of Lovaas/ABA per week as well as other non-behavioural therapy programmes (Lovaas, 1987). Results showed an average increase of 30 IQ points and a significant 47 percent of the experimental group (n=9) achieved normal intellectual and educational functioning, with normal-range IQ scores (94-120) and successful first grade performance in public schools, whereas only 2% of the control group achieved normal education and intellectual functioning (Lovaas, 1987).

In 1993, a follow up study was published, reporting that eight out of the nine children from the Lovaas (1987) study, were still in mainstream schools, and a further one child from the experimental group had moved into regular schooling (McEachin, Smith, & Lovaas, 1993). Using blind clinical assessment, eight of the nine children with the best outcomes were indistinguishable from normal controls based on clinical evaluation as well as standard clinical assessment measures (McEachin et al., 1993). Thus, the Lovaas (1987) results of 47% of the children being integrated into mainstream schooling without school aids remained intact approximately six years later. These landmark trials by Lovaas and associates began the work of a comprehensive and influential chamber of knowledge in the ABA pyramid.

A number of further research studies ensued, attempting to replicate these findings, and adding further form to the metaphorical pyramid of knowledge. All of these studies evaluated an intervention predominantly based on Lovaas's treatment manual (Lovaas, 1981) but varying in terms of their context (school, centre, home), implementation (parent, professional), and intensity (number of hours). The May Centre Study assessed the effects of 15 to 25 hours per week of home-based and centre-based Lovaas/ABA on 14 children with AD (Anderson et al., 1987). After one year, significant improvements were viewed in mental age, social age, language, and individual objectives, with 31% of the children integrated for two hours a week into mainstream classes (Anderson et al., 1987). The Murdoch Early Intervention Program evaluated the outcomes of nine children with PDD, receiving an average of 18.72 hours per week of Lovaas/ABA (Birnbrauer & Leach, 1993). After two years, substantial gains were made as measured by IQ, language, adaptive behaviour, communication, play, instruction-following, social skills, self-help, and tantrum behaviour (Birnbrauer & Leach, 1993). Smith, Groen, and Wynn (2001) examined the effects of 24 hours of Lovaas/ABA a week, for two to three years, on 15 children diagnosed with AD.

Results showed improvements superior to the control group in terms of IQ, language, and academic skills (Smith et al., 2001).

At the University of California, in San Francisco, the impact of a home-based, parent-delivered Lovaas/ABA was evaluated in 11 children diagnosed with AD (Sheinkopf & Siegel, 1998). The children received approximately 20 hours of intervention per week for periods ranging from seven to 24 months and displayed significantly higher post-treatment IQ scores and significantly lower symptom severity scores (Sheinkopf & Siegel, 1998). Butter, Mulick, and Metz (2006) provide case descriptions of eight children previously diagnosed with PDD and MR who after 20 to 40 hours per week of Lovaas/ABA no longer met the behavioural criteria for MR or a PDD and displayed substantial gains in adaptive behaviour and IQ. Eldevik et al. (2006) compared two groups of children receiving either Lovaas/ABA or eclectic treatment for an average of 12 hours per week. Results after two years revealed that the 13 children in the Lovaas/ABA group showed significantly more change than the eclectic group in intellectual functioning, language comprehension, expressive language, and communication domain scores on the Vinelands Adaptive Behavior Scales (VABS; Sparrow, Balla, & Ciccheti, 1984).

Based on these studies, and others, the efficacy of behavioural interventions in AD is clear. However, as discussed previously, although most ABA sites have implemented programmes based on Lovaas's original manual, many have altered the original Lovaas method as a means of addressing shortcomings highlighted by critiques of the original protocol or based on empirical support for additional techniques. Most have removed the aversive elements of the original programme, many have included augmentative communication such as PECS or sign language, others have added techniques such as role playing, video modelling, and social stories, and most pertinent to this research project are those programmes which have incorporated a verbal behaviour component and/or teaching in the child's natural environment (AVB/ABA).

2.8.1.2 Efficacy of AVB/ABA

The intervention evaluated in this study, AVB/ABA, has increased in popularity and demand among professionals and parents, and is receiving much attention in the ABA literature at present (Carr & Firth, 2005). In spite of its effective recent dissemination, Carr and Firth highlight that although the AVB approach is based on sound conceptual logic, the bulk of

empirical support exists in the publication of numerous studies on the training of single verbal operants rather than studies that evaluate the efficacy of the AVB/ABA programme as a package. Cautilli (2006) highlights that the core differentiating features between AVB/ABA and Lovaas/ABA -- namely Skinner's functional analysis of language and NET -- have 35 years of research to support their effectiveness. Notwithstanding, Carr and Firth maintain that although this evidence does constitute support for the AVB approach, it is rather indirect, and a more direct form of support is required to evaluate whether an AVB/ABA produces significant improvements akin to other approaches.

To date there has been only one attempt to compare the outcomes of an AVB/ABA programme with a Lovaas/ABA programme. Williams and Greer (1993) compared the language functioning of three adolescents with developmental disabilities across an AVB and Lovaas curricula. Results revealed a greater number of words emitted, more correct trials completed, and a greater percentage of correct responses during the AVB training sessions compared to the Lovaas linguistic training sessions. This study thus provided an indication of the potential benefits of the AVB language curriculum over the Lovaas linguistic curriculum. Furthermore, these benefits could be underrated as the AVB/ABA approach used in this study is a more basic application of Sundberg and Partington's (1998) description (Carr & Firth, 2005). Weiss (1999) and later Weiss and Delmolino (2006) evaluated the efficacy of the Rutgers University's AVB/ABA programme. Results revealed that 20 children having received six hours per day of this treatment, displayed less autistic behaviour and more adaptive behaviours after two years (Weiss, 1999) and results continued to improve after four years (Weiss & Delmolino, 2006). In 2005, Sallows and Graupner evaluated two groups of children with AD receiving Lovaas/ABA that incorporated procedures such as NET with a strong language component. Following 2 to 4 years of treatment, 48% of the children achieved IQ's in the average range as well as increases in language and adaptive areas comparable to the data from the UCLA project. Furthermore, at age seven these children "were succeeding in regular first or second grade classes, demonstrated generally average academic abilities, spoke fluently, and had peers with whom they played regularly" (Sallows & Graupner, 2005, 424). More recently, Goin-Kochel, Myers, Hendricks, Carr, and Wiley (2007) published a study which evaluated the outcomes of an AVB/ABA curriculum. For all of the 29 children, each skill domain, as measured by Partington and Sundberg's (1998) Assessment of Basic Language and Learning Skills (ABLLS), improved significantly over

time; nine of 16 children entered mainstream classes with an aide; and seven entered special education classes (Goin-Kochel et al., 2007). Current research thus suggests that AVB/ABA could produce results that are akin to Lovaas/ABA and could even offer some benefit over Lovaas/ABA. Further research is however needed to confirm these benefits (Barbera, 2007).

2.8.2 Factors influencing treatment outcomes

Notwithstanding the significant efficacy of ABA demonstrated by the abovementioned studies, many of them failed to appropriately replicate the substantial achievement of normal intellectual and educational functioning observed in the initial UCLA findings by Lovaas and colleagues (1987). Across all outcome studies published thus far, there is great variability in the post-treatment functioning of children. A number of studies were able to cluster children into a higher performing and a lower performing group based on their level of functioning (Sallows & Graupner, 2005; Smith et al., 2001; Goin-Kochel et al., 2007). This elicits the inference that several factors significantly influence behavioural intervention success. A number of reasons have been offered for this discrepancy. Compared to the children in many of the subsequent studies, the children in the Lovaas (1987) study (a) received substantially more hours of therapy per week, (b) received a longer duration of therapy, (c) displayed superior IQ scores at baseline, and (d) had high levels of parental involvement.

Those studies where children have received the most number of hours of ABA per week have shown the most sizeable gains (Anderson et al., 1987; Birnbrauer & Leach, 1993). Although there is no consensus regarding the optimum number of hours per week of intervention, it appears that more than 10 hours per week of ABA is necessary to effect significant change (Lovaas, 1987; Smith et al., 1997). However, one study found no correlation between change in IQ scores and number of intervention hours per week (Sheinkopf & Siegel, 1998). The duration or length of the ABA programme has also been shown to be important in predicting the child's outcome (Anderson et al., 1987; Lovaas, 1987; Sheinkopf & Siegel, 1998; Weiss, 1999; Weiss & Delmolino, 2006). The role of parents has also been shown to contribute to the child's response (Lovaas et al., 1973). When parents are significantly involved and trained in ABA techniques they are likely to continue with instructive interactions outside of formal treatment sessions, which is likely to extend the number of intervention hours and result in better outcomes (Sheinkopf & Siegel, 1998). Furthermore, a number of studies have confirmed that age at onset of ABA plays a role in the child's response (Anderson et al., 1987; Goin-Kochel et al., 2007). One study in particular by Fenske, Zalenski, Krantz, and

McClannahan (1985) directly examined the effect of the age of onset of ABA on outcome. Fenske et al. (1985) compared outcomes for nine children with AD who began an ABA programme before 60 months of age with nine children with AD who began treatment after 60 months of age. They found that the children who started ABA earlier had better outcomes in that they were living at home and were enrolled in a public school programme.

A child's level of functioning or IQ at baseline has been shown to predict overall reactions to ABA (Anderson et al., 1987; Eldevik et al., 2006; Goin-Kochel et al., 2007). It is important to note that improvement to typical levels of functioning has not been demonstrated with very low initial IQ. For example, children with low IQ receiving 30 hours a week of ABA for two years showed significant increases in IQ and better verbal skills than children receiving only 10 hours per week of ABA, but still remained quite impaired (Smith et al., 1997). Similarly, a child's initial rate of learning or initial response to ABA (usually in the first six months to one year) has been shown to be correlated with a child's outcome post intervention (Goin-Kochel et al., 2007; Sallows & Graupner, 2005). Studies by Weiss (1999) and Weiss and Delmolino (2006) directly measured the effects of initial learning rates on the outcome of 20 children receiving ABA and found that initial learning rates were correlated with outcomes after two and four years respectively.

Furthermore, although the efficacy of ABA has been empirically demonstrated, many studies have deviated from the original Lovaas/ABA protocol and adopted new and "improved" techniques, some of which have been empirically demonstrated whereas others require further empirical support. The intervention evaluated in this research, AVB/ABA, is one such "enhanced" version of the original protocol that requires further support as a treatment package. Thus the heterogeneous nature of ABA elicits uncertainty regarding the effectiveness of each treatment package.

Finally, there have been several critiques of the ABA research (Eikeseth, 2001; Gresham & MacMillan, 1998; Schopler, Short, & Meisbov, 1989, Conner, 2003) in relation to methodological issues, a failure to provide measures of treatment fidelity and social validity, and a lack of evaluation in *real-life* settings. As a result, their replication potential has been challenged and they have been criticised for falsely promising a cure for AD. The question therefore arises: have these studies instigated an overstated optimism in terms of the efficacy

of ABA as an intervention for AD? The variance in child outcome in ABA research could thus be attributed to a number of factors, namely age of onset, number of therapy hours per week, duration, IQ at baseline, appropriate implementation of ABA, techniques used, the degree of parental involvement, and methodological errors.

2.8.3 Recommendations for future research

Given the critiques of previous ABA research, further outcome research is needed to address issues relating to treatment fidelity, social validity, and the ethical impasse of control group. Such research should demonstrate intervention effectiveness in *real-life* settings; and should aim to provide an in-depth description of the subjects.

2.8.3.1 Treatment fidelity

It has been argued that an essential component of an ABA programme is that treatment should be systematically and precisely defined in such a way that another behaviour analyst could implement the treatment without needing further coaching from the treatment's designer (O'Donohue & Ferguson, 2006). When evaluating the outcome of an ABA programme it is essential to examine the fidelity of the treatment. Treatment fidelity (or integrity) is defined as the degree to which an independent variable is implemented as intended (Wheeler, Baggit, Fox, & Blevins, 2006). It includes clearly defining the nature of the intervention programme and therapist competencies; as well as an assessment of therapist adherence to intervention protocols (Maurice et al., 1996). This is essential, as a failure to adequately describe the independent variable may result in inaccurate assumptions about the presence of its functional relationship with the dependent variable (Wheeler et al., 2006). It is evident that studies examining the efficacy of ABA in AD intervention vary immensely in design, sample characteristics, settings, measures of outcome, and results. A number of original studies (Birnbrauer & Leach, 1993; Lovaas, 1987; Sheinkopf & Siegel, 1998) do not allow for accurate replication of treatment implementation and outcome comparisons due to their failure to examine the fidelity of implementation. This generates an inconvenience in the generalisability of findings and accurate replication of these studies.

2.8.3.2 Social validity

The goal of an ABA programme is to bring about meaningful changes. This means that the behaviour change should be socially valid such that the change in behaviour is explicitly evident by significant others in the individual's life. Gresham (1991) defines social validity as the establishment of clinical or practical significance of behaviour change and refers to whether or not the quantity and quality of this change has made a difference to the

individual's functioning (Gresham, 1991). Research that evaluates changes in behaviour numerically and/or statistically should also aim to assess whether those changes are socially valid for the child and the child's significant others.

2.8.3.3 The Ethical Impasse of Control Groups

Many outcome studies have employed an experimental design where the control group received noticeably inferior treatment in comparison to the experimental group. In light of substantial evidence highlighting the considerable efficacy of ABA over no therapy, or other therapies, ethical questions relating to the use of control groups arise (Green et al, 2002). Hence, is it ethical for any child to have therapy withheld, to receive substandard therapy intensity and duration, or unsubstantiated therapies for purposes of control?

2.8.3.4 Intervention effectiveness versus efficacy

Although large randomised controlled studies are able to provide information on treatment efficacy in a structured research environment, it is important for additional research to address treatment effectiveness by evaluating the extent to which the efficacious treatment can be applied in a *real-life* setting. Green et al. (2002) highlight that this is often achieved through the completion of quasi-experimental or single case studies conducted in applied settings

2.8.3.5 Comprehensive description of subjects

Large quantitative analyses are unable to provide detailed information on each subject, their family circumstances, additional treatments, medical interventions, parental involvement, as well as the cumulative outcome data across all skill areas for each child. As a result studies with large numbers tend to disregard the personal dynamic of this heterogeneous population. Again, this can be achieved through qualitative research with fewer subjects.

2.9 Conclusion

This literature review attempted to provide a description of the PDDs with specific reference to AD, its symptomatology, epidemiology, and aetiologies. An overview of popular interventions for AD was provided with a focus on behavioural interventions. The foundation of the behavioural pyramid: the "science of behaviour analysis" was described, which was followed by the application of behaviour analysis to behaviours of social significance (ABA), and finally the development of ABA programmes for children with AD. The outcome research for Lovaas/ABA was summarised and the need for further outcome studies of AVB/ABA was highlighted. And lastly, given the critiques of existing research, recommendations were provided to inform the nature and aim of future research. Based on

the existing literature, further ABA research should evaluate the effectiveness of AVB/ABA in *real-life* settings and in doing so aim to address social validity, treatment fidelity and the ethical impasse of control group. In addition, outcome studies should provide an understanding of the unique characteristic of the subject to thoroughly examine subject responses, or non-responses, to the programme.

CHAPTER 3: METHODOLOGY

3.1 Participant

Carl[1] was selected as the participant in the study due to the fact that he: (a) had an independent diagnosis of AD; (b) received intensive intervention of 20 hours per week; (c) initiated early intervention before 3 years of age; and (d) received the behavioural intervention consistently over an extended period of time. Carl was diagnosed with AD by an independent psychiatrist at 21 months of age. His parents enrolled him in TRIAD's ABA programme at the beginning of March 2006 at 22 months of age and he underwent 22 months of ABA intervention.

Carl is a white boy, from an English speaking South African family. He lives with his mother and father, three half-sisters and one half-brother. His 13 year old and 10 year old half-sisters were from his father's first marriage and his other 13 year old half-sister and 15 year old half-brother were from his mother's first marriage. In addition, Carl's father has a five year old daughter who does not live with them and has Cerebral Palsy due to complications at birth. In total there are four half-siblings living at home with Carl and his parents as well as two domestic workers who work full-time. Carl's father (age 44) is a building contractor on a full-time basis and his mother (age 41) works full-time at a Beauty Therapy Training School. Although there is no history of PDD in Carl's extended family, both his sisters have been diagnosed and treated for ADHD.

Carl crawled at 6 months, walked at 13 months, never babbled, and at the onset of the ABA programme had not spoken. Carl's parents noticed that he was different from other children several months after he was born as he cried continuously, did not seek proximity to his caregivers, was abnormally afraid of strangers, and displayed poor eye contact. As a toddler he did not develop any play behaviours, began to spin objects, became very fixed in his routine, and did not show any signs of verbal communication. At the age of one year, Carl's parents began seeking assistance from a number of different doctors until a psychiatrist diagnosed Carl with AD at 21 months of age. At the onset of the programme, behaviour consultants at TRIAD reported that Carl was a passive and aloof child with very low

---

[1] For purposes of confidentiality the real name of the child in this study will not be divulged

motivation levels. He did not appear to have a sense of enjoyment or fun and did not engage in imaginative or socially imitative play. He alternated between screaming hysterically and crying without making any sound at all. He had numerous fears of toys, pictures, games, and songs. His eye contact was poor, and he tended to look at things out of the corners of his eyes or hanging upside down rather than straight on. He also became fixated with light and began to flap his fingers and spin objects.

Carl attended a mainstream day-care centre from the age of three months until 22 months when he was enrolled in the ABA programme evaluated in this study. He has not received any occupational therapy or physiotherapy intervention. At 40 months, he began attending half an hour per week of speech therapy. From the age of 6 months, Carl experienced a number of ear and upper respiratory tract infections, and was given grommets at 18 months of age. Other than dust mite allergies, Carl does not have any current medical conditions. Since 2 years of age, Carl has been taking several products from the Patrick Holford supplement range such as a multivitamin, Omega 3 supplement, Brain Food, and Allex (a supplement for allergies).

3.2 Setting

The ABA programme evaluated in this study is conducted at TRIAD, a new private centre in the Durban area. The centre provides an exclusive one-to-one ABA programme for young children diagnosed with AD and has been in operation since the beginning of January 2006. It is privately owned and funded by the two co-directors: senior behaviour consultants with 23 years of combined experience in special needs and 15 years of combined experience in ABA. Their initial ABA training was "Lovaas method" training by a senior behaviour analyst in Cape Town. Subsequently, they have obtained further training and support from the founders of Applied Behaviour Consultants (ABC), Inc: a behavioural centre in California that has provided ABA for more than 3000 children with special needs (http://www.abcreal.com/about_abc.html). In addition, both senior behaviour consultants are currently completing an online postgraduate degree in ABA to become board certified Associate Behaviour Analysts in the USA. All ABA technicians at the centre initially undergo one week of intensive training in the theory of ABA and two weeks of practical training in the application of ABA from the senior behaviour consultants. In addition, all ABA technicians receive ongoing training and supervision on a regular basis.

3.2.2 Curriculum

The centre utilises the ABLLS (Partington & Sundberg, 1998) as an Individualised Educational Programme (IEP) development, and curriculum guide. The ABLLS provides strategies for developing an effective and specialised IEP for each child and each child's IEP and curriculum is designed, reviewed, and managed by a senior behaviour consultant with the curriculum being implemented by a behaviour consultant or a trained ABA technician. The curriculum guide ensures that ABA technicians adhere to strict session protocols according to a predetermined task analysis and thus do not deviate from the specified intervention procedure. The ABLLS covers 26 skills that are allocated into four skill groupings: 1) basic-learner skills (comprises the language domain; social and play domain; and additional domain); 2) academic domain; 3) self-help domain; and 4) motor domain (see Appendix A for an overview of the skill groupings and learning domains).

3.2.3 Description of the ABA Programme used at TRIAD

The programme at TRIAD builds on all of ABA research, particularly research on Lovaas/ABA, but has attempted to address the language deficiency and reduced generalisability of skills in the original Lovaas protocol by incorporating AVB components such as natural environment teaching and Skinner's analysis of language. The programme could therefore be classified as an AVB/ABA programme and is described briefly below. For further details of an AVB/ABA programme, see the treatment manual by Sundberg and Partington (1998) and the parents' user guide by Barbera (2007).

3.2.3.1 Programme Structure

Essentially the behavioural programme is structured in a way that first provides the essential foundations of learning (i.e., teaching how to learn) before progressing to higher levels of functioning (i.e., teaching skills). The child's behavioural deficits and excesses are identified. Each behavioural deficit is addressed independently and every deficient skill is taught in a step-by-step fashion (Lovaas & Smith, 1989). For behaviour excesses, a functional analysis is made of the problematic behaviour (i.e., the antecedents and consequences are analysed to determine what is evoking the behaviour). Functions of behaviour include attention, gaining access to tangibles, escape, and sensory seeking (Barbera, 2007). Once the function of the behaviour has been identified, behavioural techniques are applied to redirect or extinguish the problematic behaviour (Lovaas & Smith, 1989). The corresponding functionally equivalent alternative behaviour is taught to ensure

the child learns to get the same needs met through a more positive behaviour pattern (M. Haynes, personal communication, March 27, 2008).

3.2.3.2 Learning from the Environment

One of the essential foundations of learning is assisting the child to become more responsive to his/her environment. As children with AD respond to a narrow range of reinforcers, neutral stimuli (such as praise) are paired with reinforcing stimuli (such as food or toys) in order to teach the child to respond and react to environmental cues (Lovaas & Smith, 1989). In this way the child with AD can be taught to begin to learn from his/her environment to a far greater extent. Similarly, the behaviour consultant or technician pairs herself with reinforcers to encourage the child to approach the behaviour consultant or technician eagerly and to associate positive experiences with learning (Barbera, 2007).

3.2.3.3 Discrete Trial Teaching/Instruction (DTT/DTI)

Much of the teaching in the programme occurs in trial format, beginning with the behaviour consultant's or technician's instruction and ending with a child's response or failure to respond. Discrete Trial Instruction (DTI) refers to a technique where the adult makes a request, the child responds, the consequence (reward) follows, a short pause ensues, and the next trial begins. *Discrete* refers to the pause in between skills. This form of teaching consists of breaking down a complex behaviour into manageable units; each unit is then taught, using a combination of behavioural techniques (prompting, reinforcing, fading etc) until the child has completely mastered all individual units; and the units are then chained together to form a more complex behaviour (Lovaas, 1981). This teaching is predominantly conducted via a 1:1 teacher-to-student ratio at a desk (Barbera, 2007).

3.2.3.4 Natural Environment Teaching (NET)

Whereas Lovaas/ABA is conducted primarily in discrete trial format, TRIAD's initial phase of teaching includes a combination of table teaching and teaching in the child's natural environment. Natural environment teaching (NET), commonly referred to as incidental or milieu teaching, occurs at any time, in any situation, relies heavily on the child's interest, and has no defined location (Kates-McElrath & Axelrod, 2006). Thus NET teaching occurs in a variety of settings; in the individual's natural environment or an environment similar to that of their natural environment; during activities such as play or meal time; and in the presence of other children or adults.

3.2.3.5 Prompting and Fading

In the beginning stage of teaching a specific skill, it is necessary to prompt the child (i.e., to manually or physically guide the child through the required action). Prompts include acts such as physically moving the child to the desired place, moving the child's arms in the required way, or tickling the child to prompt vocalisation. After the prompted behaviour, the child is rewarded until the prompt is able to be gradually faded from the most intrusive (physical prompt) to the least intrusive (visual or postural prompt). Eventually the child should be able to do what is required without the prompt (Lovaas, 1981). When teaching a child a new skill, in order to prevent a child from making mistakes, errorless teaching is used. If there is a chance that the child is likely to make a mistake, zero-second prompting is used where prompts are given immediately. This encourages reinforcement for correct responses rather than the unpleasantness of error correction (Barbera, 2007)

3.2.3.6 Extinction

Extinction is used as a behavioural technique in order to decrease the frequency of certain behaviours. By removing or reducing a specific reinforcer over time it is likely that the behaviour will also decrease. A simple yet useful example of extinction is ignoring a child's attention seeking behaviour, which is likely to lead to a decrease in that behaviour as it is no longer being reinforced. Through simultaneously reinforcing a behaviour that is incompatible with the problem behaviour, a more desirable behaviour is likely to replace the problem behaviour (Nye, 1992).

3.2.3.7 Punishment

Considering the controversy surrounding punishment as a technique, it is essential for commentary to be made on applied behaviour analysts' position on the use of punishment. The centre follows Skinner's recommendations and very rarely uses punishment as a first choice. O'Donohue and Ferguson (2001) differentiate between two types of punishment: Type I and Type II. Type I punishment refers to an aversive stimulus that immediately follows the undesirable behaviour. Physical restraint, such as holding a child's arms when the child is acting out, is an example of Type I punishment that has been known to be used in some ABA programmes but to date has not been employed at TRIAD. Type II punishment involves removing a positive reinforcer, for example, if a child has a favourite toy, Type II punishment would involve removing the toy following the child's aggressive behaviour. It is, however, only in extreme circumstances where reinforcement-type interventions are not

successful that Type II punishment is considered in TRIAD's programme (O'Donohue & Ferguson, 2001).

3.2.3.8 Verbal Behaviour

The ABA programme used at TRIAD differs from Lovaas/ABA in that the acquisition of language is the primary goal. This task is informed by Skinner's analysis of verbal behaviour (Skinner, 1957) and its application to AD by Sundberg and Michael (2001). Initially, a child is taught to develop an imitation (echoic) repertoire that forms the basis of learning other classes of verbal operants. This is subsequently followed by mand training (i.e., teaching a child to make a request for something). Mand training aims to increase the child's spontaneous and functional communication by using behavioural techniques to increase the complexity and frequency of mands (requesting behaviours). In situations where the child has significant deficits in vocalising, TRIAD makes use of PECS (the exchange of picture icons described above) as a means of initiating communication and encouraging appropriate vocalisations. Once the child has an echoic repertoire and has acquired numerous consistent mands, tact training (labelling) follows as well as training in textual behaviour (writing) and reading. Finally, once the child has developed a suitable vocabulary, intraverbals (conversational language) can be taught (Sundberg & Partington, 1998).

