Investigating the incorporation of precision teaching assessment methods within a structured approach for children with autism.

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Abstract

The aim of this research was to investigate the incorporation of a 'structured approach' to teaching children with autism, with precision teaching assessment methods. The rationale for the research focused on the limited evidence base regarding educational approaches for children with autism (Jones, 2002), and the growing need to provide appropriate educational provision for this