3.2.3.9 Teaching Non-Verbal Skills

Teaching children non-verbal skills, such as receptive language, imitation, and matching skills, occurs early in the programme. As children with AD usually do not have strong receptive language, an essential aspect of the programme is teaching receptive language so that the child learns to respond to his/her name as well as to another person's directions (Barbera, 2007). Another important foundational non-verbal skill is that of imitating others. As children with AD do not always naturally learn by imitation, TRIAD behaviour consultants and technicians initially teach children with AD to imitate simple, gross body movements and then shape the imitation of increasingly finer or more complex movements such as word utterances, play activities, and non-verbal gestures (Lovaas & Smith, 1989). Identifying the similarities and differences between objects is one of the fundamental skills of learning that a child must acquire before he/she can progress to more advanced skills (Lovaas, 1981). Children with AD tend to overselect (focus on one dimension of a stimulus to the exclusion of others) (Lovaas & Smith, 1989). This is addressed through teaching the child to discriminate by matching an object with an identical or similar object in a group of objects in front of him/her. This is known as match-to-sample (Barbera, 2007). The child is

taught to match objects in their concrete form (three dimensional objects), in their abstract form (pictures), as well as the abstract to the concrete and vice versa (Lovaas, 1981). Simple object matching (such as objects, shapes, colours etc) can then progress to matching of more complex stimuli to samples (such as sounds, words, feelings, or play activities).

3.2.3.10 Programming for Generalisation

Another essential component of an ABA programme is establishing generalisation of stimuli used and skills learned during treatment. The component of an ABA programme that specifically aims at extending target behaviour to situations outside of the teaching environment has been referred to as "programming for generalisation" (O'Donohue & Ferguson, 2001). TRIAD utilises a five-step generalisation programme, designed by Brenda Terzich, co-director of ABC , Inc., as a means of teaching each child to generalise his/her skills acquired during DTI to other settings. This programme is called Recreating Environments to Accelerate Learning (R.E.A.L.) and is applied from the first presentation of a new skill, in every session, by all ABA technicians and/or consultants. The R.E.A.L. programme involves rewording requests as well as NET techniques such as moving away from the table to natural settings, adding natural environment distracters, and requiring the skill in daily life routines or activities. In addition, the learning environment purposefully includes noise and activity from other children and adults in order to create an environment as similar as possible to the child's natural environment. Learners are encouraged to interact with other children at TRIAD and are also given the opportunity to bring siblings, other family members, or family friends to TRIAD in order to facilitate social interaction with children from mainstream schools. Learners are also encouraged to attend mainstream schooling intermittently as a means of generalising their skills learned to a mainstream setting.

3.2.4 Parental Training and Involvement

Parent participation and parent training is recommended for all parents at TRIAD. If necessary, a behaviour modification programme based on the ABA techniques is designed by a senior behaviour consultant and presented to the parents for implementation in the home environment. This encourages consistency of intervention between TRIAD and the child's home and promotes generalisation of skills. In addition, a communication book is kept between parent and staff where the behaviour consultant or technician is able to provide feedback after each session and parents are able to provide information on the child's behaviour and/or situation at home. In this way, ABA consultants or technicians are able to

request that parents reinforce or generalise skills covered during the most recent session. Furthermore, quarterly meetings are held between the parents and senior behaviour consultants where feedback is provided about the child's current programme, progress, and areas to be worked on. Whenever necessary, specific meetings are arranged between parents and senior behaviour consultants in the event that certain issues need to be discussed. Carl's entire family attended training sessions and each member has learnt the necessary techniques to continue learning at home and encourage generalisation. Every day Carl spent one hour *learning* with his mother and half an hour with his brother. Techniques that were used often at home include positive reinforcement, pairing the environment with the reinforcer, ignoring, physical prompting, as well as teaching imitation, manding, echoics, tacting, intraverbals, motor skills and play. Positive reinforcers that were used frequently include praise and sweets. Towards the end of the programme, affection became a conditioned reinforcer. Carl's parents and TRIAD staff utilised PECS in the initial stages of his programme until vocalisations began. Once skills such as reading, maths, writing, spelling, grooming and toileting were introduced in the ABA programme, these skills were reinforced at home using a variety of resources such as Baby Einstein DVDs, flashcards, writing books, and magnetic boards. Physical punishment (smacking) was attempted several times by his parents but proved to be unsuccessful. Instead time-out was used occasionally when Carl engaged in dangerous or behaviour excesses such as screaming, kicking, or hitting.

3.2.5 Interaction with Other Professionals

The behaviour consultants also attempt to work closely with other professionals who come into contact with the children at TRIAD such as teachers, physiotherapists, occupational therapists (OTs), or speech and language therapists. This is generally a two way process where feedback is provided from both parties to ensure consistency between programmes. Carl attended Speech and Language Therapy for half an hour per week for the last five months of the intervention and speech activities were incorporated into Carl's programme. By the end of the study period Carl had not initiated an OT or physiotherapy programme.

3.3 Procedure

A within-subject, repeated measure, evaluation design was used for this case study. The participant was compared to himself at various time points over an extended period of time. The study procedure which is described in detail below, included: 1) informed consent; 2) ethical clearance; 3) ABLLS assessments administered by a behaviour consultant prior to the

programme, at three points during the programme, and post-intervention; 4) the tabulation and graphical representation of assessment results; and 5) an interview with the participant's caregiver. All study procedures were carried out by the researcher unless otherwise indicated. See Figure 1 below for a summary of the intervention hours and dates of assessments.

3.3.1 Informed Consent

Informed consent was obtained from Carl's caregiver for Carl to be the participant in the study and for an interview with the caregiver on completion of the study.

3.3.2 Ethical Clearance

In accordance with the Code of Ethics for Research on Human Subjects, the research received ethical clearance from the Faculty of Humanities at the University of KwaZulu-Natal.

3.3.3 Assessment

A number of standardised language and/or adaptive behaviour assessments are used to assess children with AD (e.g., The VABS, Illinois Test of Psycholinguistic abilities, Peabody Picture Vocabulary Test, Preschool Language Test, Test for Auditory Comprehension of Language) (Sundberg & Partington, 1998). Although these assessments are useful in providing the child with a linguistic or adaptive functioning age equivalent and assist in diagnosing a language or developmental disorder, there are several drawbacks to these assessments. First, they are typically administered by an unknown individual, in an unfamiliar environment, and correct responses are not reinforced. Sundberg and Partington argue that these conditions make it impossible to gain an accurate appraisal of the child's language abilities especially considering the current behavioural research that shows a decrease in responding under extinction conditions. Second, age equivalents do not provide the professional with a starting point or guide for the development of an appropriate intervention programme (i.e., a 4 year old child with AD differs from his linguistic age equivalent: a 1.8 year old typically developing child) (Sundberg & Partington, 1998). Third, these assessments do not take into account Skinner's different types of expressive language (Sundberg & Partington, 1998). For example, being able to identify a picture of scissors (tacting) does not generalise to being able to request scissors (manding) in their absence. Fourth, these assessments are mostly designed to be administered as a once off standardised

occurrence which does not allow for continuous tracking of the child's progress over time. Lastly, most assessments used in assessing linguistic abilities in children with AD do not account for other aspects of the child's functioning such as play, social skills, or self-help skills.

Therefore an assessment of a child with AD should (a) identify specific verbal deficits by assessing the functional and structural aspects of language as denoted by Skinner; (b) provide an accurate account of the individual's abilities by assessing the child under different stimuli and environments in structured and unstructured settings; (c) provide an ongoing process of assessment; (d) provide an assessment of all aspects of the child's functioning; and (e) serve as a guide for the development of an appropriate behavioural language intervention programme.

In 1998, Sundberg and Partington developed the comprehensive behavioural language assessment that is utilised as the standard outcome measure by behaviour consultants at TRIAD. This assessment, the Assessment of Basic Language and Learning Skills (the ABLLS), fulfills the above criteria, and has been used extensively in a number of ABA programmes in assessing behavioural change in children with AD (Goin-Kochel et al., 2007; Schwartz, Boulware, McBride, & Sandal, 2001). In addition, the new National Institute of Mental Health Research Units in Paediatric Psychopharmacology and Psychosocial Intervention (RUPP-PI) Autism Network utilised the ABLLS as an assessment of the response of children with AD to a trial of antipsychotic medication and parent management training (Aman et al., 2004).

Carl's progress was therefore assessed using the standard outcome measure utilised by TRIAD: The ABLLS (Partington & Sundberg, 1998). The ABLLS was administered by a senior behaviour consultant on a number of occasions, namely at entry to the programme (i.e., at 0 months or baseline); at various intervals throughout the intervention (at 2, 3, and 14 months); and in the final week of the study period (at 22 months). ABLLS assessments were repeated in the first three months to assess Carl's initial skill acquisition. Thereafter, assessments were conducted on a yearly basis.

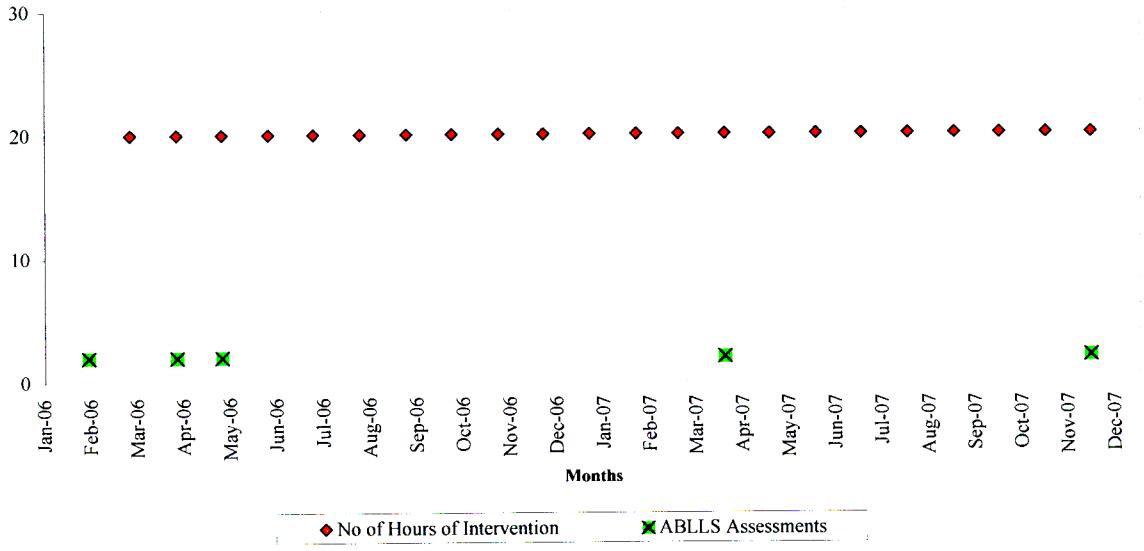


Figure 1: Summary of intervention hours and assessment dates

The ABLLS, as well as an IEP development and curriculum guide, consists of a performance-based questionnaire that assesses relatively fine steps in development in children's functioning at or below that of a typical child five years of age (Aman et al., 2004). The ABLLS is also designed to account for a child's motivation to respond, ability to attend to a variety of environmental stimuli and generalise skills, and tendency to use those skills spontaneously (Aman et al., 2004). The scores of the ABLLS are not directly interpretable as the instrument is not age normed. Instead, the ABLLS provides a developmental perspective of Carl's progress by comparing Carl's scores to himself over time.

The ABLLS assessment tool consists of a series of tasks that can be grouped into the following six domains: language; social and play; additional; academic, self-help, and motor. A breakdown of the skills that comprise each domain is included as Appendix A. Carl was evaluated according to each task and allocated a score based on his mastery of that particular task. Scores differ between tasks with a maximum score of 2 for some and 4 for others. The higher the score, the greater the degree of mastery Carl displayed for that particular task. Evaluation is highly objective as specific guidelines are provided for each task in terms of the task requirement and scoring criteria. For example, task B3 requires Carl to match the pictures of an item with one of three objects in an array. The maximum score for this task is

2 and minimum 0. Scoring criteria specify a score of 2 if Carl can match three items in succession, 1 if he can match a single item per task presentation, and 0 if he is unable to match a picture with an object. For more complicated tasks, examples are given and descriptive notes are included for further clarity. Carl thus receives a total score for each domain. The maximum possible score for the language domain is 600; for social and play, 140; for academics, 168; for self-help, 88; and for motor 56. Some additional tasks, with a maximum score of 224, have been excluded from the above five domains but are included in the ABLLS composite score. These tasks combined with the above domains result in a maximum ABLLS composite score of 1276. Appendix A provides a breakdown of the maximum possible score for each skill area in each domain. These objective scoring requirements contribute to the reliability and validity of the instrument as there is little room for interpretation or subjectivity by the behaviour consultants or technicians. A copy of the ABLLS assessment grid is provided in Appendix B.

3.3.4 Tabulation and Graphical Representation of Data

The scores on the ABLLS assessments were used to produce tables and linear graphs in order to graphically represent changes in skills over time. Barlow and Herson (1984) state that visual inspection of graphed data is the most common method of analysing single case research and according to Gresham (1991, 8) this "interocular test of significance" is the most socially valid way of determining practical significance". For this reason, the linear graphs of ABLLS scores throughout the programme have been visually inspected in order to determine reliable treatment effects by comparing baseline levels of performance to post-intervention levels of performance (Gresham, 1991).

3.3.5 Caregiver Interview

At the end of Carl's ABA programme, an informal caregiver interview was held with Carl's mother. This interview aimed to determine (a) Carl's developmental and medical history, (b) his family history, (c) the nature of his home environment, and (d) details of other treatments. In addition, this interview allowed for social validity (i.e., the meaningfulness of the behaviour change noted by the ABLLS) to be determined as the caregiver was asked to rate the overall change in behaviour on a five point Likert scale, in order to derive a subjective evaluation of the behaviour change from a person who is familiar with the child (Gresham, 1991). The Likert scale included the following options for Carl's parents to rate their opinion of his overall progress: (a) *My child's behaviour significantly improved*; (b) *My child's*

behaviour improved; (c) *My child's behaviour improved somewhat*; (d) *My child's behaviour remained much the same*; and (e) *My child's behaviour got worse*. A copy of the interview schedule is provided in Appendix C.

CHAPTER 4: RESULTS

The results of the study have been separated into the following sub-sections: treatment fidelity; graphical data; and social validity.

4.1 Treatment Fidelity

An essential component of outcome evaluation is to appraise the integrity of the intervention (i.e., construct validity). A number of procedures played an essential role in ensuring that the independent variable (the ABA programme) was implemented as intended. First, senior behaviour consultants received intensive training in ABA and have provided inservice training for all the staff at the centre. Second, senior behaviour consultants closely follow the ABLLS strategies for designing, reviewing, and managing each child's specialised IEP. Third, the ABLLS curriculum guide ensures that senior behaviour consultants and ABA technicians adhere to strict protocols at each therapy session. Fourth, senior behaviour consultants sporadically observe therapy sessions and videotapes of sessions (conducted by ABA technicians) to ensure adherence to session protocols.

4.2 Graphical Data

The scores from the ABLLS assessments skill-tracking grids[2] were tabulated and converted into linear graph format. The following graphs depict Carl's progress on the various domains of the ABLLS throughout the intervention. The results are summarized in the figures below. Note that higher scores show better functioning and when combined on one graph, each skill area cannot be directly compared with another as maximum scores differ for each skill. For this reason, individual skill areas have been plotted separately against the correct maximum ABLLS score for that skill area and are attached as Figures A to Y in Appendix D.

4.2.1 Progress across All Domains

Figure 1a displays the trajectory of scores on the ABLLS composite measure (i.e., the total of all ABLLS domains) at each ABLLS assessment. Figure 1b provides a summary of the trajectory of the scores from each ABLLS assessment for all six ABLLS domains namely: language; play and social; academic; self-help; motor; and additional domain.

---

[2] This data can be made available by contacting the author.

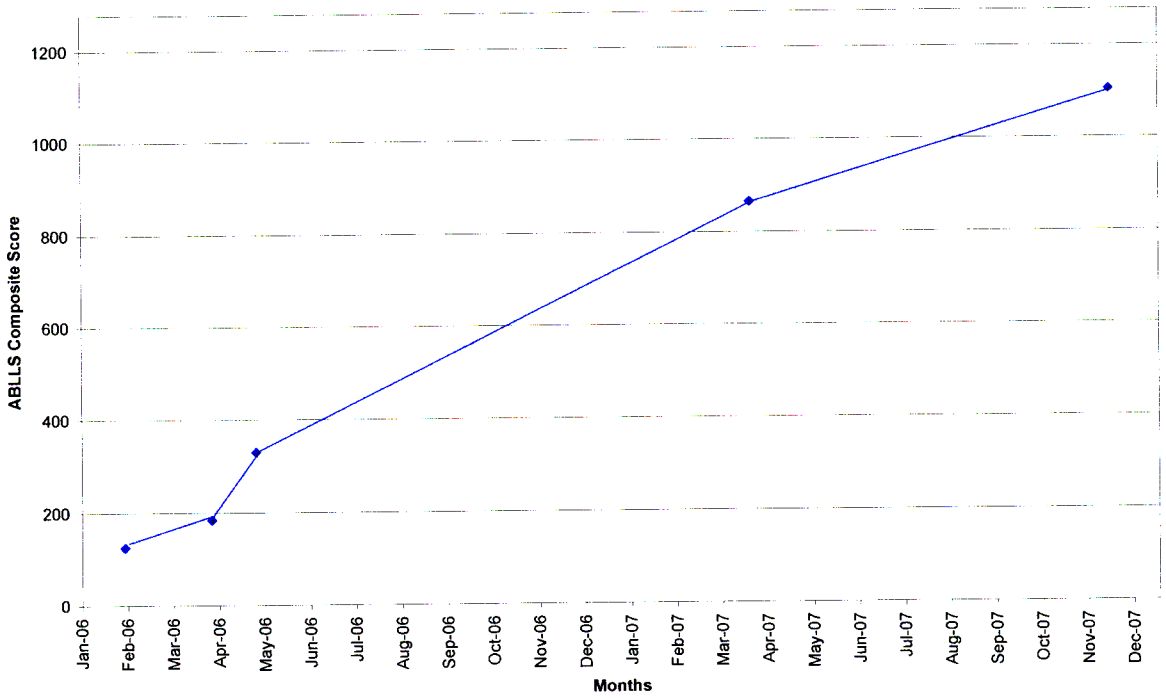


Figure 1a: Trajectory of ABLLS composite score

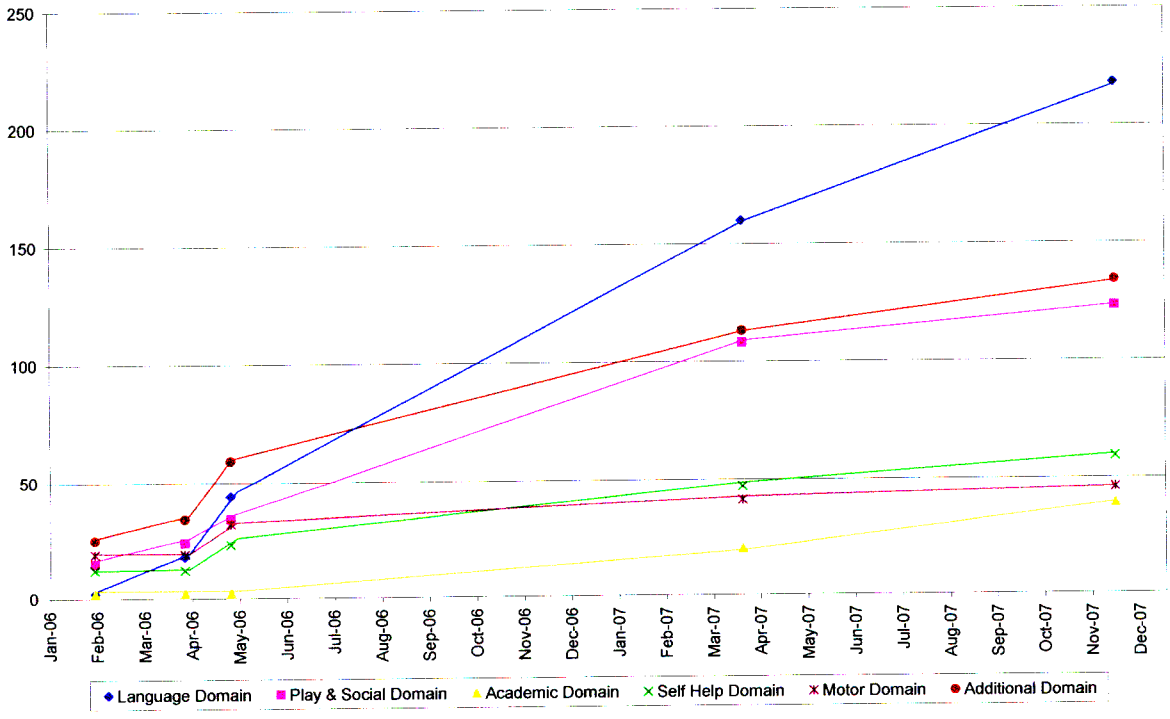


Figure 1b: Summary of all domain score trajectories

The following sections include the Figures of the score trajectories for each ABLLS learning domain. Each section contains two graphs: the first (a) depicts the trajectory of the total

combined score for that learning domain and the second (b) reflects the score trajectory for each skill area in that domain.

4.2.2 Progress in the Language Domain

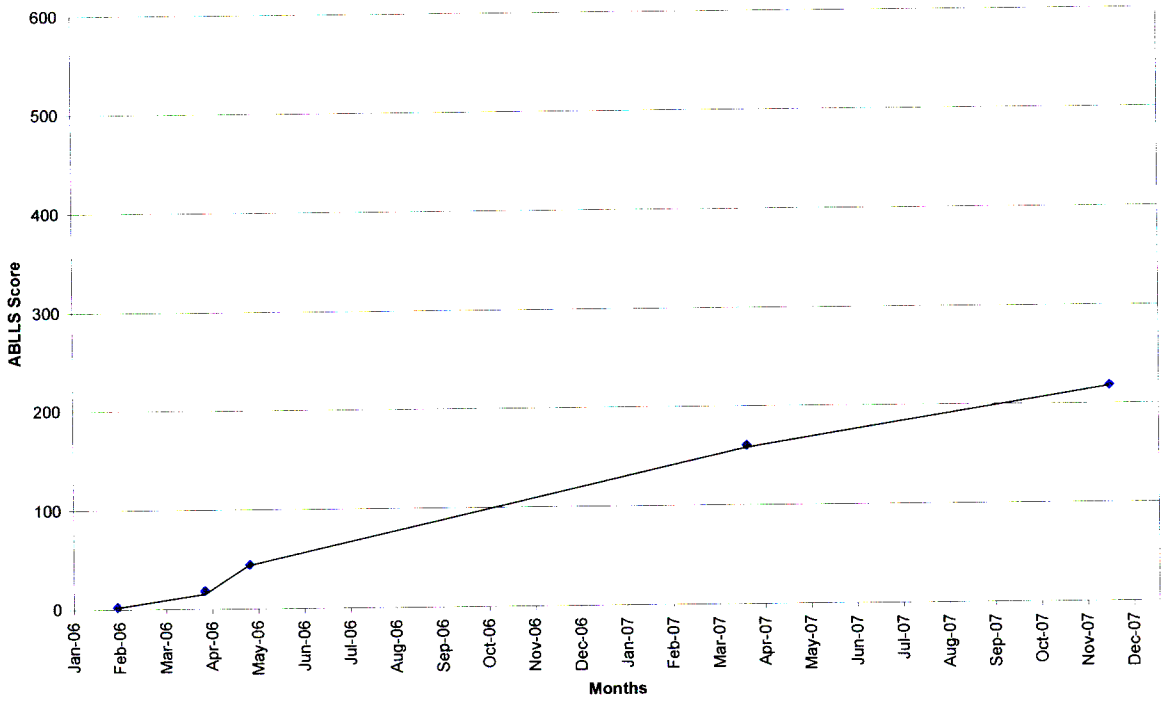


Figure 2a: Language domain score trajectory

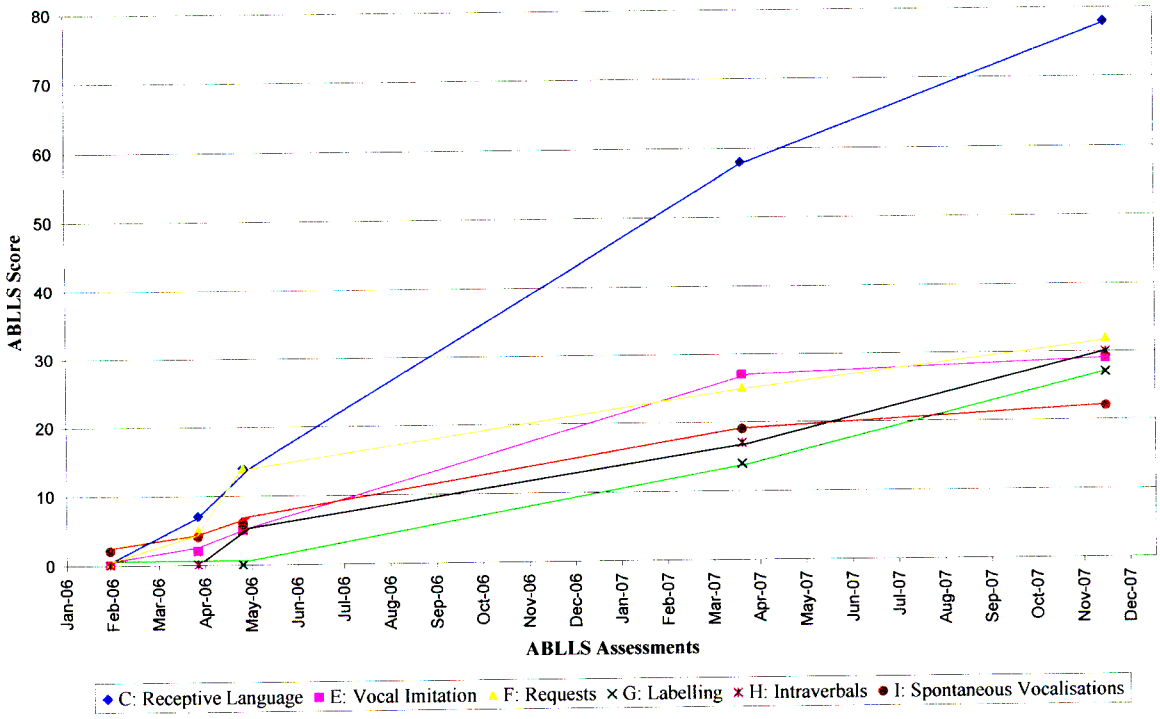


Figure 2b: Summary of all skill areas in the language domain

4.2.3 Progress in the Play and Social Domain

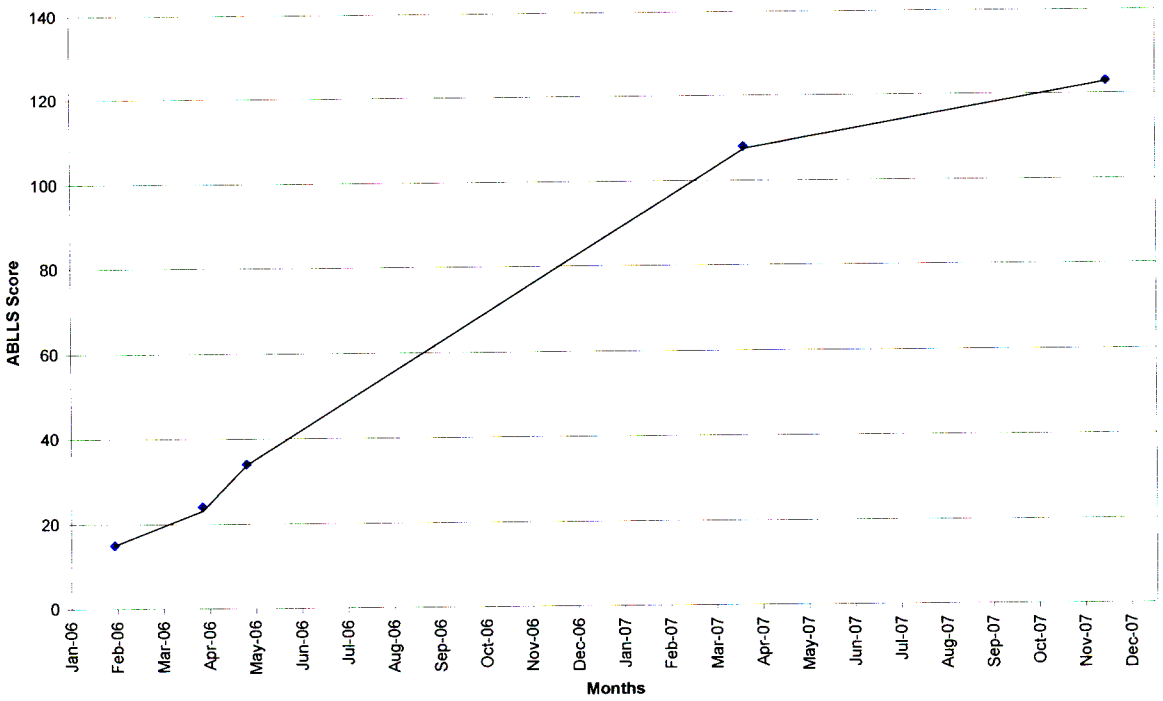


Figure 3a: Play and social domain score trajectory

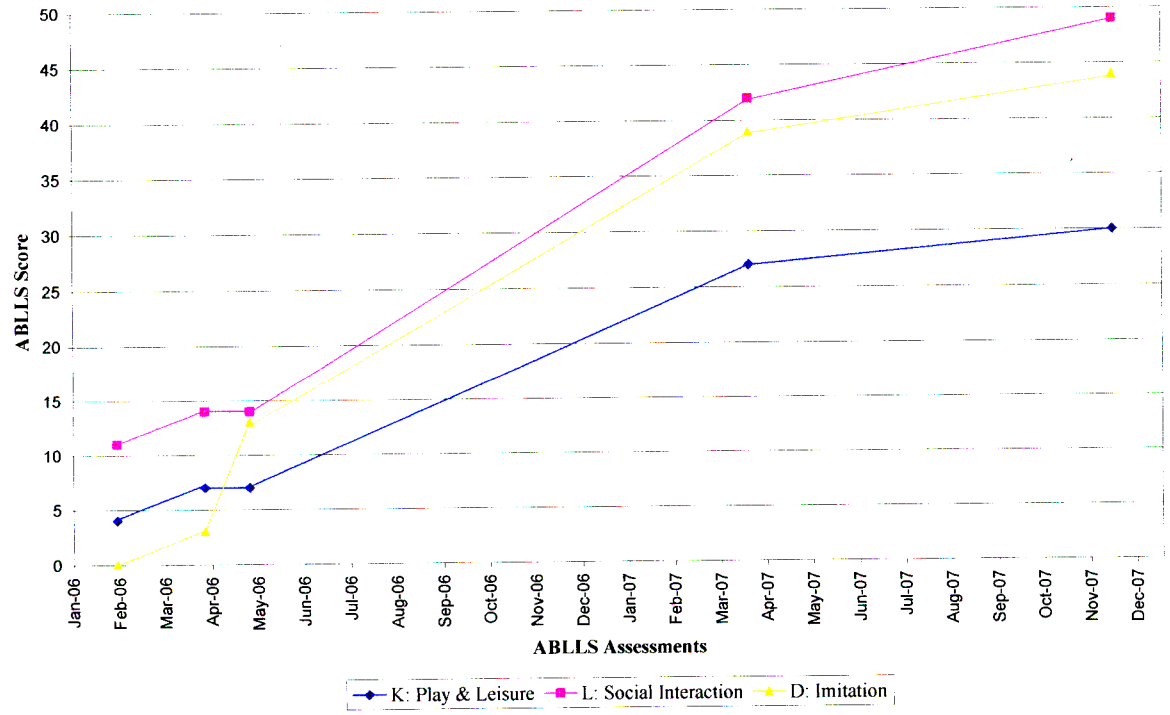


Figure 3b: Summary of all skill areas in the play and social domain

4.2.4 Progress in the Academic Domain

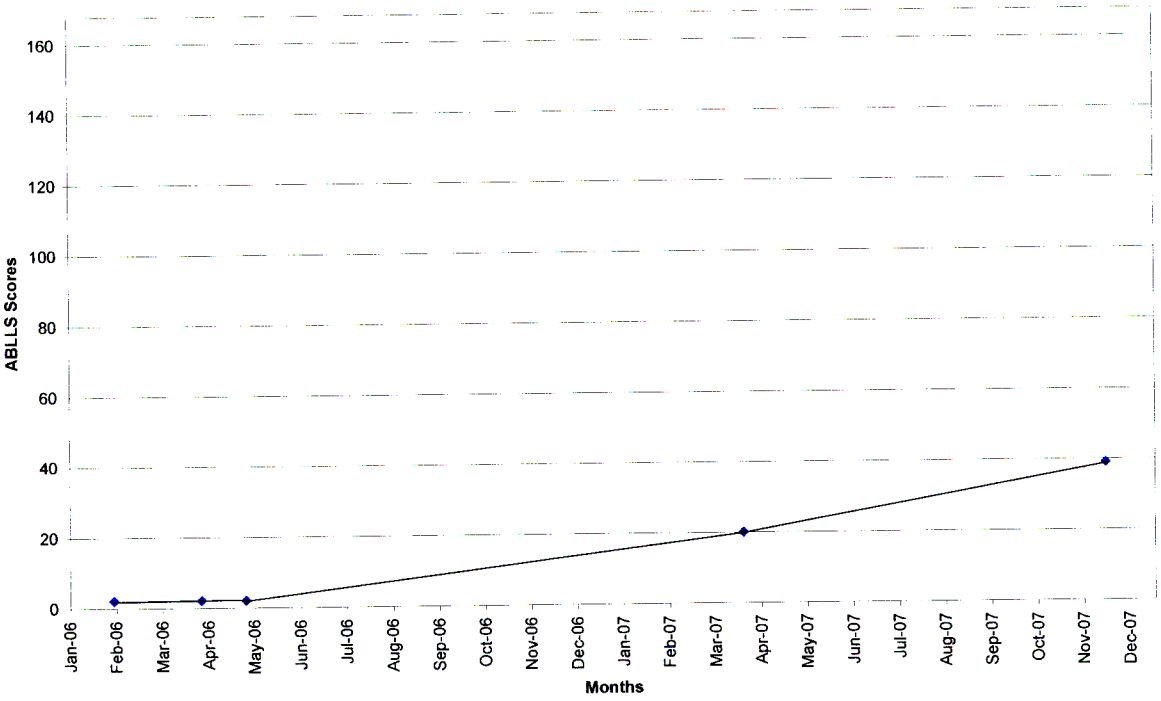


Figure 4a: Academic domain score trajectory

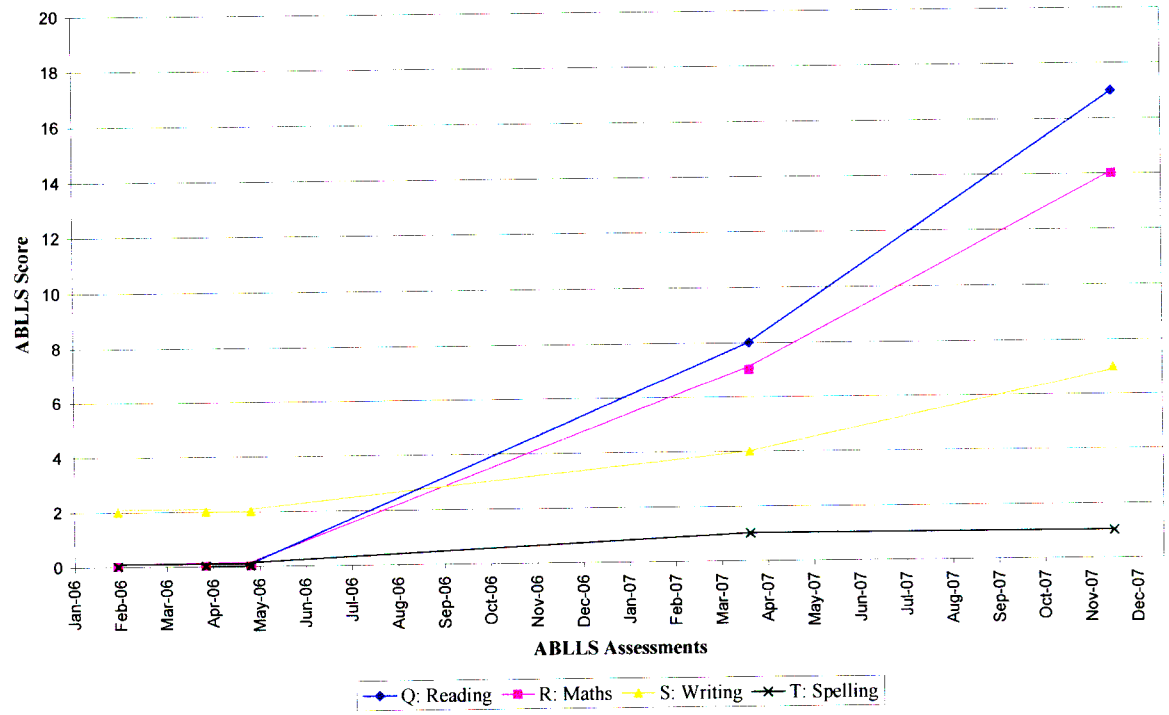


Figure 4b: Summary of all skill areas in the academic domain

4.2.5 Progress in the Self-Help Domain

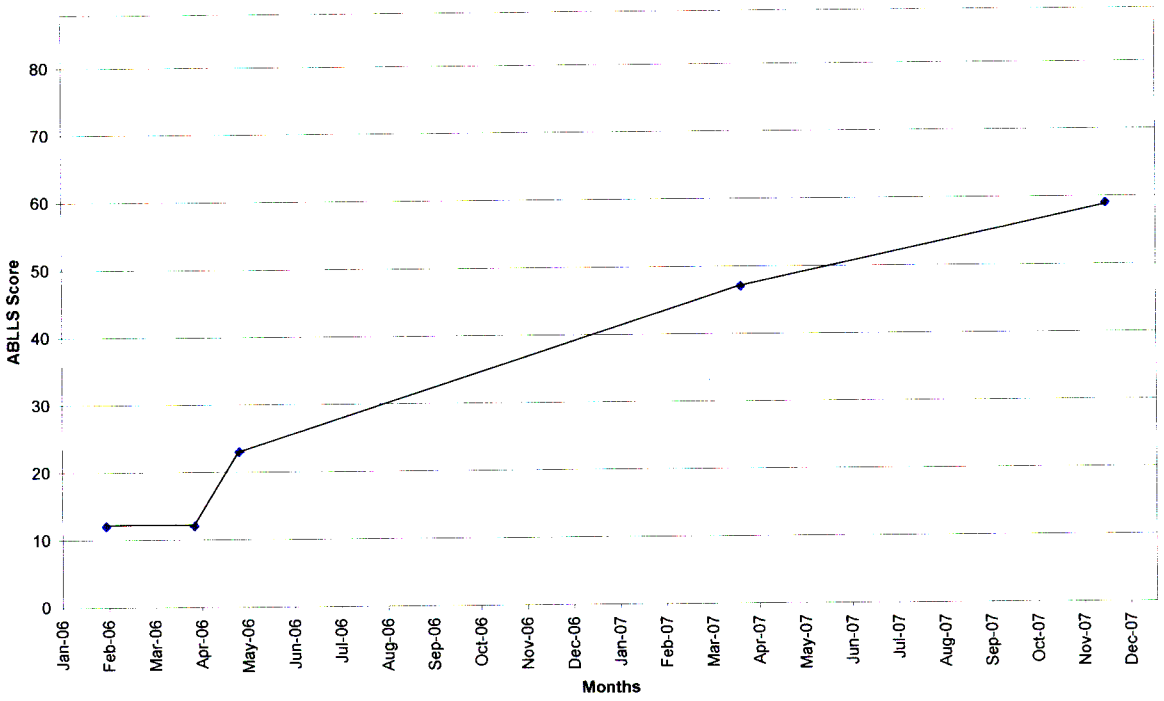


Figure 5a: Self-help domain score trajectory

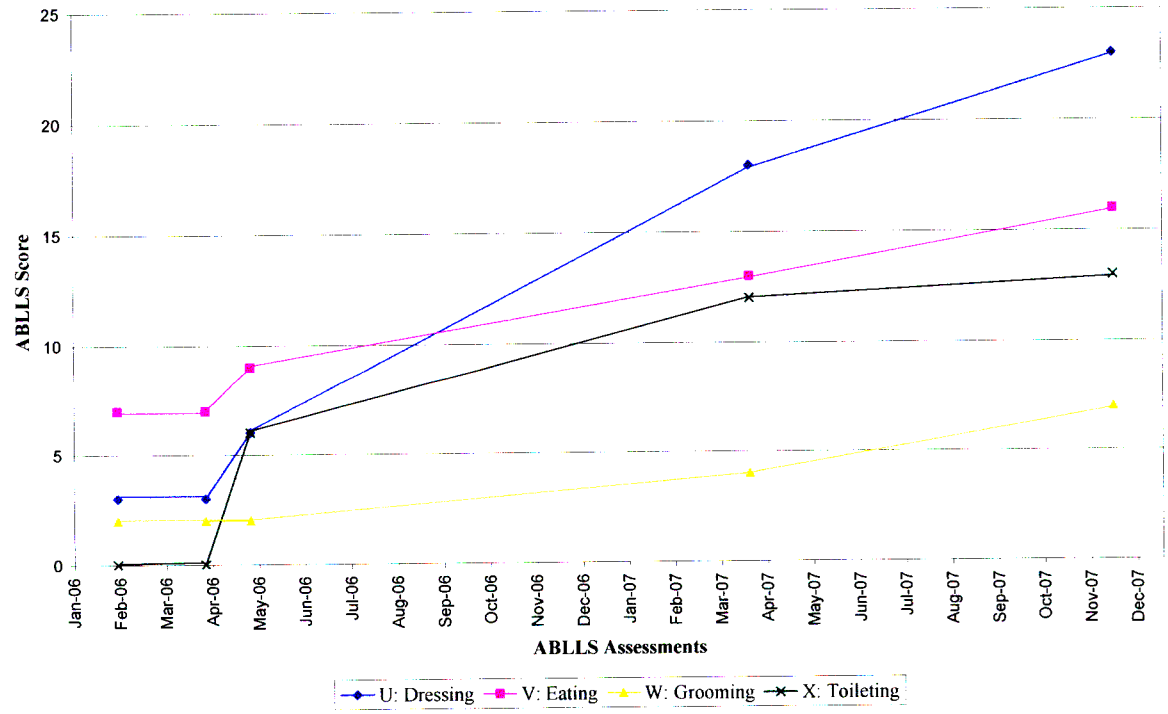


Figure 5b: Summary of all skill areas in the self-help domain

4.2.6 Progress in the Motor Domain

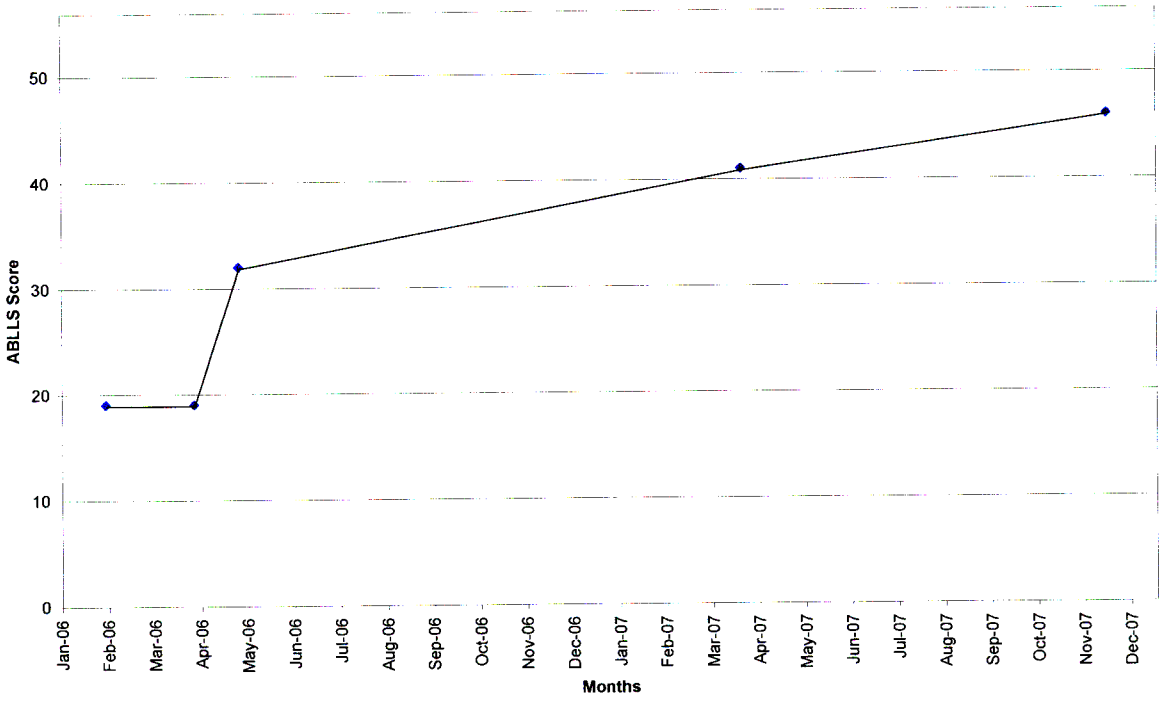


Figure 6a: Motor domain score trajectory

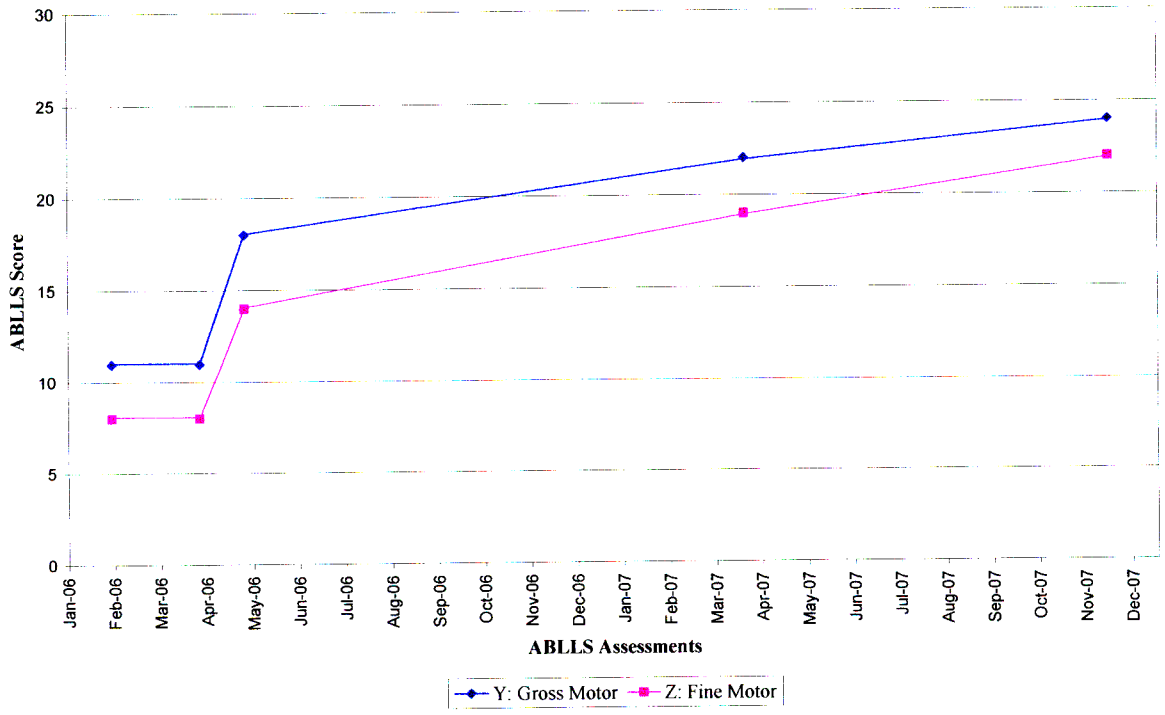


Figure 6b: Summary of all skill areas in the motor domain

4.2.7 Progress in the Additional Domain

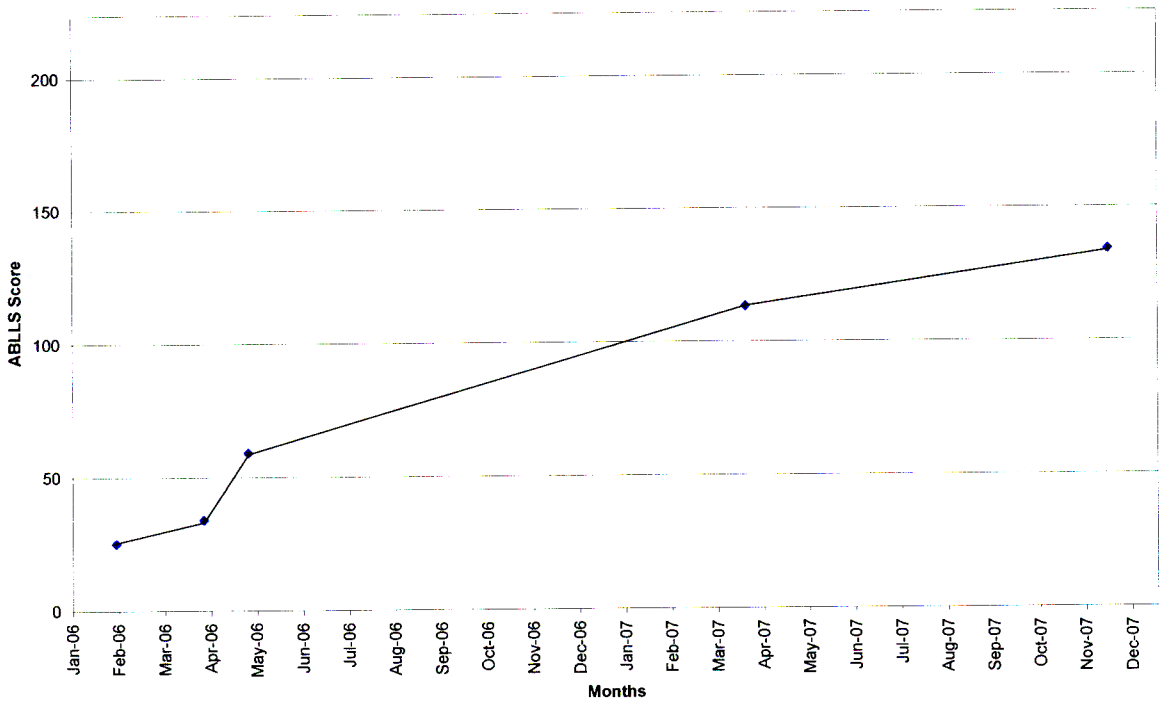


Figure 7a: Additional domain score trajectory

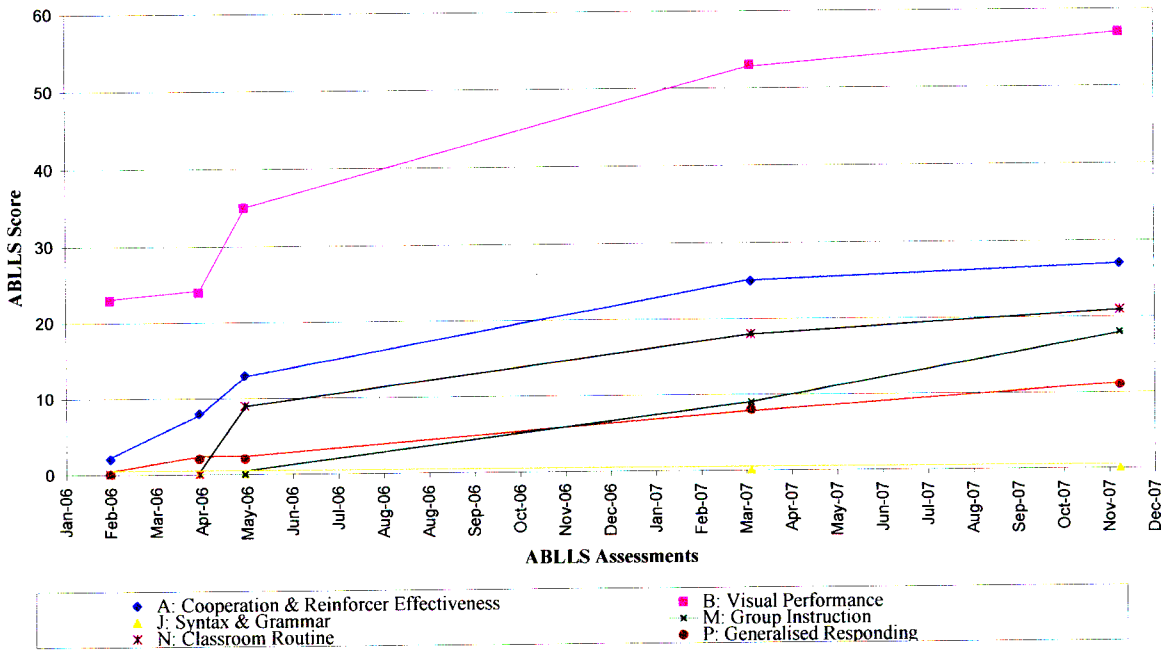


Figure 7b: Summary of all skill areas in the additional domain

4.3 Social Validity

Another essential component of outcome evaluation is to assess the social validity of the changes in behaviour. Social validity refers to the clinical or practical significance of the behaviour change such that the change in behaviour is explicitly evident and meaningful to significant others in Carl's life. The social validity of Carl's progress was evaluated by asking Carl's caregiver (mother) to rate his overall change in behaviour on a five point Likert scale, anchored by (a) *my child's behaviour significantly improved* at one extreme, to (e) *my child's behaviour got worse,* at the other. Carl's mother responded that she believed that his behaviour had *significantly improved* to the point that their family life had drastically changed as a result of the intervention. To illustrate, Carl's mother and father were previously unable to take him to social gatherings due to his problematic behaviour but over the past few months Carl has been able to accompany them to numerous social gatherings without difficulties. Another critical indication of Carl's progress is his being accepted into mainstream schooling after 22 months of intervention. Although his ABLLS results suggest that he could cope with the demands of Grade 0, given his original diagnosis, educators at the mainstream school have recommended that he commence in grade 00 with a facilitator. He will however still continue with ABA at TRIAD for one hour daily.

CHAPTER 5: DISCUSSION

The present study demonstrated the effectiveness of an intensive ABA intervention on a young child with AD. Results revealed that a young boy with AD, enrolled early (at 21 months), in an intensive ABA programme (20 hours of intervention per week), over a 22 month period, improved in all language and learning domains, as measured by the ABLLS. Furthermore, the boy's parents noted that his behaviour, after the 22 months of ABA, showed significant improvement such that he was enrolled in mainstream schooling at the end of the intervention period and was engaging with same age peers. Thus, results support the study hypothesis that a child undergoing an ABA programme at TRIAD would show continued progress across all learning domains throughout the programme and that this change would be socially valid for the child's caregivers.

The use of the case study design allowed for the study to be conducted in a typical clinical setting (TRIAD) where a true experiment would not be feasible for practical, methodological, and ethical reasons (Green et al., 2002). Given that randomised controlled studies of intensive ABA interventions are financially and ethically challenging, there is a need for published case studies that document intervention effectiveness (Butter et al., 2006). Random assignment of a control group to no, or inferior treatment begets ethical concern, and long-term, intensive ABA treatment, on a large scale, is very costly. Furthermore, large controlled studies fail to account for the individual differences in how children respond to intensive ABA, and although demonstrating intervention efficacy in a controlled environment, these studies do little to ascertain the effectiveness of the application of such interventions in the community. Consequently, the present study was a means of demonstrating the effectiveness of a centre-based intervention through providing a well-described case history of a child's individual response to the programme.

In the following sections, the results of the study are discussed, the implications of the findings highlighted, the limitations of the study acknowledged, and suggestions made for further research.

5.1 Findings

5.1.1 Language Domain

In the language domain, Carl showed considerable progress in all areas namely: receptive language; vocal imitation; requests; labelling; intraverbals; and spontaneous vocalisations. Carl did not display any language at the onset of the programme with an absence of noteworthy receptive language, vocal imitation, requesting, labeling, and intraverbal skills prior to the intervention. For this reason, PECS, a practical picture-exchange communication system, was used as an initial means of communication for him. A substantial improvement was seen in Carl's vocal imitation (i.e., his ability to repeat sounds and words).

5.1.1.1 Spontaneous vocalisations

Prior to the programme, Carl displayed very few spontaneous vocalisations such as vocal play or babbling. Behaviour consultants at TRIAD noted that Carl was a silent child, who even when crying would very seldom make any noise at all. In a typical child, spontaneous vocalisations have been shown to play an important role in language development because vocal activity strengthens the vocal chords and allows for the random combination of sounds that often accidentally produce words that can be reinforced by parents (Sundberg & Partington, 1998). Spontaneous vocalisations include speech sounds, words, phrases, songs, and spontaneous contributions to conversation. Carl's spontaneous vocalisations improved substantially and consistently from the first month of the intervention through to the final 22 month assessment. This confirms Baker and Frosts' (2006) assertion that PECS does not limit the child's development of spoken language, but instead encourages the child's progression to vocalisations.

5.1.1.2 Vocal imitation

The existence of substantial vocalisations for a nonverbal child can be a good predictor for the easy development of vocal imitation and eventually other types of verbal behaviour (Sundberg & Partington, 1998). It is therefore not surprising that Carl's vocal imitation also improved drastically within the first month, and continued to improve over a 14 month period. For the final 8 months of the intervention, Carl's progress in this area slowed somewhat but continued to show improvement. Vocal imitation tasks include imitating sounds, words, phrases, and intonation.

5.1.1.3 Receptive Language

Receptive language denotes Carl's ability to understand and act upon specific words and phrases. Receptive language tasks include responding to own name, and following

instructions (involving prepositions and pronouns), making choices, selecting items representing location, emotions, and social interaction. Although not a guarantee, the strength of receptive skills can often predict the rate at which other types of language are acquired (Sundberg & Partington, 1998). Carl's receptive language increased consistently from the first month of ABA throughout the entire intervention period.

5.1.1.4 Requesting

Carl's requesting skills were absent prior to the programme. As he had not learnt to use words to ask for what he wanted, he had developed negative behaviour, such as screaming, as a way of communicating. His requesting skills showed substantial improvement in the first three months and this increase could be explained by the introduction of PECS as a means of encouraging requesting (manding) in this initial 3-month period. Once adequate manding skills had developed, PECS was faded out to encourage further verbal requests. As a result, requesting skills continued to improve steadily throughout the remainder of the intervention.

5.1.1.5 Labelling

Labelling (or tacting) is the ability to verbally label common items and actions. Labelling tasks include labeling reinforcers, objects, people, actions, pictures, and adjectives. Advanced labelling tasks included labelling an item when told its function, features, or class. As well as labelling noun-verb and noun-adjective combinations, internal events and emotions, and social interaction behaviour. For the first two months of the intervention Carl was unable to verbally name common items in his environment. Thereafter he developed some labeling skills, using PECS, and continued to improve slowly yet steadily in this area throughout the 22 months, until he could label vocally.

5.1.1.6 Intraverbals

Intraverbals (or conversational language) includes answering questions and participating in meaningful conversations. Intraverbal tasks include filling in missing words, providing opposites, describing steps in sequence of a daily activity, and answering who, what, why, can, does, or will questions. Advanced intraverbal tasks include answering novel questions, spontaneous conversation, and telling stories. Conversational skills are very important for social interaction and the development of academic skills, and many children with AD never acquire conversational skills despite a speaking vocabulary of hundreds of words (Sundberg & Partington, 1998). Although absent prior to the intervention, Carl showed some improvement in intraverbals in the first month and thereafter improved slowly but steadily throughout the intervention period.

5.1.2 Play and Social Domain

In the play and social domain, substantial and consistent improvement throughout the 22 month period was noted overall and all three skill areas in this domain showed improvement.

5.1.2.1 Imitation

The most substantial improvement in this domain was evident in the area of imitation skills. Imitation skills require the child to physically imitate motor movements modelled by others from imitating head movements to spontaneous and delayed motor imitation. Imitation skills are essential as children acquire a number of important skills through imitation of adults and other children (Sundberg & Partington, 1998). Motor imitation fosters the development of vocal imitation and plays an important role in the development of play skills and social interaction (Sundberg & Partington, 1998). Prior to the intervention, Carl was unable to imitate any motor movements modeled by others, was unable to attend to others, and showed little interest in the actions emitted by others. His imitation skills increased drastically within the first two months of ABA, and continued to improve substantially throughout the remaining 20 months.

5.1.2.2 Social Interaction

Social interaction tasks include appropriate responses to others, sharing, eye contact, initiating and returning greetings, and conversing with others. At baseline, Carl was generally uninterested in other people and preferred to be isolated. He displayed poor eye contact and was described by TRIAD behaviour consultants as "very detached". On occasion, he would approach family members but tended to retreat if interaction was requested. Little improvement was seen in this area in the first two months of the intervention but significant progress was made in the remaining 20 months. By the end of the intervention, Carl had formed a close friendship with another boy at TRIAD with whom he played regularly and spontaneously. He now demonstrates a desire to communicate with, interact with, and play with family members and occasionally with strangers. In addition, he spontaneously hugs and kisses his family members.

5.1.2.3 Play and Leisure

Similarly, play and leisure skills, were predominantly absent at baseline. Play and leisure skills include exploring and playing with toys in the environment, playing with peers, sociodramatic play, and outdoor leisure activities and games. TRIAD behaviour consultants noted that Carl was unable to entertain himself and had negligible play and leisure skills. Carl's parents were unable to take him along to social gatherings and public venues such as

friends' houses, restaurants, movies, and the zoo, due to his negative behaviours in social circumstances when interaction was forced. Little improvement was noted in the first two months of ABA but thereafter some progress was noted in this area. This progress was slow yet steady, and after 22 months of intervention, Carl had developed an ability to play independently and interact more appropriately in everyday social situations. By the end of the intervention, Carl was accompanying his parents to social gatherings with ease.

5.1.3 Academic Domain

The skills that form the academic domain (reading, maths, spelling, and writing) were for the most part absent at the onset of the intervention and no change was noted in any of these academic skills in the first three months of ABA. This is not surprising as tasks aimed at addressing these skills are not introduced in the initial stages of the programme. From three months however, slight but steady improvement was noted in all four areas. Given Carl's age at the end of the programme (3 years, 8 months), slow progress in academic skills is not of significant concern and can be addressed further in maintenance ABA therapy and preschool classes.

5.1.4 Self-Help Domain

In terms of Carl's self-help domain, all skill areas showed improvement throughout the intervention. At baseline Carl displayed no independent toileting skills but by the end of the treatment period, Carl was fully toilet trained during the day and only required nappies at night due to occasional bedwetting. Carl's dressing, grooming, and eating skills were minimal at the onset of the intervention. After 22 months he had, for the most part, gained independence in dressing and eating. Grooming skills however did not improve in the same manner as other self-help skills and require further attention.

5.1.5 Motor Domain

In the motor domain, both Carl's fine motor and gross motor skills began to improve between the first and second month of the intervention. Although his motor skills were not an area of weakness for him at the onset of the intervention, consistent improvement was noted.

5.1.6 Additional Domain

Finally, in the additional domain, substantial improvement was noted in five of the six skill areas.

5.1.6.1 Cooperation and Reinforcer Effectiveness

Carl's cooperation and reinforcer effectiveness was relatively low at the onset of the intervention. He displayed behaviour excesses such as crying or screaming when required to work, and required a lot of prompting and powerful reinforcers before complying with behaviour consultant's or technician's requests. As teaching in the ABA programme involves a large amount of positive reinforcement, reinforcer effectiveness is crucial for learning to be optimal. Similarly, the level of motivation and cooperation play an essential role in the rate of learning. It is therefore noteworthy that this essential skill area developed quickly in the first three months and then continued to improve consistently throughout the remainder of the programme. Tasks included in this skill area include responding to instructor controlled reinforcers, intermittent reinforcers, non-edible reinforcers, and social reinforcers. By the end of the 22 month period Carl displayed a strong cooperative repertoire as he was able to sit at a table and work with an adult for extended periods of time without emitting disruptive behaviours. In addition, he was responding to all levels of reinforcement including identifying task completion as a reinforcer in itself.

5.1.6.2 Visual Performance

Visual performance skills include the ability to attend to visual stimuli and to discriminate between differing stimuli (Sundberg & Partington, 1998). Visual performance skills are assessed and taught through matching tasks, sorting, puzzle building, block design, mazes, and picture sequences. These tasks are typically assessed in IQ tests and are an indication of cognitive ability (Sundberg & Partington, 1998). As Carl displayed some visual performance skills at the onset of the programme, where many play, language, and social skills were absent, it is likely that Carl's deficits could primarily be attributed to his AD symptoms rather than any significant cognitive impairment. Carl's visual performance skills, although good at the onset of the programme, continued to improve throughout.

5.1.6.3 Follow Classroom Routine

At the onset of the intervention, Carl was unable to follow any classroom routine despite having attended a mainstream daycare centre for the 19 months prior to enrolling at TRIAD. Tasks included in this skill area include lining up on request, returning materials, working independently, waiting turn, and keeping classroom schedules. No improvement was evident in this area for the first month, but by the end of the second month of the intervention Carl displayed significant improvement. For the remaining 20 months Carl improved substantially and consistently to a point where he has very little difficulty in adhering to the

daily routine and demands at TRIAD. His strength in this skill area is likely to impact favourably on his transition to mainstream school.

5.1.6.4 Generalised Responding

As discussed previously, a critique of Lovaas/ABA has been its lack of generalisation of skills. TRIAD thus incorporated NET and made use of a five-step generalisation programme, discussed above, to ensure adequate generalisation of skills. At baseline, Carl displayed no generalisation skills. However, generalisation was observed in the first month of the intervention with consistent and substantial improvement over the entire 22 month period. . By the end of the intervention period, Carl displayed an ability to generalise skills learnt across stimuli, instructors, environments, and in group situations. In addition, he had learnt to generalise from one verbal operant to another.

5.1.6.5 Group Instruction

The area of group instruction included the assessment of abilities in group situations such as sitting appropriately, attending, raising a hand, taking turns, and following instructions. Although this skill was absent at the onset of the programme, after the first month steady and considerable improvement was observed over the remaining 21 months.

5.1.6.6 Syntax and Grammar

As Carl displayed no verbal language until several months into the ABA treatment, the skill area of syntax and grammar was not developed at the onset of the programme. Given Carl's initial lack of spoken language, the acquisition of language was a primary focus throughout the programme. For this reason, syntax and grammar were not specifically addressed in the 22 month period and did not show any improvement throughout the programme. As Carl's verbal language improves however, behaviour consultants or technicians can target this skill area in maintenance sessions.

5.2 Predictor Variables

Despite research confirming the efficacy of ABA as a successful intervention for AD, a substantial proportion of children do not improve to the same degree as others, and others' trajectories are almost flat or even declining (Goin-Kochel et al., 2007). Many larger scale studies have been able to cluster the sample into two separate groups (higher-performing or lower-performing) based on the child's level of functioning at the end of the intervention (Lovaas; 1987; Sallows & Graupner, 2005; Goin-Kochel et al., 2007). These varying results indicate the potential for significant growth as well as the likelihood that ABA will not significantly benefit all children with AD. The reason for this discrepancy is not yet clear.

Some studies show that more hours of ABA per week result in better outcomes (Lovaas, 1987; McEachin et al., 1993; Sallows & Graupner, 2005). Others reveal that the younger the child at the onset of the programme the better the child's response to the programme (Anderson et al., 1987; Goin-Kochel et al., 2007). Additionally, children with a higher level of functioning or IQ at baseline have been found to respond better than those with lower IQs (Anderson et al., 1987; Eldevik et al., 2006; Goin-Kochel et al., 2007) and responsiveness to treatment in the first 6 months, as measured by the ABLLS, has been shown to predict a better outcome (Goin-Kochel et al., 2007). Lastly, parental involvement appears to improve the child's response to treatment (Lovaas et al., 1973; Sheinkopf & Seigel, 1998).

Given the different outcome measures used in the above studies, it is impossible to make direct comparisons with the present study. Nonetheless, it is essential to discuss the findings of the present study with this existing body of literature in mind. Factors that were likely to predict a good outcome were Carl's age at onset, quick initial skill acquisition rate, number of hours of ABA per week, and parental involvement. As pretreatment IQ was not assessed, it is not possible to ascertain how this could have predicted his response to the programme. Carl was thus a suitable candidate for ABA treatment and his response to the programme supports the existing body of research that reveals that the above factors are associated with good outcome.

5.2.1 Number of Hours and Parental Involvement

Although some studies have shown that close to half of the children receiving approximately 40 hours of intensive ABA intervention achieved essentially normal educational and intellectual functioning (Lovaas, 1987; McEachin et al., 1993; Sallows & Graupner, 2005), less impressive gains were made with less intensive treatment (approximately 20 hours per week) (Birnbrauer & Leach, 1993; Anderson et al., 1987). As some parents and professionals have expressed concerns that 40 hours per week of ABA might put too much stress on the child and leave too little time to play and socialise with peers (Eldevik et al., 2006), it is useful to note that, although superior progress could potentially have been achieved with more hours, in this study a substantial improvement was achieved with a lesser number of intervention hours (20 hours of formal intervention per week). Furthermore, as in the higher performing groups in the Lovaas (1987), McEachin et al. (1993), and Sallows and Graupner (2005) studies that averaged 40 hours of ABA per week, the subject in the present study, with 20 hours of ABA per week, was included in a mainstream school programme (albeit with an

aid). It is however essential to note that Carl's family was very actively involved in his treatment. Carl's mother reported that they utilised many ABA techniques and procedures in the home environment and he had on average 1.5 hours additional learning with his mother and brother every day. This added an approximate 10 hours of intervention per week. Although he was enrolled for 20 hours of formal ABA per week, his additional sessions with his parents increased this to an approximate 30 hours per week. It is likely that this impacted favourably on his response to the intervention (Sheinkopf & Seigel, 1998)

5.2.2 Age at Onset of Intervention

Regression analyses reveal that children in the higher-performing group tend to have an earlier age at onset of the ABA programme (Fenske et al., 1985; Goin-Kochel et al., 2007). As Carl was diagnosed early, at 21 months of age, he was at an excellent age to initiate an ABA programme. This young age at onset was likely to have played a role in his good response to the programme.

5.2.3 Functioning at Baseline and Early Learning Rates

A low IQ has been associated with poorer outcomes (Anderson et al., 1987; Eldevik et al., 2006; Goin-Kochel et al., 2007). As no standardised IQ measure was administered at baseline, his pretreatment level of functioning is uncertain. Based on his ABLLS scores and reports by parents and TRIAD behaviour consultants, it is clear that he had very few skills but this is likely to have been as a result of his young age at the time. Notwithstanding, he began to acquire skills very quickly. Weiss (1999) and Weiss and Delmolino (2006) showed that children who initially learn skills quickly continue to demonstrate rapid acquisition rates. In almost all of the learning domains, Carl demonstrated progress in the first 3 months, and there was not a substantial difference in the average slope of the graphs in the first 3 months as compared to the remaining 19 months. In keeping with the Weiss (1999) and Weiss and Delmolino (2006) studies, it appears that Carl's initial rate of learning was sustained throughout the remainder of the intervention.

5.3 Implications

A number of implications are suggested by the study findings.

5.3.1 Contribution to Existing Efficacy Studies

Results are in keeping with the broader body of knowledge that ABA is efficacious as a treatment for children with AD and that the AVB adaptation of ABA has the potential to produce at the very least comparable results to Lovaas/ABA. The results add to the existing outcome studies and provide further support for the efficacy of ABA in general but in particular the more recent alternative ABA model: AVB/ABA. Although comparatively more empirical support currently exists for Lovaas/ABA, several authors have suggested that the AVB/ABA approach could demonstrate improved efficacy over Lovaas/ABA based on a stronger language component, improved generalisation of skills, and natural environment teaching (NET) (Barbera, 2007). This study does not provide evidence of superior efficacy to Lovaas/ABA due to the single case design and differing outcome measures used. However the study does contribute to the existing literature and provides further evidence for at least the comparable efficacy of AVB/ABA.

5.3.2 Predictor Variables

Results of the study confirm the likelihood that factors such as age at onset, hours of treatment, skill acquisition rates, and parental involvement are likely to play important roles in the child's response or non-response to the programme. This information is useful in the South African context where ABA treatments are limited and costly. Many parents rely on loans from friends, family, or banking institutions to assist in covering the intervention costs. It is therefore essential to be able to assess which children are likely to benefit from the programme in order to justify the expense. Furthermore, given that the programme is intensive and involves a significant and long-term commitment by parents, being able to identify children who are unlikely to benefit adequately from ABA, would allow for alternative treatments to be attempted during the critical, early, developmental years. Additionally, given that an early age at onset is essential for best outcome, professionals should make every effort to diagnose early rather than delay diagnosis as a means of avoiding stigma or misdiagnosis.

5.3.3 Effectiveness and Fidelity of TRIAD's ABA Programme

This case study provides important information on the details of the AVB/ABA programme at TRIAD and provides support for the effectiveness of this particular programme in a clinical setting (i.e., this efficacious treatment has been implemented effectively at TRIAD). Too often, clinical settings are short-staffed, under-funded, and lack the necessary expertise

to apply protocols accurately so as to produce beneficial outcomes akin to those reported in highly controlled research settings (O'Donohue & Ferguson, 2006). The information provided in this study thus informs referring professionals that a local centre is able to apply AVB/ABA accurately and effectively.

5.3.4 Economic and Policy Implications

The effectiveness of the programme at TRIAD carries certain economic and policy implications. The cost of 20 hours per week of intensive ABA treatment at TRIAD for 2006 and 2007 averaged at R4000 per month, R48 000 per annum, and an approximate R88 000 for the 22 month period. Although this cost is overwhelming for many South African families, not offering effective treatment at a crucial stage in the child's development is also expensive in terms of lost potential and the continued need for supportive services throughout the child's life. Thus, if other children display similar progress to that depicted in the present study, and can achieve some form of mainstream school inclusion as a result, the costs incurred could be considered a worthy investment. Although one medical aid has recently endorsed TRIAD's ABA programme and provided a percentage contribution to the treatment, others have yet to grant reimbursement. Similarly, given the current literature on the efficacy of ABA programmes, and the present study's description of the effectiveness of TRIAD's implementation of ABA, it is the author's opinion that government funding should be made available for this area of special education. In 2004, the prevalence of AD in South Africa was extrapolated to be 88 896 individuals with an incidence of 490 new cases every year (Statistics by country for autism, n.d.) and most South African families with a child with AD are unable to afford the high prices of an intensive ABA intervention. If government funding were to be made available, more children could be enrolled in ABA programmes, and ABA training could be provided for special needs teachers and staff in the community.

5.4 Limitations

The above implications need to be considered with the following limitations in mind.

5.4.1 Methodological Limitations

Several methodological limitations need to be considered. The case study design lacks a control group or comparison group. Thus, given their lack of control, case studies are unable to rule out the effect of extraneous variables (Kazdin, 2003). In this case, intervening variables that could have hindered or improved Carl's response to the ABA programme

include his age at the onset of the programme, the number of hours of ABA per week, his IQ, the high degree of parental involvement in his programme, vitamin supplements, or even his four months of speech therapy.

Another notable problem with the case study design is the generalisability of the findings. Kazdin (2003) notes that individual cases tend to reflect marked or unique characteristics and do not provide widely generalisable findings. Although Carl's progress was notable and valid, one could argue the possibility of idiosyncratic findings when the case is viewed in isolation. It is therefore important that the findings of the study be viewed as a contribution to the existing ABA outcome research. Kazdin (2003) notes further that rather than the number of subjects, the assessment and design of the study determine the extent to which valid inferences can be drawn. The use of standardised and replicable procedures, as in the present study, plays an important role in making the data more convincing. Similarly, assessments on multiple occasions reflect the consistency of sustained and incremental progress over time. Finally, by combining qualitative information from Carl's progress as observed by his parents with the direct measures of overt behaviour as measured by the ABLLS, provides a better basis for claiming that reliable change has in fact occurred (Kazdin, 2003).

Furthermore, the retrospective design of the study did not allow for a single subject experimental design such as a multiple baseline, multiple probe, reversal, or alternating treatment design. As there was no return to baseline, the present study offers a less powerful indication of the control of the independent variable over the dependent variable. Future research could therefore aim to include a second baseline period to reflect a loss of or reduction in skills gained during the initial intervention phase and after the second baseline period a subsequent recovery of skills lost in a second intervention phase. This removal of treatment at a crucial stage in development does however elicit ethical concerns. Alternatively, comparing progress made during one ABA intervention phase with a second alternative treatment phase, could provide information on ABA effectiveness in comparison to other AD treatments.

5.4.2 Maturation

A threat to internal validity that should be kept in mind is the impact of *maturation* on the results, in other words, could the gains made throughout the programme be accounted for, to

some extent, by normal child development? Again, it is essential to consider the results in combination with current literature on the developmental course of AD and the poor prognosis that is typically associated with the disorder. Given that most children with AD never develop language or are very seldom enrolled into mainstream schooling, these gains made by Carl are extraordinary for a child with the severity of AD symptoms described by Carl's parents at the onset of the programme.

5.4.3 Lack of Norm-Referenced Psychometric Assessments

As the ABLLS is not age normed, the scores are not directly interpretable and do not provide an adaptive functioning age equivalent or IQ level. Similarly, each skill area differs in terms of maximum score. This makes it difficult to compare progress made on one skill area with another by merely examining the line graph. Although tracking Carl's scores on each skill area over time provides a valuable developmental perspective, future studies could be strengthened if ABLLS scores could be compared to baseline and post intervention assessments of adaptive functioning using registered norm-referenced psychometric tests such as the VABS (Sparrow, Balla, & Ciccheti, 1984). If consistent improvement or decline could be shown for each child across both assessment tools, reliability of findings could be increased. Furthermore, additional information of Carl's progress could have been obtained by comparing Carl's abilities (e.g., adaptive functioning level) at baseline and post-intervention to other children of the same age.

5.4.4 Personal Bias

The ABLLS data used in the study have been obtained from TRIAD and have been compiled and provided by TRIAD employees. Given that TRIAD staff could have a vested interest in seeing Carl progress, making sole use of this data could reduce reliability of findings as it provides a platform for personal bias of information. Therapist bias has, to some extent, been accounted for by the social validity evaluation of behaviour change provided by Carl's parents. Nonetheless, while Carl's parents and behaviour consultants are probably the most knowledgeable about his abilities and development, this intimacy could interfere with their objectivity. Although the scoring criteria of the ABLLS are highly specific and require very little subjective interpretation by the behaviour consultant, to guard against the possibility of bias, future research should aim to include an additional assessment tool that is administered by an independent professional. In this way ABLLS data could be compared to the alternative assessment to assess for potential bias.

5.4.5 Autism Diagnosis

Another concern could be related to the reliability of Carl's AD diagnosis. An essential inclusion criterion was a diagnosis by an independent psychiatric or psychological professional. Given Carl's level of functioning and reduction in AD symptomatology at the end of the intervention, Carl's initial diagnosis could be challenged. However, an erroneous diagnosis is highly unlikely considering that it was made by an experienced Psychiatrist specialising in child psychiatry. Furthermore, observations by behaviour consultants at TRIAD, and Carl's ABLLS scores, endorse Carl's AD symptomatology at the onset of the intervention. For further studies however, a means of increasing the reliability of the diagnosis could be to administer or complete an objective baseline measure of AD such as the Childhood Autism Rating Scale.

5.5 Need for Further Research

5.5.1 Efficacy of AVB/ABA

An APA taskforce – Division 12 Task Force Promotion and Dissemination of Psychological Procedures – has been assembled to help promote efficacious psychological interventions (O'Donohue & Ferguson, 2006). O'Donohue and Ferguson discuss the Task Force's division of efficacious therapies into two groups: well-established treatments and probably efficacious treatments (O'Donohue & Ferguson, 2006). According to the Task Force, efficacy can be demonstrated through the use of at least two good between group design experiments or more than nine single case experiments. In addition, the Task Force requires that this research includes the use of treatment manuals, the explicit statement of participant characteristics, and results from at least two different research teams. As these criteria have not as yet been met for AVB/ABA, further research could aim to compare a large sample of AVB/ABA with Lovaas/ABA or a waiting list control group. Alternatively, a number of single case experimental design studies using an alternating treatments design (with placebo or Lovaas/ABA) is likely to be less costly and arduous.

5.5.2 Alternative Treatments

Although research has shown that specific factors play a role in predicting outcome to ABA, there is limited information on alternatives available for those who are not suitable candidates for ABA. Further comparative research could thus address this issue through the use of

single case alternative treatment design studies, or large scale randomised studies that compare two or more treatments.

5.5.3 Effectiveness and Fidelity of Community Programmes

Further studies of a similar nature to the present study, with other children at TRIAD, would provide additional information and increased support for TRIAD's ABA programme. It should be noted that the child chosen as the subject for the study started intervention early, received a consistent and intensive number of hours of intervention per week, had an AD diagnosis, and had significant parental support. Although these inclusion criteria were essential for the purposes of the present study to rule out the effects of extraneous variables, many cases at TRIAD are not as straightforward. Diagnoses are seldom as early as 21 months of age and tend to vary between AD, AS, and PDD-NOS, with or without comorbid mental retardation. In addition, hours are reduced and increased as funds or medical aids allow and parents often remain uninvolved in their child's treatment. Ultimately, the evaluation of a number of single cases would allow for (a) an evaluation of the reliability of treatment effects across all types of cases, (b) treatment effects to be compared to existing outcome studies, and (c) further support for potential predictor variables such as specific child (e.g., age at onset, or IQ at baseline) and programme characteristics (e.g., number of hours of intervention) (Carr & Firth, 2005).

Given the low socioeconomic status of so many families with children with AD, making intensive ABA treatment available in rural or semi-rural communities should be explored further. Behaviour consultants at TRIAD, in conjunction with behaviour consultants from ABC in California, intend to initiate a programme to train para-professionals to become ABA technicians in poorer communities. ABA is relatively advanced and complex, thus much training and supervision is necessary to ensure accurate implementation of techniques and procedures. It would therefore be essential that studies of a similar nature to the present study be carried out to assess for the effectiveness and fidelity of these interventions.

5.6. Conclusions

Although conclusions offered are provisional, and no causal inferences can be made, the clinical description of a child with AD achieving such measurable gains is still noteworthy. It would appear that the intensive ABA programme evaluated in this study was successful in bringing about measurable and observable gains in a young child with AD. The present study

thus provides support for the effectiveness of the ABA programme at TRIAD. The possibility exists that, if initiated sufficiently early, and implemented intensively, with adequate parental involvement, after two years of intensive ABA, a child could be enrolled in a mainstream school with an aide. The study contributes to the existing ABA outcome literature and provides further evidence for the AVB approach to ABA. Results confirm the likelihood that factors such as age at onset, hours of treatment, skill acquisition rates, and parental involvement play important roles in the child's response or non-response to the programme. The results suggest that the cost of intensive treatment over two years, although ostensibly excessive, may well be justifiable in the long-term. Consequently, the present study provides several useful guidelines for professionals to (a) endeavour to diagnose early; (b) administer an IQ measure to gauge the child's cognitive potential; and (c) assess the parents' commitment to a treatment programme. Given a young age at diagnosis, average intellectual ability, and parental commitment to treatment, professionals should encourage families to make every effort to finance an intensive ABA programme, such as the programme offered at TRIAD.

REFERENCES

Aman, M.G., Novotney, S., Samango-Sprouse, C., Lecavalier, L., Leonard, E., Gadow, K.D., et al. (2004). Outcome measures for clinical drug trials in autism. *CNS Spectrums, 9*(1), 36-47.

American Psychiatric Association (APA). (2000). *Diagnostic and statistical manual of mental disorders, fourth edition, text revision.* Washington, DC: American Psychiatric Association.

Anderson, S.R., Avery, D.L., Di Pietro, E.K., Edwards, G.L., & Christian, W.P. (1987). Intensive home-based early intervention with autistic children. *Education and Treatment of Children, 10*(4), 353-366.

Ash, M.E. (2006, October). *Is autism an immune mediated inflammatory disorder?* Paper presented at the Autism Safari, 2nd World Autism Congress, Cape Town, South Africa.

Baer, D.M. (1978). On the relation between basic and applied research. In Catania, A.C. & Brigham, T.A. (Eds). *Handbook of applied behavior analysis.* (pp 11-16). New York: Irvington Publishers, Inc.

Baker, S. & Frost, I. (2006, October). *Twenty years of PECS, the picture exchange communication system: A widely used intervention to promote functional communication skills*. Paper presented at the Autism Safari, 2nd World Autism Congress, Cape Town, South Africa.

Barbera, M.L. (2007). *The verbal behaviour approach. How to teach children with autism and related disorders.* London: Jessica Kingsley Publishers.

Barlow, D. & Herson, M. (1984). *Single case experimental designs: strategies for studying behaviour change (second edition).* New York: Pergamon Press Inc.

Birnbrauer, J.S., & Leach, D.J. (1993). The Murdoch early intervention program after two years. *Behaviour Change, 10,* 63-74.

Butter, E.M., Mulick, J.A. & Metz, B. (2006). Eight case reports of learning recovery in children with pervasive developmental disorders after early intervention. *Behavioral Interventions, 21*: 227–243.

Carr, J.E. & Firth, A.M. (2005). The verbal behavior approach to early and intensive behavioral intervention for autism: a call for additional empirical support. *Journal of Early and Intensive Behavioral Intervention, 2(1): 18-27.*

Cautilli, J. (2006). Validation of the verbal behavior package: old wine new bottle – a reply to Carr & Firth. *The Behavior Analyst Today, 7*(2): 242-252.

Connor, M. (2003). Monitoring and reviewing early intervention in autism (Lovaas). *Educational Psychology in Practice, 19*(1): 21-33.

Corsello, C.M. (2005, April-June). Early intervention in autism. *Infants and Young Children, 18*(2), 74-86.

Eikeseth, S. (2001). Recent critiques of the UCLA Young Autism Project. *Behavioural Interventions, 16,* 249-264.

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.

Esau, L.E., Kaur, M., Adonis, L., & Arief, Z. (2006, October). *Autism and the serotonin transporter: a genetic study in south african individuals.* Paper presented at the Autism Safari, 2nd World Autism Congress, Cape Town, South Africa.

Fenske, E.C., Zalenski, S., Krantz, P.J. & McClannahan, L.E. (1985). Age at intervention and treatment outcome for autistic children in a comprehensive intervention program. *Analysis and Intervention in Developmental Disabilities, 5*: 49-58.

Freeman, B.J., Cronin, P., & Candela, P. (2002). Asperger syndrome or autistic disorder? The diagnostic dilemma. *Focus on Autism and Other Developmental Disabilities, 17*(3): 145-151.

Goin-Kochel, R.P., Myers, B.J, Hendricks, D.R., Carr, S.E. & Wiley, S.B. (2007). Early responsiveness to intensive behavioral intervention predicts outcomes among preschool children with autism. *International Journal of Disability, Development and Education, 54*(2):151-175.

Govender, P., (2006, October). *Occupational therapy intervention for children with autism spectrum disorders.* Paper presented at the Autism Safari, 2nd World Autism Congress, Cape Town, South Africa.

Green, G. (2001). Behavior analytic instruction for learners with autism: advances in stimulus control technology. *Focus on Autism and Other Developmental Disabilities*, *6*(2): 72-92.

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.

Gresham, F.M. (1991). Moving beyond statistical significance in reporting consultation outcome research. *Journal of Educational and Psychological Consultation, 2*(1), 1-13.

Gresham, F.M. & MacMillan, D.L. (1998). Early intervention project: can its claims be substantiated and its effect replicated? *Journal of Autism and Developmental Disorders, 28*(1), 5-13.

Harris, S.L. & Delmolino, L. (2002, January). Applied behavior analysis: its application in the treatment of autism and related disorders in young children. *Infants & Young Children, 14*(3): 11-18.

Heilbroner, P.L. & Castaneda, G. (2006). *Pediatric Neurology: Essentials for General Practice.* Philadelphia: Lippincott Williams & Wilkins.

Hyde, G.W. & Hooper, S.R. (1992). *Neurological basis of childhood psychopathology.* London: Sage Publications.

Kates-McElrath, K. & Axelrod, S. (2006). Behavioral intervention for autism: a distinction between two behavior analytic approaches. *The Behavior Analyst Today, 7*(2): 242-252.

Kazdin, A.E. (2003). *Research design in clinical psychology.* Boston: Allyn & Bacon

Lauritsen, B.M., Pederson, C.B. & Mortenson, P.B. (2004). Effects of familial risk factors and place of birth on the risk of autism: a nationwide register based study. *Journal of Child Psychology and Psychiatry, 46*(9): 963-971.

Lee, D.A., Lopez-Alberola, R., & Bhattacharjee, M. (2006, October). *Childhood autism: a circuit syndrome?* Paper presented at the Autism Safari, 2nd World Autism Congress, Cape Town, South Africa.

Lord, C. (1995). Follow-up of two-year-olds referred for possible autism. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 36*(8):1365-1382.

Lovaas, O.I. (1981). *Teaching developmentally disabled children: the ME book.* Austin, TX: Pro-Ed, Inc.

Lovaas, O.I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*(1), 3-9.

Lovaas, O.I., Koegel, R.L., Simmons, J.Q., & Long, J.S. (1973). Some generalization and follow-up measures on autistic children in behavior therapy. *Journal of Applied Behavior Analysis, 6*: 131-166.

Lovaas, O.I., & Smith, T. (1989). A comprehensive behavioral theory of autistic children: paradigm for research and treatment. *Journal of Behavior Therapy and Experimental Psychiatry, 20*:17-29.

Maurice, C., Green, G., & Luce, S.C. (Eds). (1996). *Behavioral intervention for young children with autism: a manual for parents and professionals.* Austin, TX: Pro-ed.

McEachin, J.J., Smith, T., & Lovaas, O.I. (1993). Long term outcome for children with autism who received early intensive behavioral treatment. *American Journal on Mental Retardation, 97*(4): 359-372.

Nye, R.D. (1992). *The legacy of B.F. Skinner. Concepts and perspectives, controversies and misunderstandings.* California: Brooks/Cole Publishing Company.

O'Donohue, W. & Fergusen, K.E. (2001). *The psychology of B.F. Skinner.* Thousand Oaks, CA: Sage Publications.

O'Donohue, W. & Fergusen, K.E. (2006). Evidence-based practice in psychology and behavior analysis. *Behavior Analyst Today, 7*(3): 335-350.

Partington, J.W. & Sundberg, M.L. (1998). *The assessment of basic language and learning skills: an assessment, curriculum guide, and skills tracking system for children with autism or other developmental disabilities: Version 2.3.* Danville, CA: Behavior Analysts Inc.

Perrson, B.A., Perrson, B.A., & Sivberg, B. (2006, October). *Evidence –based treatment and autism.* Paper presented at the Autism Safari, 2nd World Autism Congress, Cape Town, South Africa.

Posey, D.J. & McDougle, C.J. (2000, July/August). The pharmacotherapy of target symptoms associated with autistic disorder and other pervasive developmental disorders. *Harvard Review of Psychiatry, 8*(2): 45-63.

Robertson, B. (1996). *Handbook of Child Psychiatry.* Cape Town: Oxford University Press.

Sadock, B.J., & Sadock, V.A. (2003). *Kaplan & Sadock's synopsis of psychiatry: behavioral sciences/clinical psychiatry, Ninth Edition.* Philadelphia: Lippincott Williams & Wilkins.

Sallows, G.O., & Graupner, T.D. (2005). Intensive behavioral treatment for children with autism: four-year outcome and predictors. *American Journal on Mental Retardation, 110*(6): 417–438.

Schaaf, R.C., Miller, L.J. (2005). Occupational therapy using a sensory integrative approach for children with developmental disabilities. *Mental Retardation and Developmental Disabilities Research Reviews, 11*: 143–148.

Scheinkopf, S.J., & Siegel, B. (1998). Home-based behavioral treatment of young children with autism. *Journal of Autism and Developmental Disorders, 28*(1), 15-23.

Schopler, E., Short, A., & Meisbov, G. (1989). Relation of behavioral treatment to "normal functioning": comment on Lovaas. *Journal of Consulting and Clinical Psychology. 57*(1), 162-164.

Schwartz, I.S., Boulware, G.L., McBride, B.J., & Sandall, S.R. (2001). Functional assessment strategies for young children with autism. *Focus on Autism and Developmental Disabilities,* 16: 222-227.

Sicile-Kira, C. (2003). *Autism spectrum disorders. The complete guide.* UK: Vermilion.

Siegel, B. (1996). *The world of the autistic child, understanding and treating autistic spectrum disorders.* Oxford: Oxford University Press.

Simpson, R. (2005). Evidence-based practices and students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities, 20*(3): 140-149.

Skinner, B.F. (1957). *Verbal behavior.* Englewood Cliffs, NJ: Prentice Hall, Inc.

Skinner, B.F. (1974). *About behaviorism.* London: Jonathan Cape Ltd.

Smith, T., Groen, A.D., Wynn, J.W. (2001). Randomised trial of intensive early intervention for children with pervasive developmental disorder. *American Journal of Mental Retardation, 105*, 269-285.

Smith, T., Eikseth, S., Klevstrand, M., Lovaas, O.I. (1997). Intensive behavioral treatment for pre-schoolers with severe mental retardation and pervasive developmental disorder. *American Journal of Mental Retardation, 102*: 238-249.

Sparrow, S.S., Balla, D.A., & Ciccheti, D.V. (1984). *Vineland Adaptive Behavior Scales, Interview Edition, Survey Form.* Circle Pines, MN: American Guidance Service.

Sundberg, M.L. & Michael, J. (2001). The benefits of Skinner's analysis of verbal behavior for children with autism. *Behavior Modification, 25*(5): 698-724.

Sundberg, M.L. & Partington, J.W. (1998). *Teaching language to children with autism or other developmental disabilities.* Pleasant Hill, CA: Behavior Analysts, Inc.

Taylor, B. (2006). Vaccines and changing epidemiology of autism. *Child: Care, Health and Development, 31(5): 511-519.*

Watson, R.I. (1979). *Basic writings in the history of psychology.* New York: Oxford University Press.

Weiss, M.J. (1999). Differential rates of skill acquisition and outcomes of early intensive behavioral intervention for autism. *Behavioral Interventions, 14:* 3-22.

Weiss, M.J., & Delmolino, L. (2006). The relationship between early learning rates and treatment outcome for children with autism receiving intensive home-based applied behavior analysis. *The Behavior Analyst Today, 7*(1): 96-110.

Wheeler, J.J., Baggett, B.A., Fox, J., & Blevins, L. (2006, Spring). Treatment integrity: a review of intervention studies conducted with children with autism. *Focus on Autism and Other Developmental Disabilities, 21*(1), 45-54.

Williams, G., & Greer, R.D. (1993). A comparison of verbal-behavior and linguistic communication curricula for training developmentally delayed adolescents to acquire and maintain vocal speech. *Behaviorology, 1*: 31-46.

Wrong Diagnosis. (2004). *Statistics by country for autism*. Retrieved 27 February, 2008, from http://wrongdiagnosis.com

APPENDIX A: SUMMARY OF DOMAINS, SKILLS, AND MAXIMUM SCORES

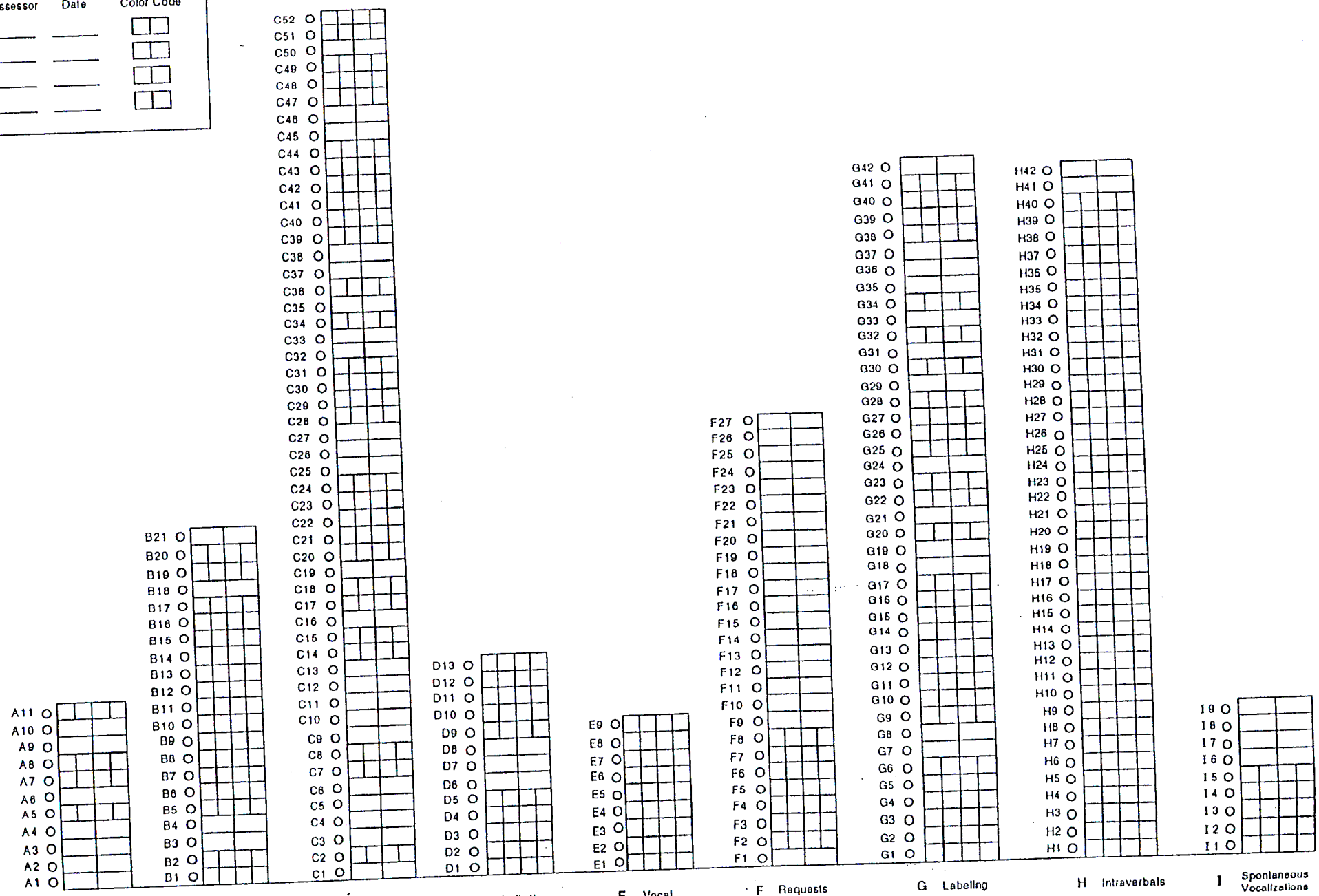
	ABLLS COMPOSITE SCORE	1276
	Basic Learner Skills	964
	Language Domain	600
C	Receptive language	162
E	Vocal imitation	36
F	Requests	68
G	Labeling	142
H	Intraverbals	164
I	Spontaneous vocalizations	28
	Play and Social Domain	140
K	Play and leisure	36
L	Social interaction	58
D	Imitation	46
	Additional Domain	224
A	Cooperation and reinforcer effectiveness	30
B	Visual performance	76
J	Syntax and grammar	44
M	Group instruction	38
N	Follow classroom routines	24
P	Generalised responding	12
	Academic Domain	168
Q	Reading skills	48
R	Maths skills	72
S	Writing skills	32
T	Spelling skills	16
	Self-help Domain	88
U	Dressing skills	32
V	Eating skills	20
W	Grooming skills	14
X	Toileting skills	22
	Motor Domain	56
Y	Gross motor skills	28
Z	Fine motor skills	28

APPENDIX B: ABLLS SKILLS TRACKING SYSTEM

Student: _____

Assessor	Date	Color Code
____	____	
____	____	
____	____	
____	____	

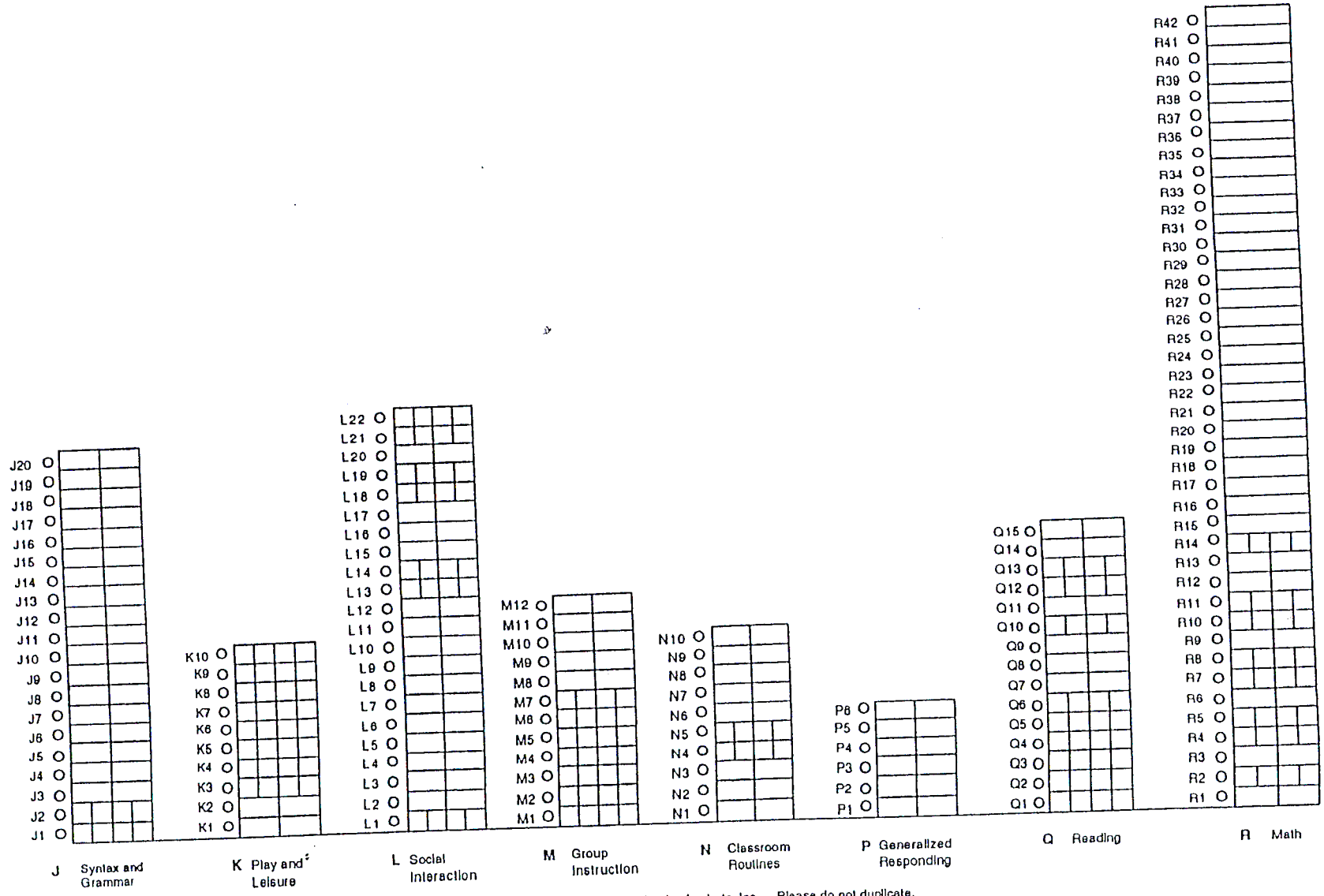
Assessment of Basic Language and Learning Skills
Skills Tracking System



Student: _____

Assessor	Date	Color Code
_____	_____	
_____	_____	
_____	_____	
_____	_____	

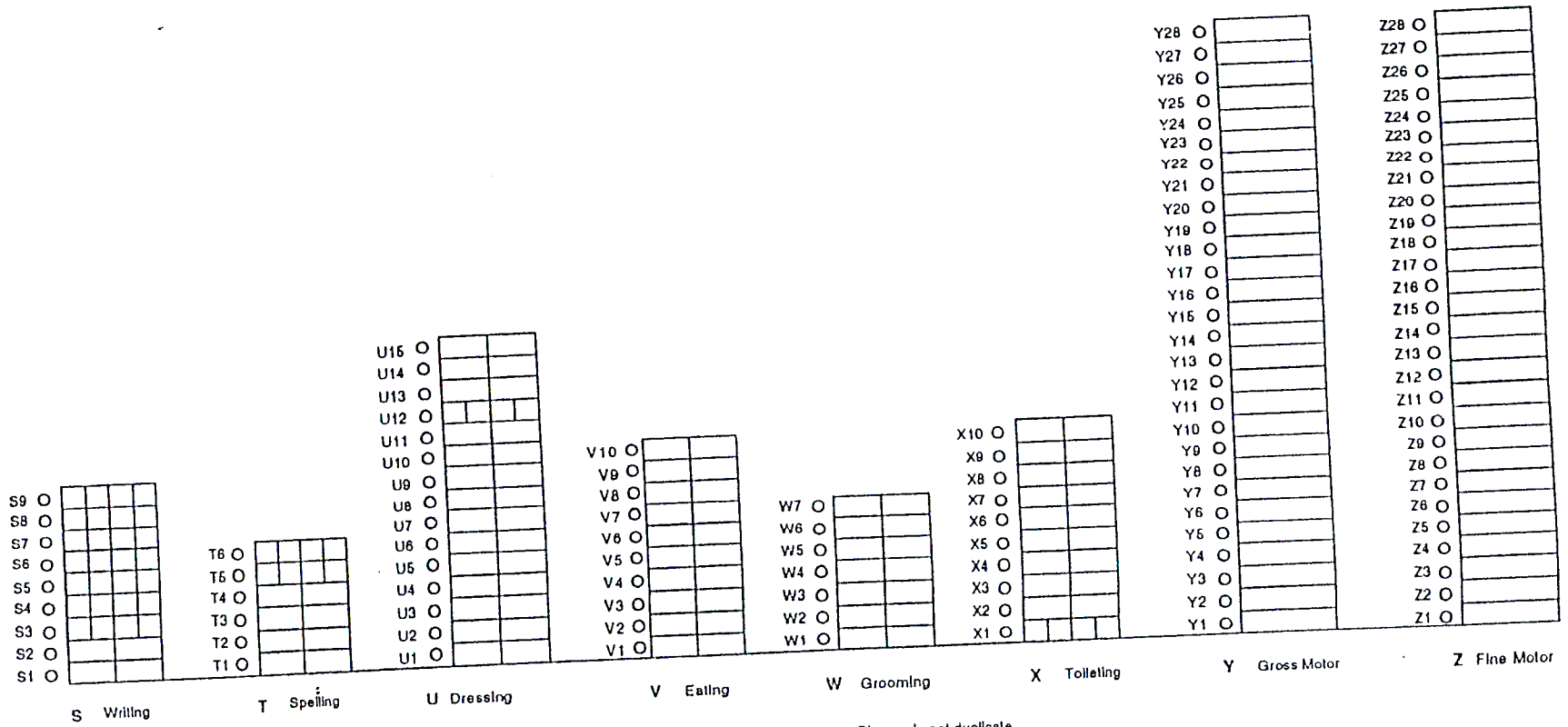
Assessment of Basic Language and Learning Skills
Skills Tracking System



Student: _____

Assessor	Date	Color Code

Assessment of Basic Language and [illegible]
Skills Tracking System



APPENDIX C: CAREGIVER INTERVIEW SCHEDULE

CAREGIVER INTERVIEW SCHEDULE

I am interested in finding out some background information about your child that will aid in the study. I will be asking you some questions about your child and your family. Please feel free to refrain from answering any questions you do not feel comfortable discussing.

I. Details of Interviewee:

Please provide the following information about yourself:

Name: _____

Relationship to child: _____

Signature: _____

II. Details of Child:

Please provide the following information about your child:

Personal History

Name: _____

Date of Birth: _____

Gender: _____

Race: _____

Official Diagnosis: _____

Age at Diagnosis: _____

Diagnosis made by: Clinical Psychologist ____ Paediatrician ____ Psychiatrist ____

Complications during pregnancy: _____

Complications during delivery: _____

Developmental history

Please provide the following information about your child's early development:

A. Developmental milestones:

1. Babbled	YES / NO	If YES, at what age? _____
2. Talked	YES / NO	If YES, at what age? _____
3. Crawled	YES / NO	If YES, at what age? _____
4. Walked	YES / NO	If YES, at what age? _____
4. Toilet trained	YES / NO	If YES, at what age? _____
5. Caregiver reach	YES / NO	

B. When did you first notice there was something different about your child? _____

What did you notice? _____

_____

_____

_____

C. Childhood illnesses/injuries: YES / NO

If yes, please specify:

ILLNESS/INJURY	AGE	CONSEQUENCES	TREATMENT

D. Current medical/physical conditions (epilepsy, hearing impairment, etc): YES / NO

If yes, please provide the following information:

CONDITION	AGE OF DIAGNOSIS	NATURE OF RESULTING IMPAIRMENT

E. Current medication? YES / NO

If yes, please provide the following information:

MEDICATION	DATE OF ONSET	DURATION	NATURE OF CHANGE NOTICED

F. Language ability at the onset of the behavioural programme:

____ a. no language
____ b. one word at a time
____ c. phrases of two or more words at a time
____ d. full sentences
____ e. able to have a conversation

II. Details of Family

A. Please provide the following information about the people living at home with your child:

RELATION	AGE	PROFESSION / GRADE	FULL TIME/PART TIME
Parent/Caregiver:			
Siblings:			
Grandparents:			
Other:			

B. Please specify if there is any family history of a mental/medical disorder:

DISORDER	Y / N	IF YES, SPECIFY RELATIONSHIP TO THE CHILD
Autistic Disorder		
Aspergers Disorder		
PDD NOS		
ADHD		
Mental Retardation		
Epilepsy		

Other:		

IV. Details of Home Environment

A. Are there any techniques, aids, or activities used with your child in the home to attempt to improve the level of functioning? Elaborate:

TECHNIQUE / AID / ACTIVITY	Y / N	IF YES, ELABORATE
Punishment		
Rewards		
Academic tasks		
Play activities		
Language activities		
Other:		

B. To what extent are the following techniques/procedures applied at TRIAD used at home?

0: Never 1: Sometimes 2: Often DK: Don't know

TECHNIQUE / AID / ACTIVITY	0/1/2/DK	IF YES, ELABORATE
Positive reinforcement		
Pairing environment/people with reinforcer		
Ignoring		
Time out		
Physical prompting		
Errorless teaching		
Discrete Trial Teaching (DTT)		
Natural Environment Teaching (NET)		
Picture Exchange Communication System (PECS)		
Teaching Imitation skills		
Teaching Match-to-sample		
Teaching Manding (requesting)		
Teaching Echoics (vocal imitation)		
Teaching Tacting (labelling)		
Teaching Intraverbals (conversation)		
Teaching Play		
Teaching Reading		
Teaching Maths		
Teaching Writing		
Teaching Spelling		
Teaching Dressing		
Teaching Grooming		
Teaching Toileting		
Teaching motor skills		

V. Details of Intervention

Please provide the following information about your child's participation in the ABA programme at TRIAD:
Date of onset of ABA programme: _____
No of hours per week: _____

Has there been any change in the hours of intervention? YES / NO
If YES, please specify: _____

Has your child been involved in any other treatment at the same time as the behavioural analysis programme at TRIAD (e.g., speech therapy, occupational therapy, special schooling, diet therapy, other autism interventions)? YES / NO

If yes, please provide the following information:

TYPE OF INTERVENTION	DURATION (Starting and end date)	HOURS PER WEEK

Could you rate your opinion of your child's overall progress as observed by you and your family since beginning the behavioural programme at TRIAD?

_____ a) My child's behaviour significantly improved
_____ b) My child's behaviour improved
_____ c) My child's behaviour improved somewhat
_____ d) My child's behaviour remained much the same
_____ e) My child's behaviour got worse

Please could you describe the changes that you have noticed? _____

DATE OF INTERVIEW: _____

DETAILS OF INTERVIEWER:
Name: _____
Designation: _____
Signature: _____

APPENDIX D: INDIVIDUAL SKILL AREA SCORE TRAJECTORIES

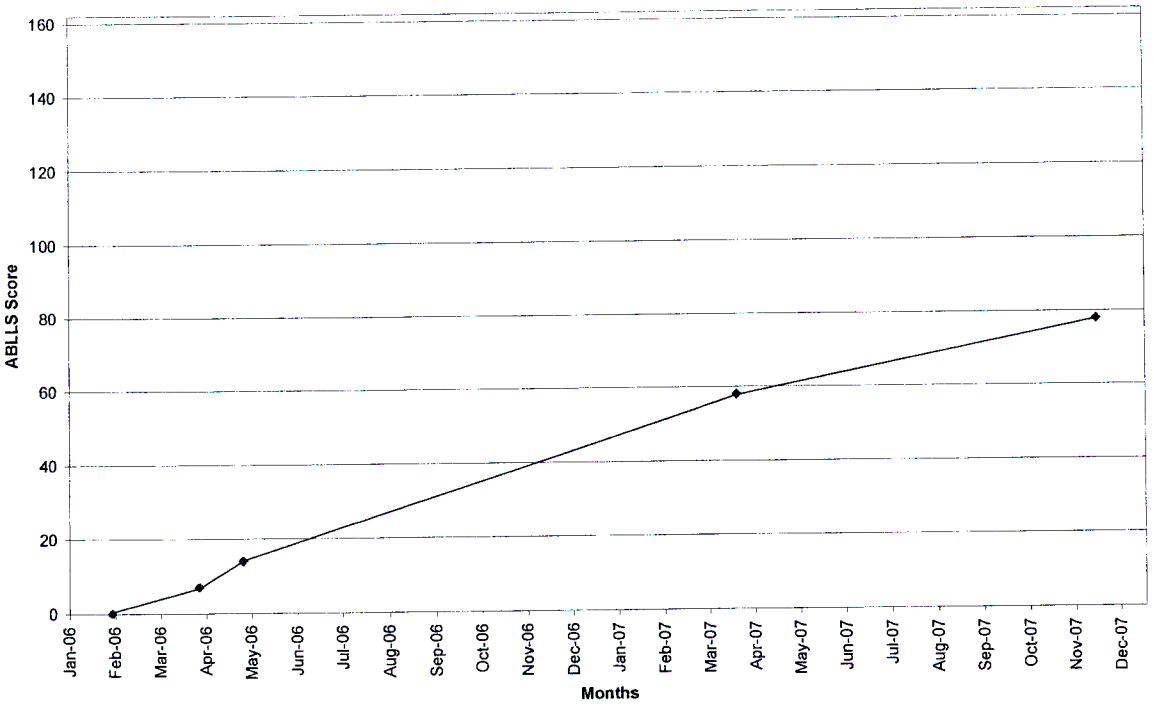


Figure A: Receptive language (C) score trajectory

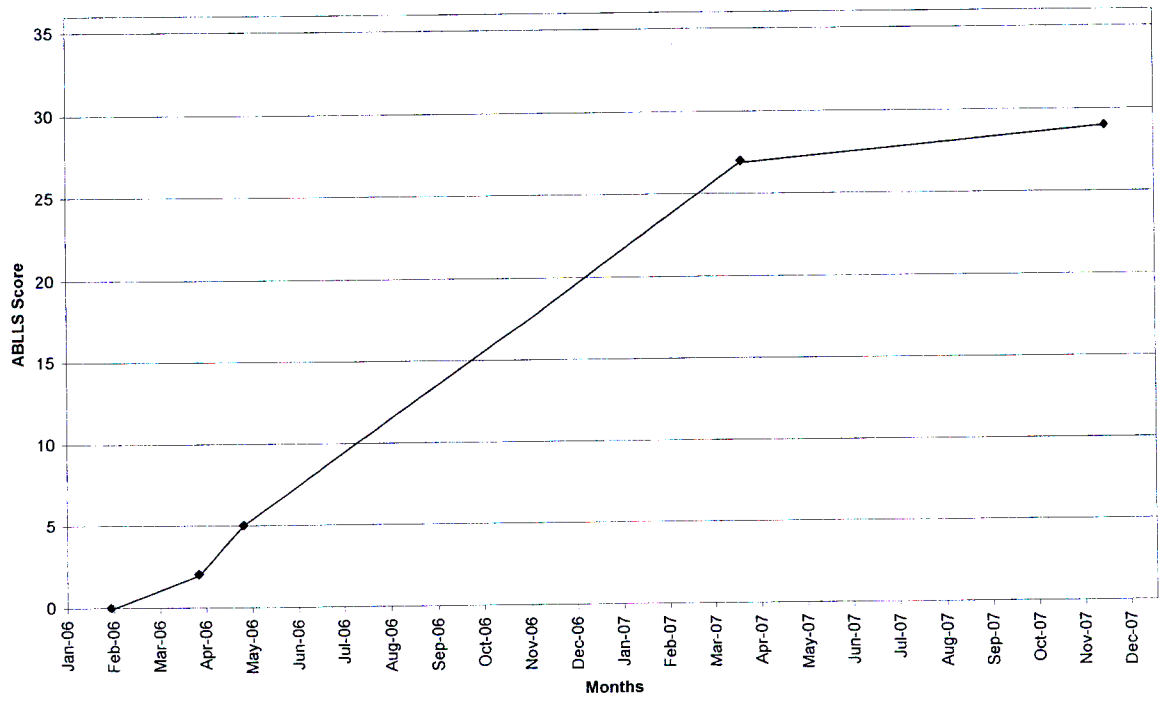


Figure B: Vocal imitation (E) score trajectory

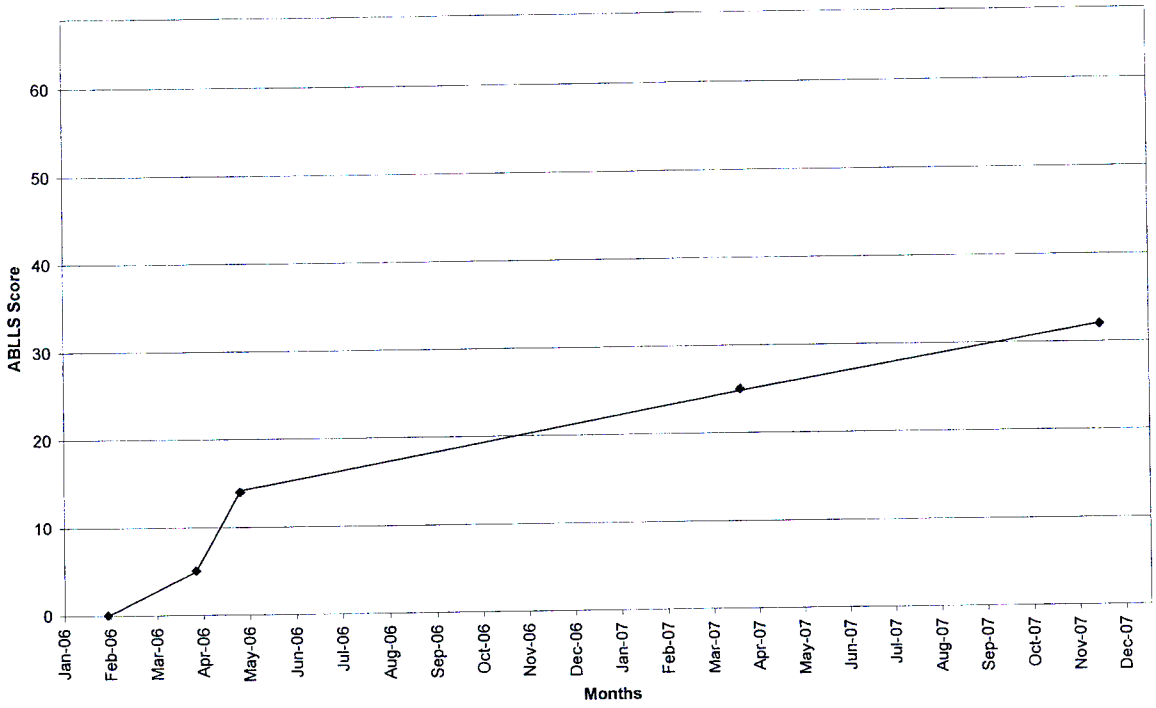


Figure C: Requesting skills (F) score trajectory

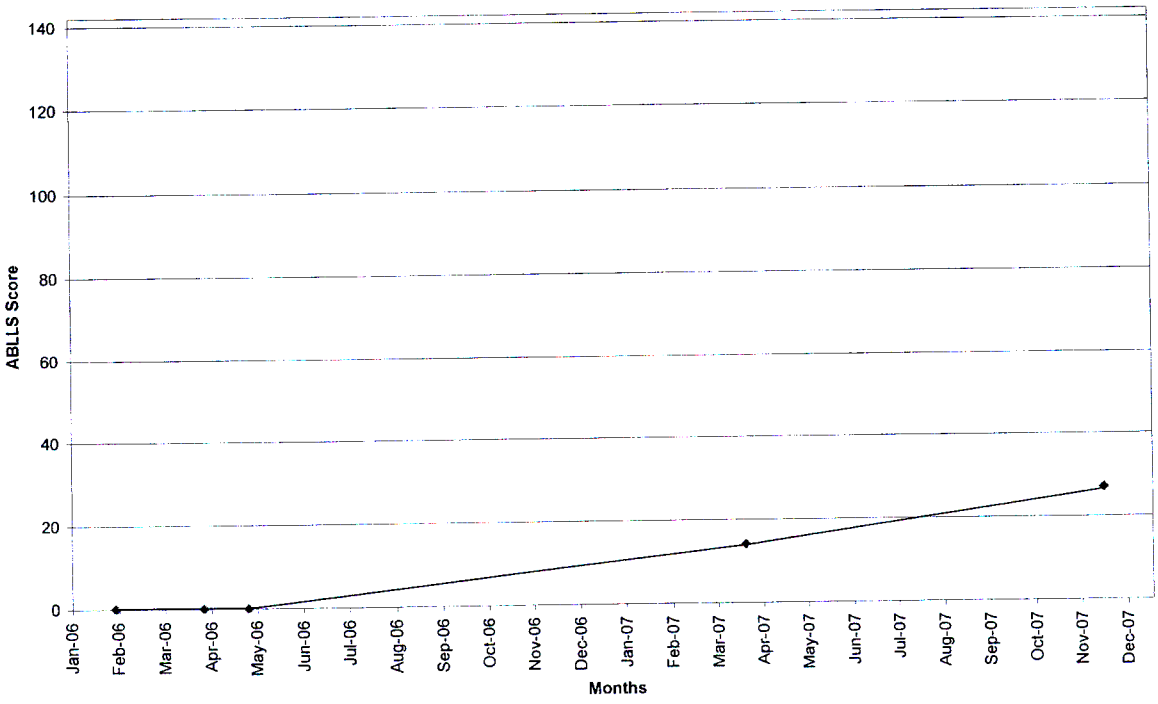


Figure D: Labelling skills (G) score trajectory

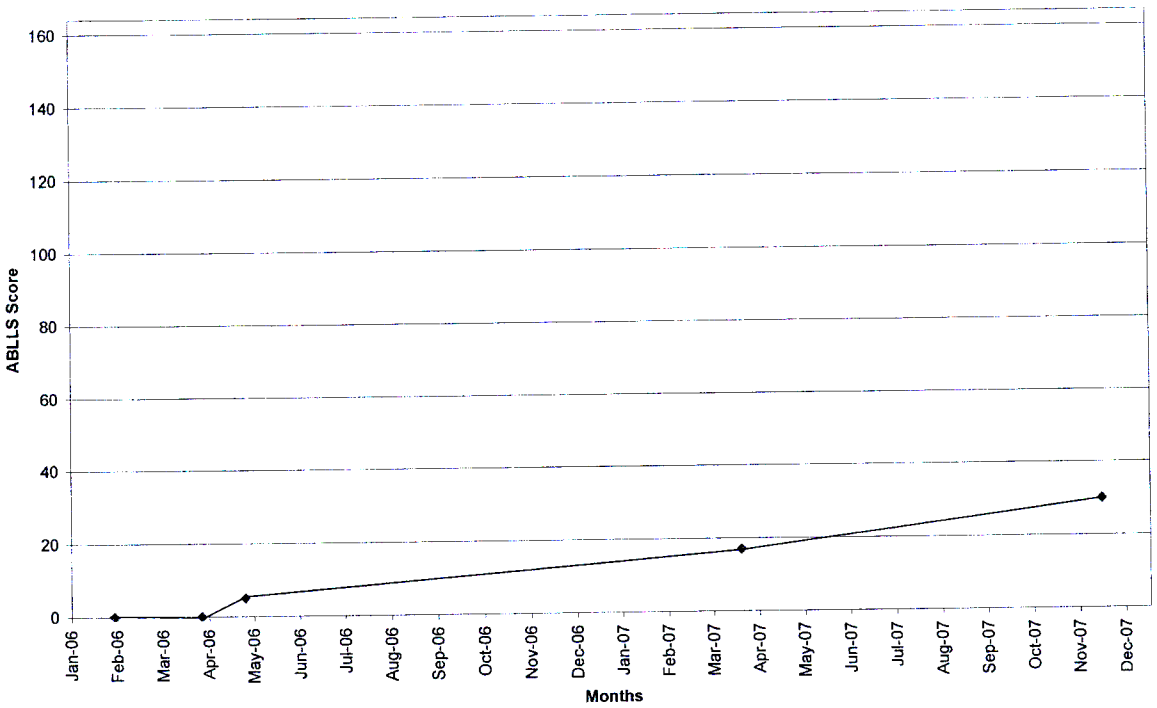


Figure E: Intraverbal skills (H) score trajectory

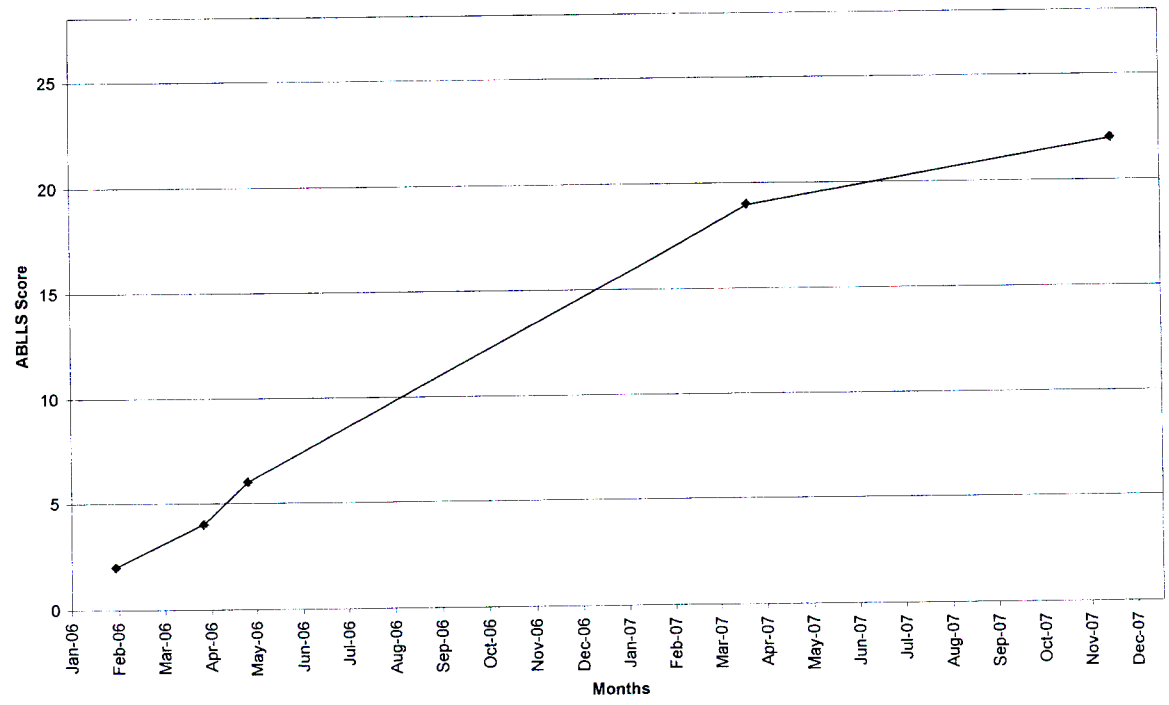


Figure F: Spontaneous vocalisations (I) score trajectory

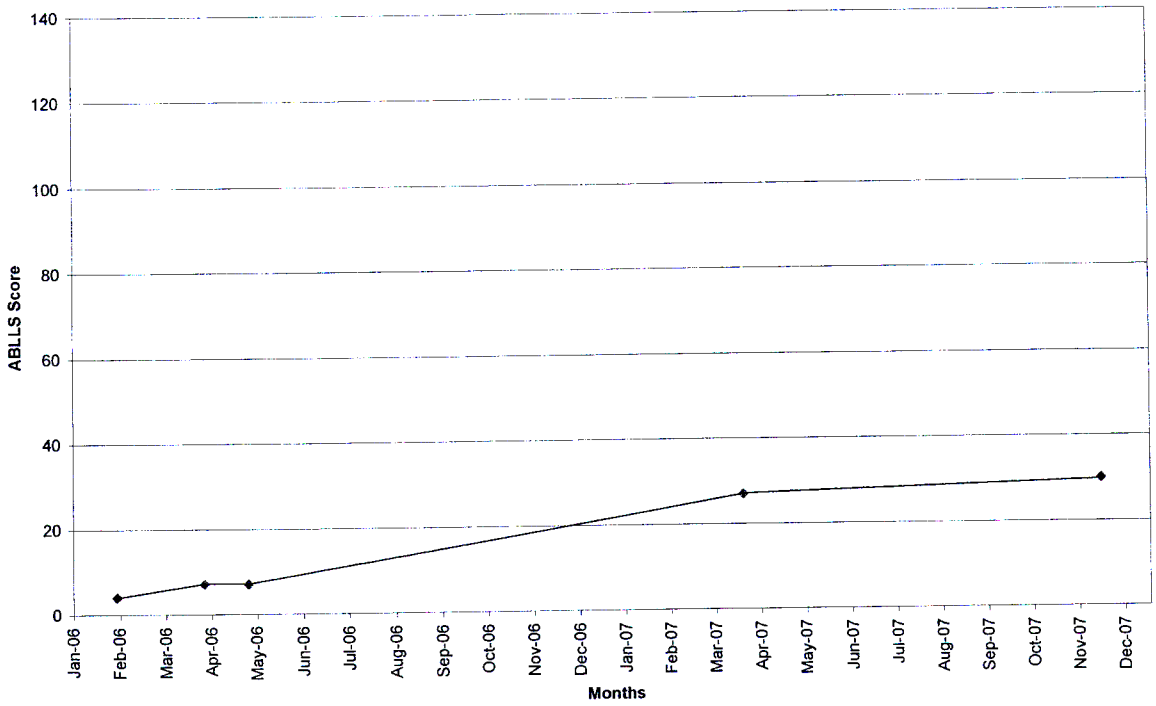


Figure M: Play and leisure skills (K) score trajectory

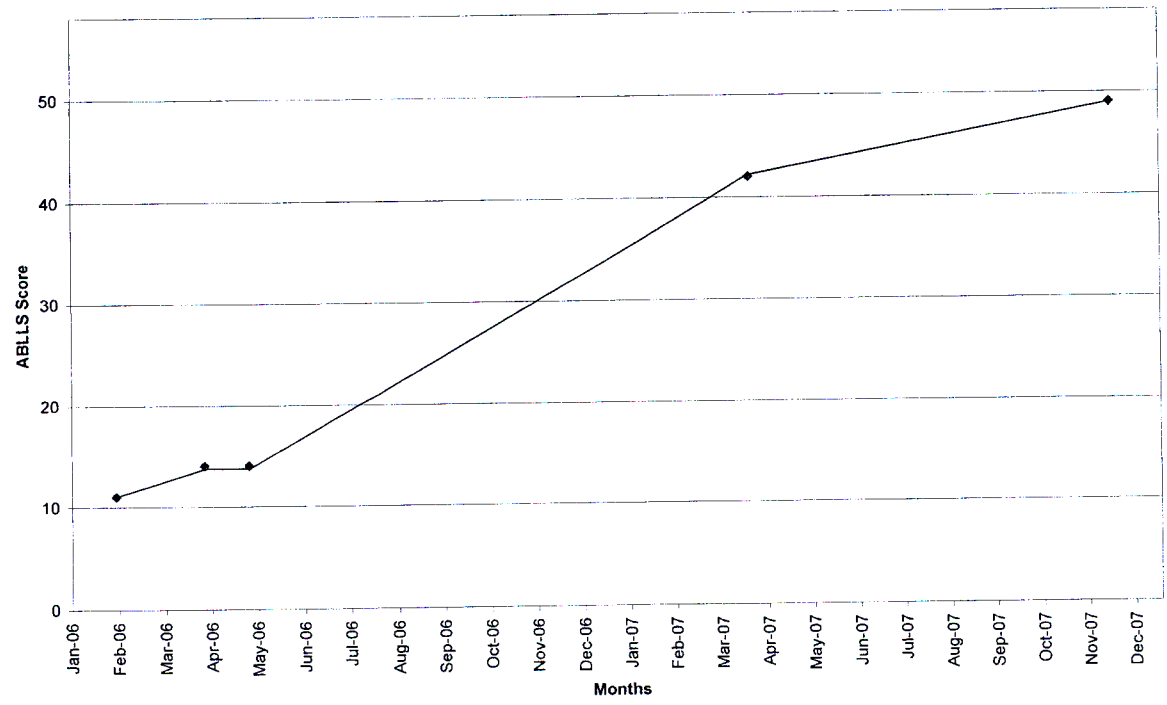


Figure N: Social interaction skills (L) score trajectory

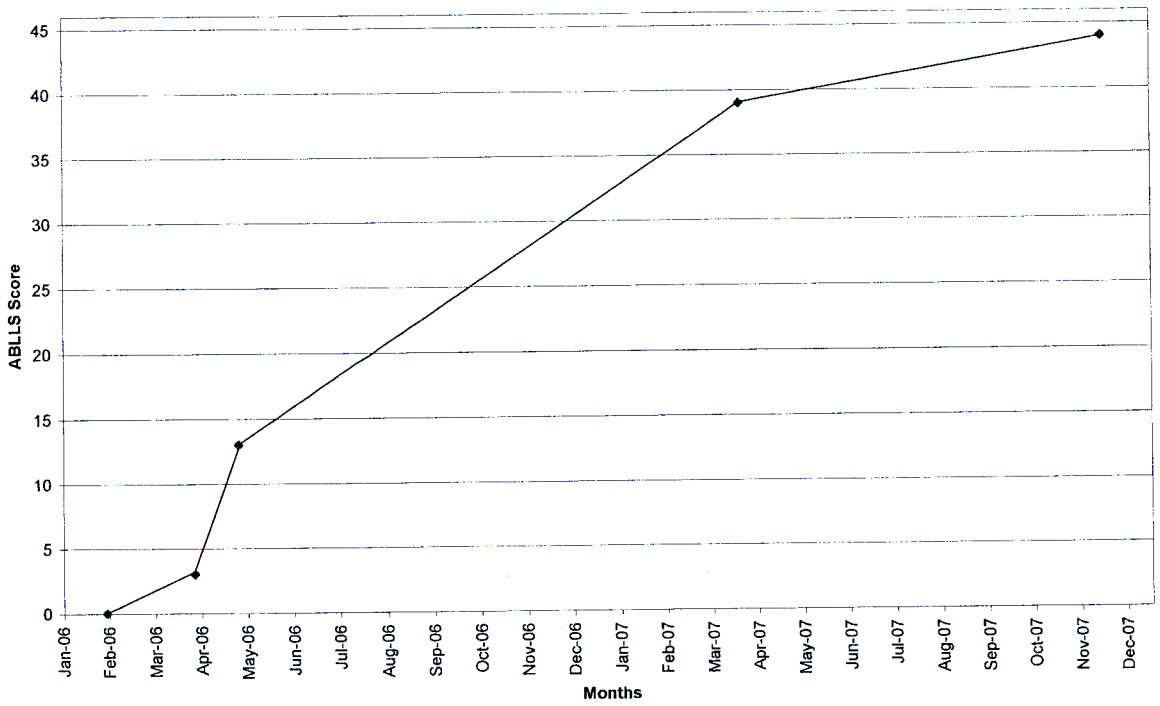


Figure O: Imitation skills (D) score trajectory

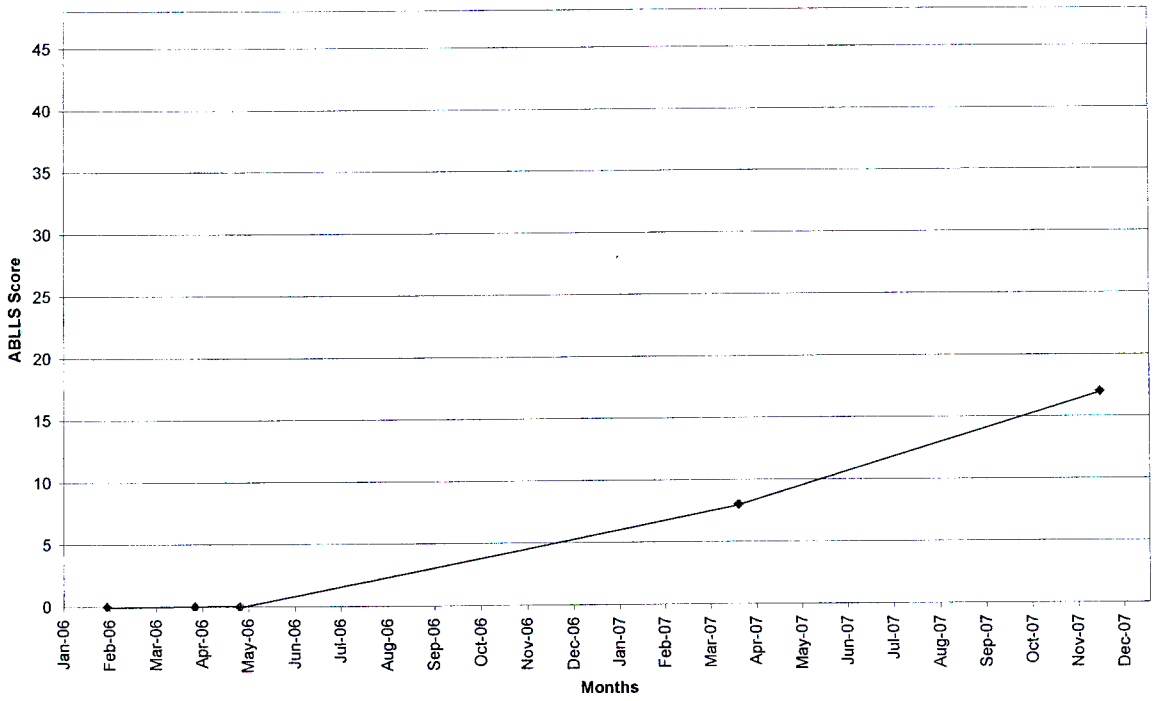


Figure P: Reading skills (Q) score trajectory

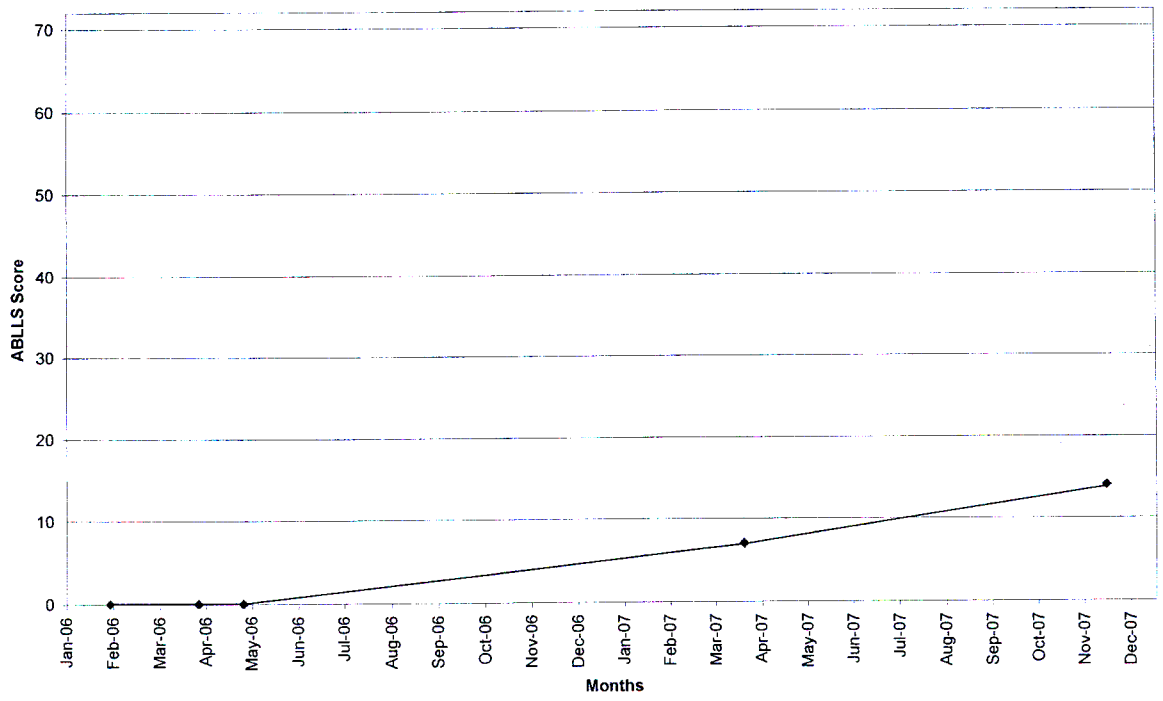


Figure Q: Maths skills (R) score trajectory

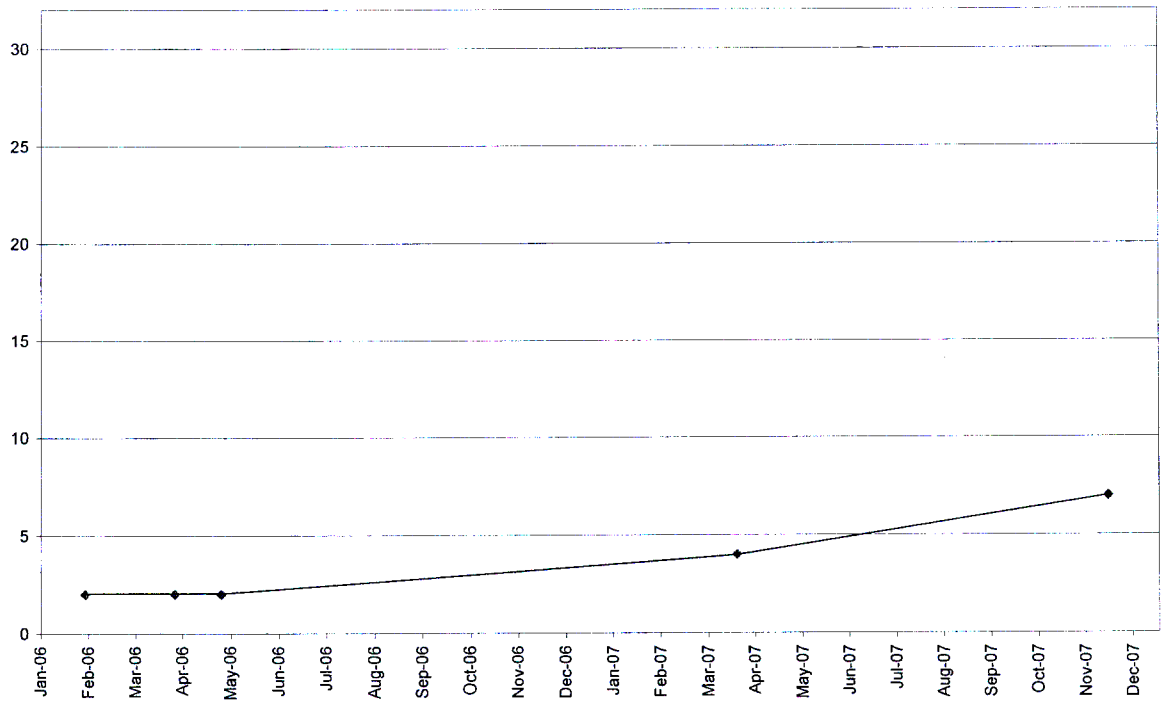


Figure R: Writing skills (S) score trajectory

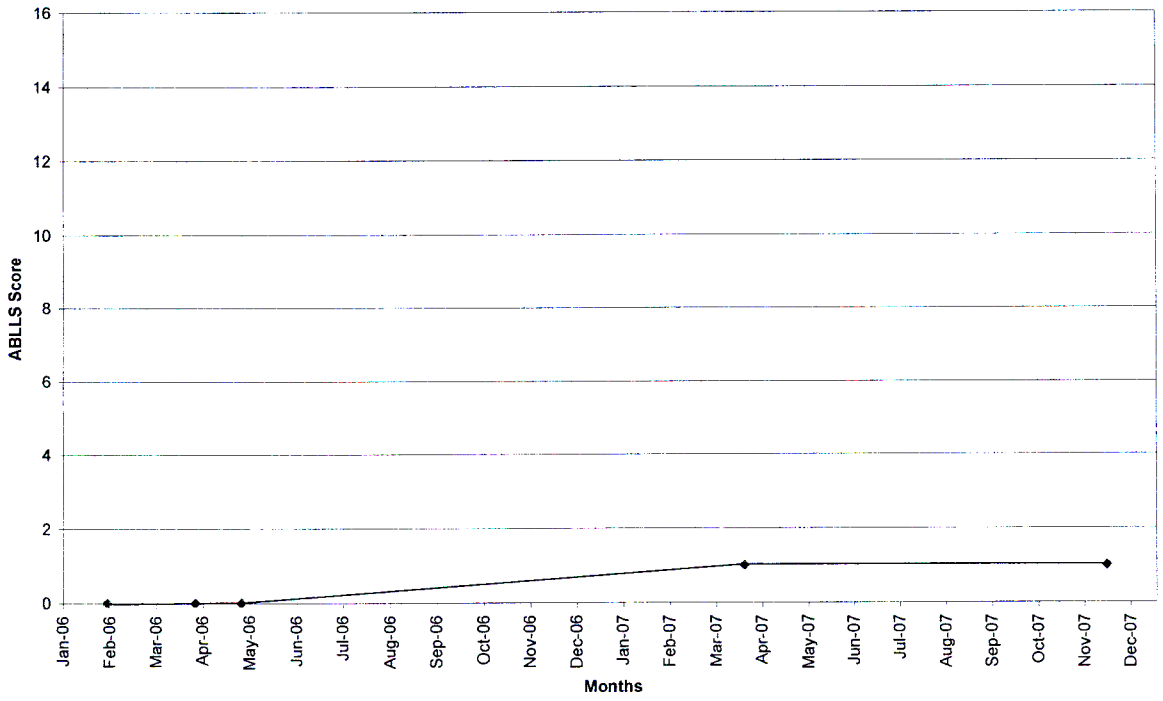


Figure S: Spelling skills (T) score trajectory

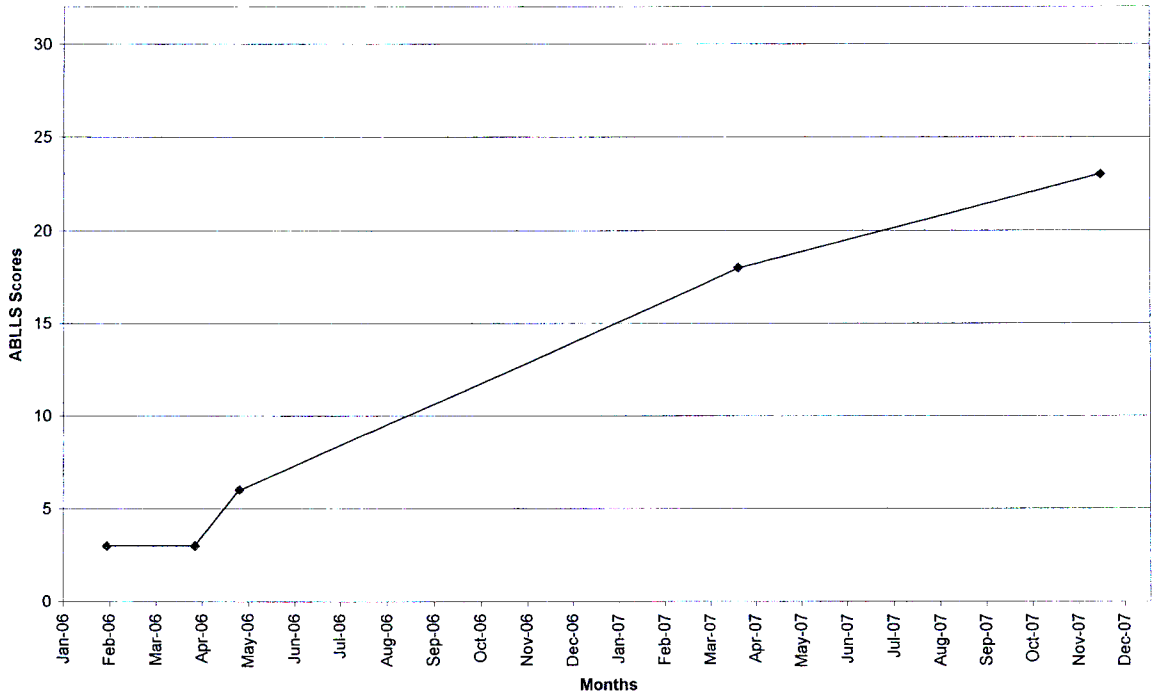


Figure T: Dressing skills (U) score trajectory

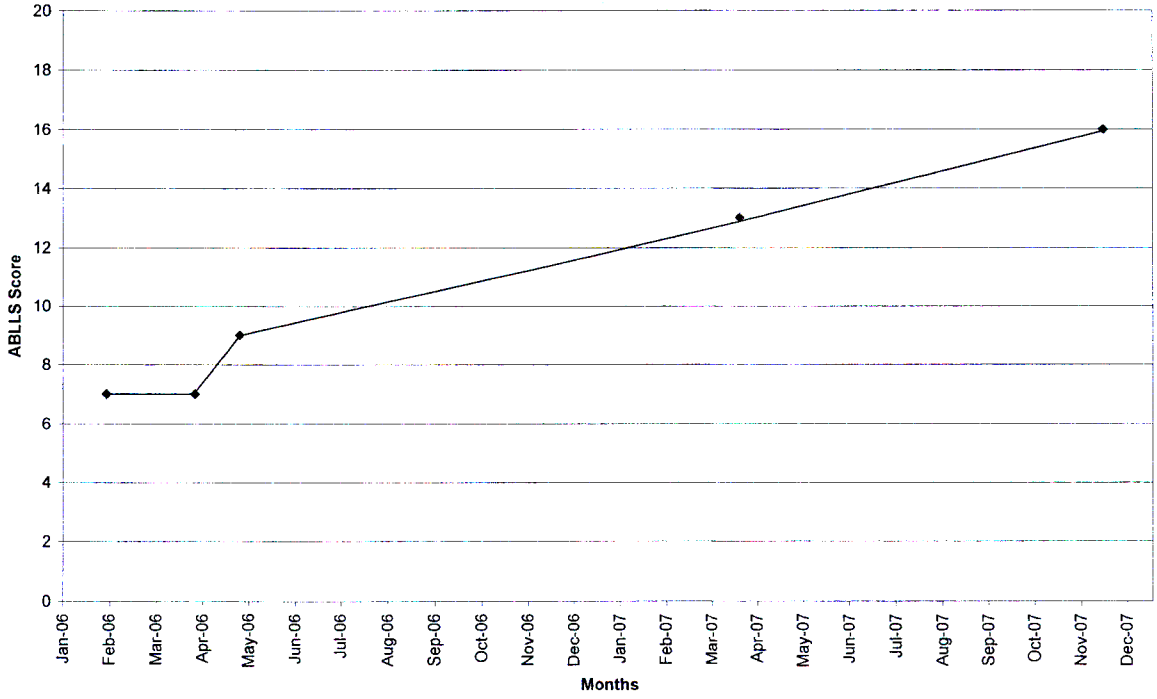


Figure U: Eating skills (V) score trajectory

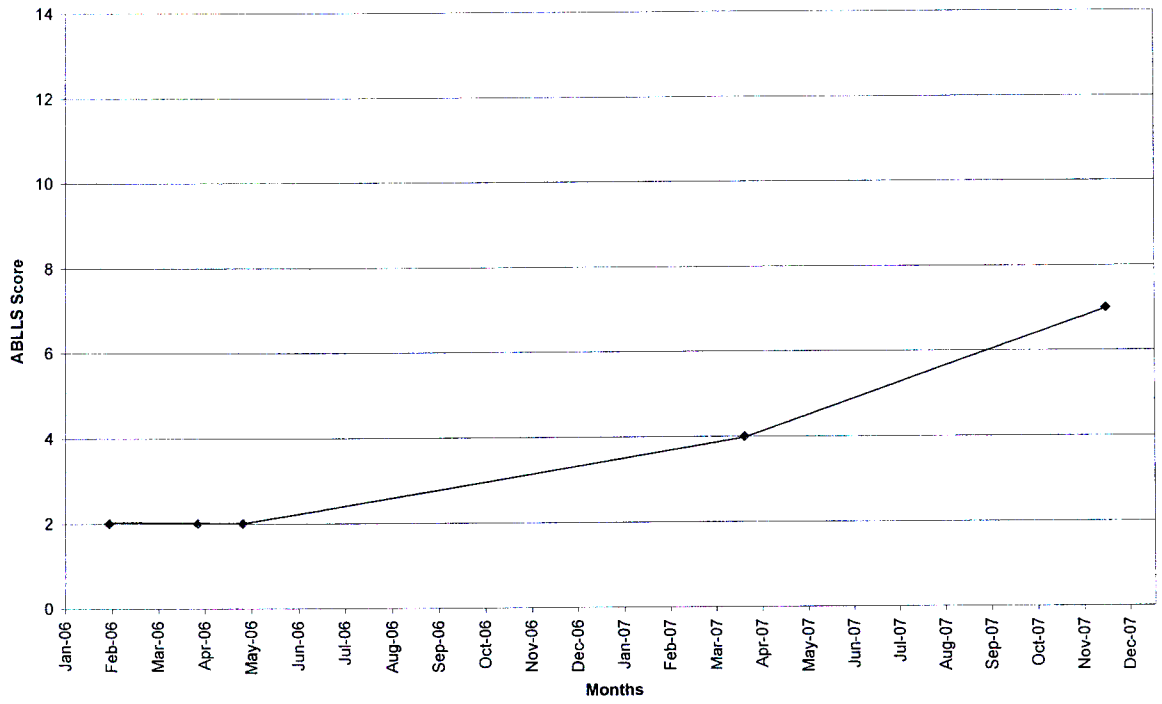


Figure V: Grooming skills (W) score trajectory

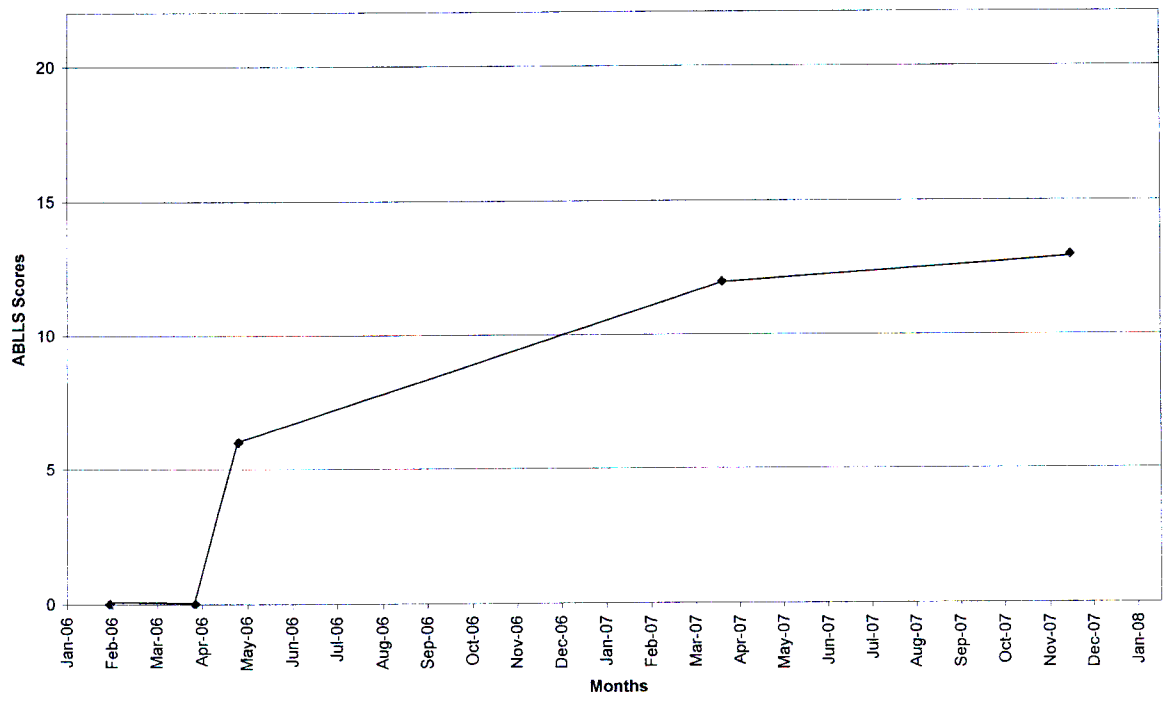


Figure W: Toileting skills (X) score trajectory

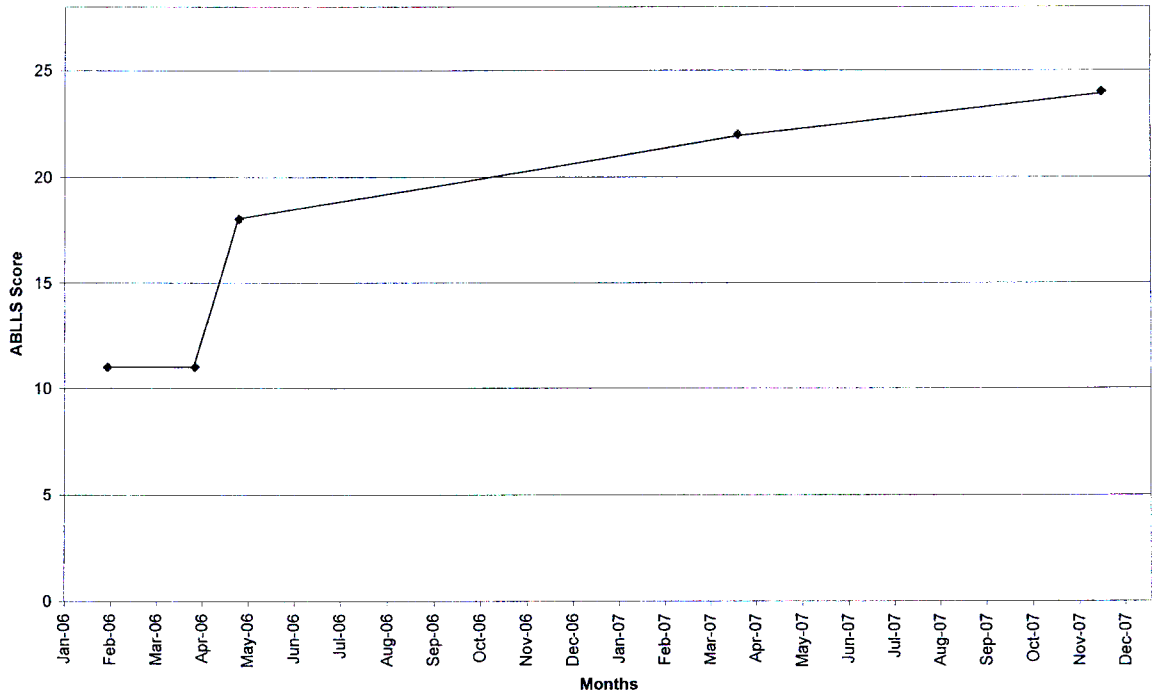


Figure X: Gross motor skills (Y) score trajectory

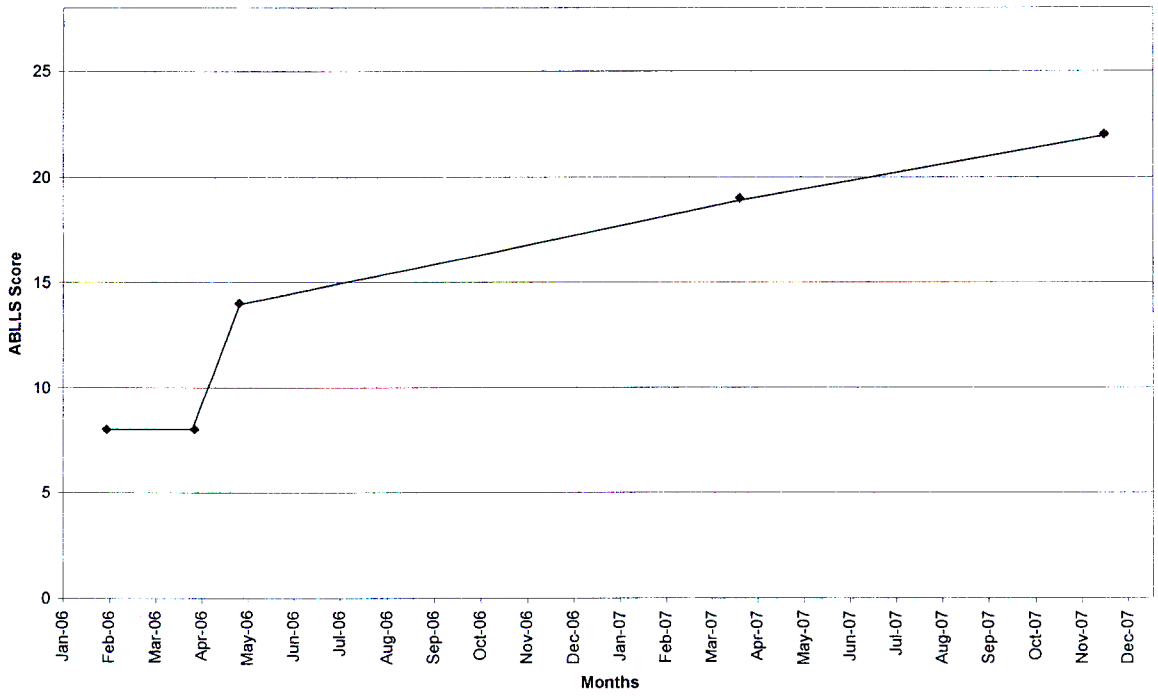


Figure Y: Fine motor skills (Z) score trajectory

INDIVIDUAL SKILL TRAJECTORIES IN THE ADDITIONAL DOMAIN

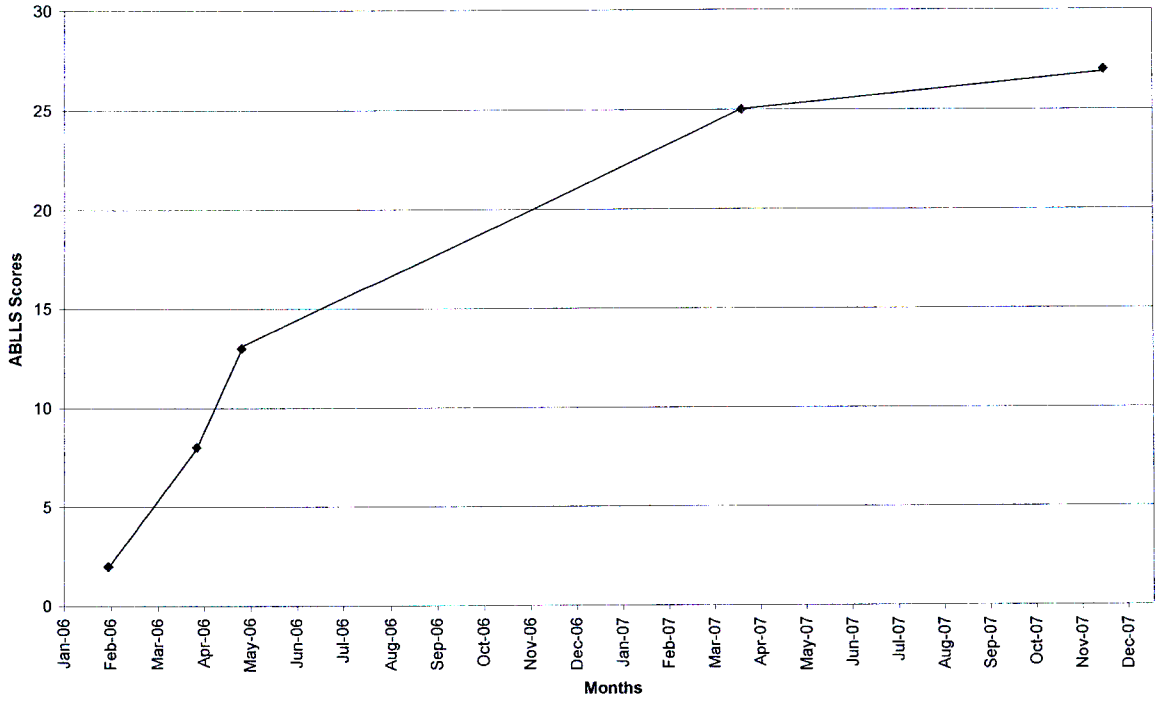


Figure G: Cooperation and reinforcer effectiveness (A) score trajectory

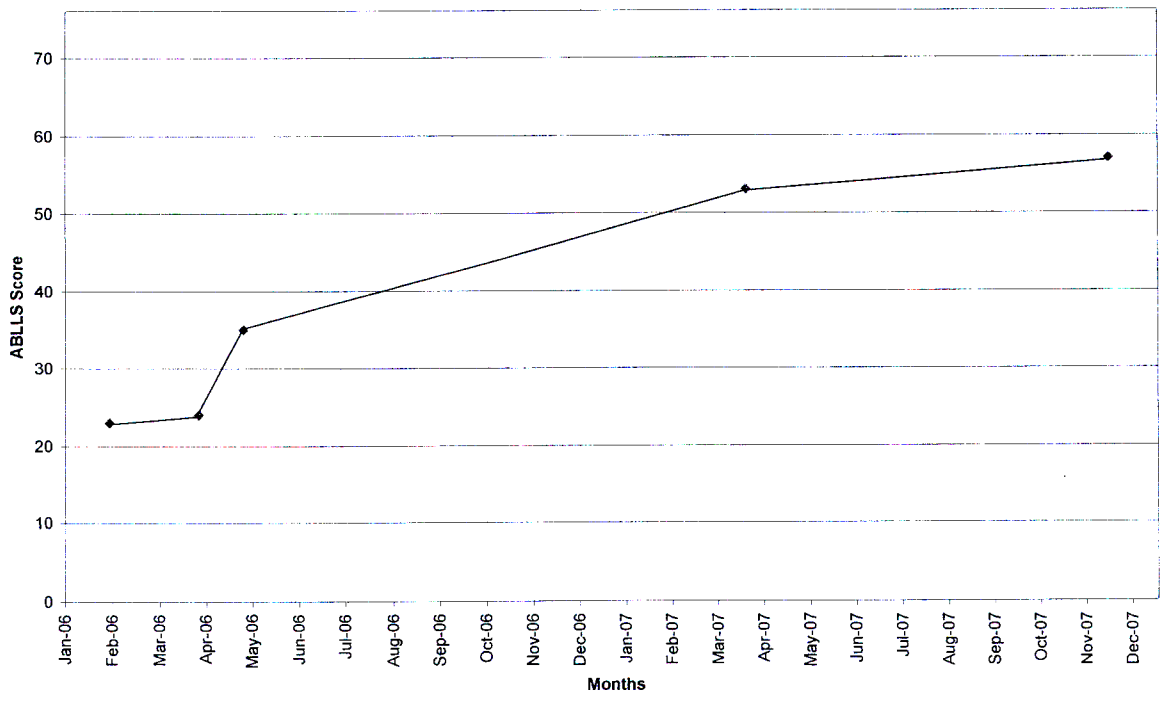


Figure H: Visual performance (B) score trajectory

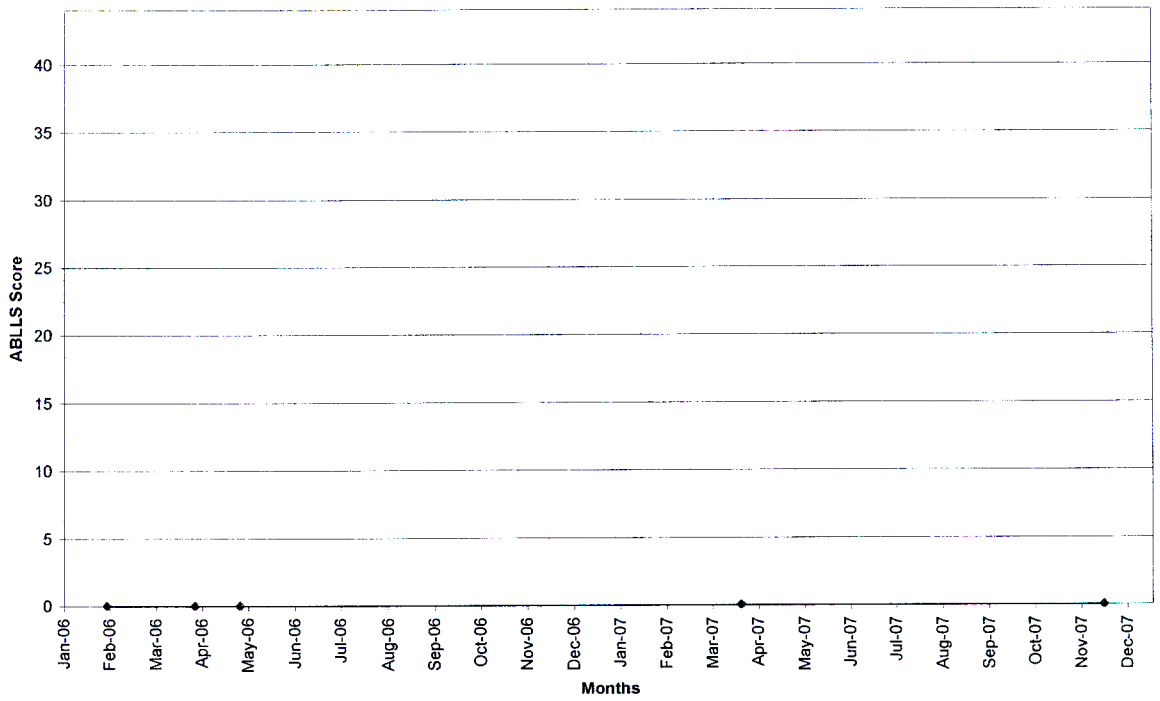


Figure I: Syntax and grammar (J) score trajectory

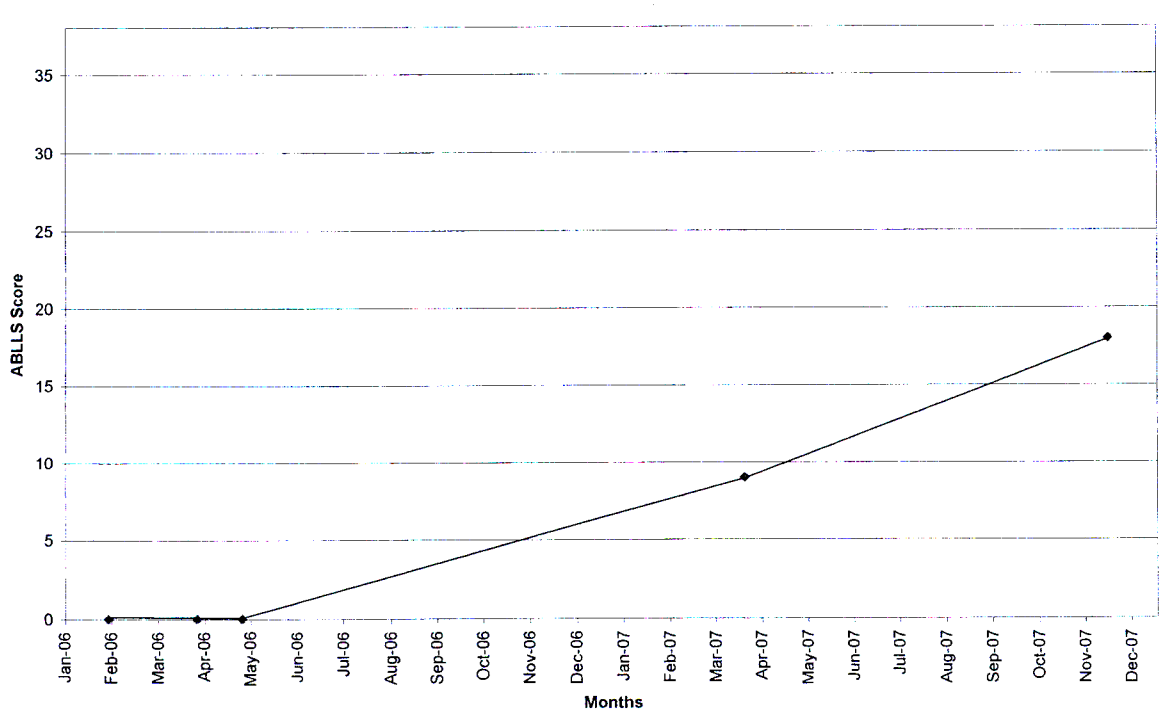


Figure J: Group instruction (M) score trajectory

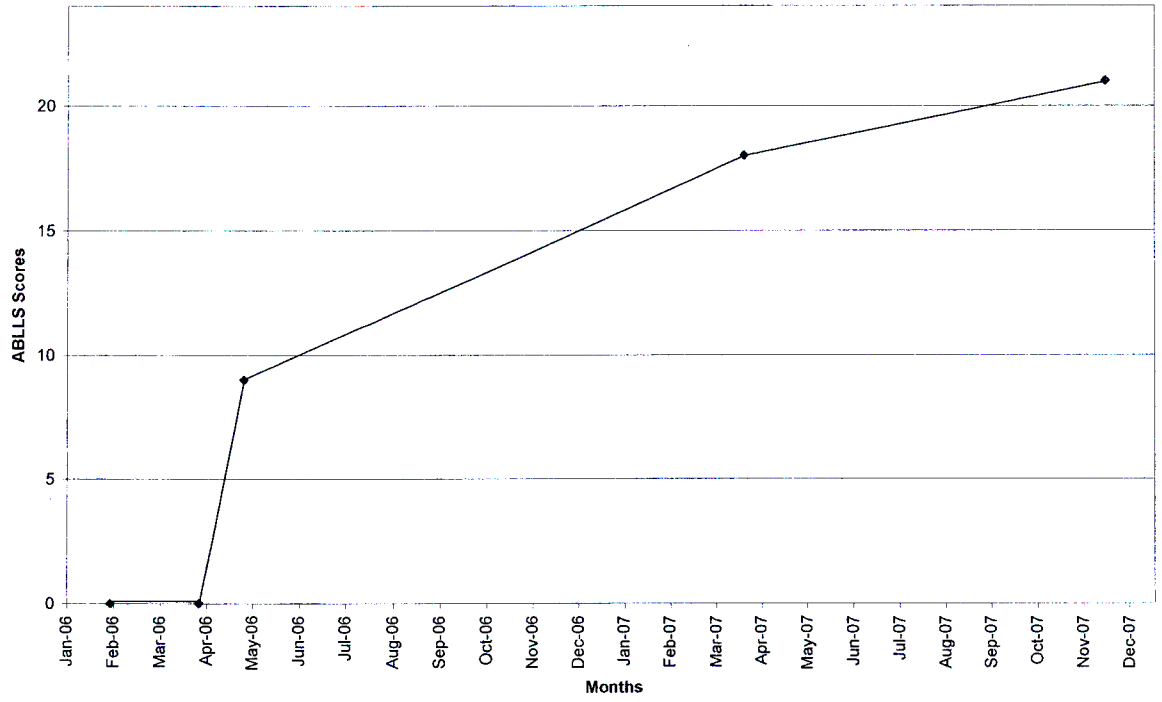


Figure K: Follow classroom routines (N) score trajectory

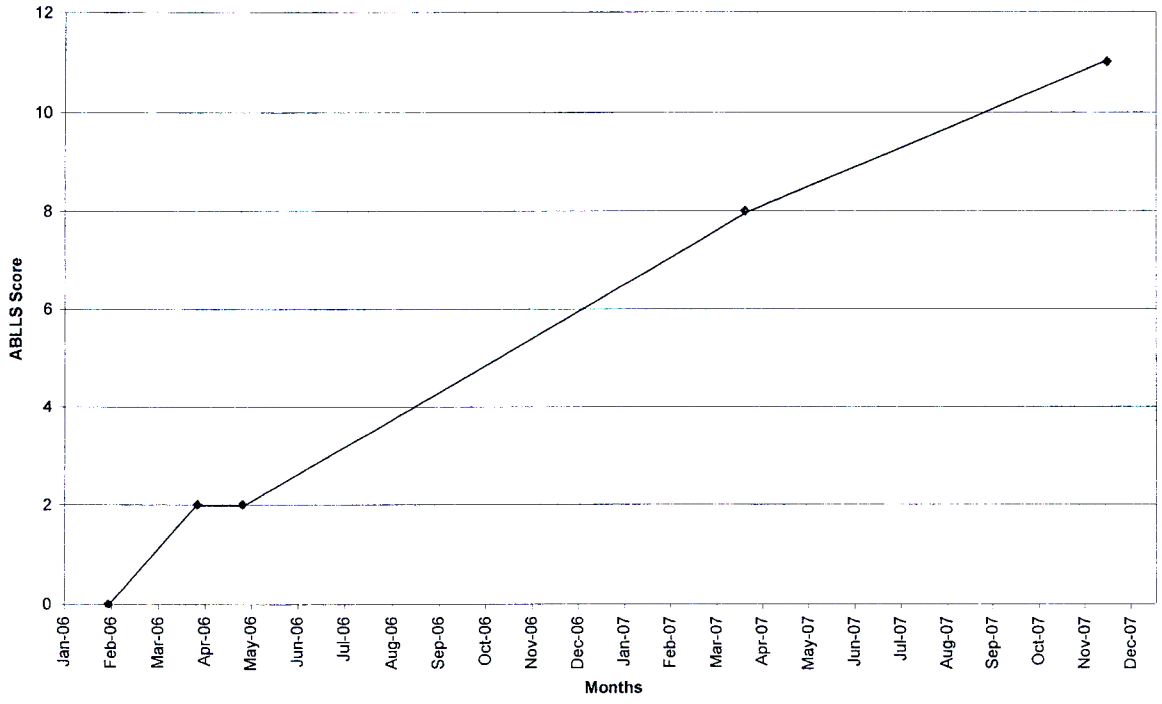


Figure L: Generalised responsiveness (P) score trajectory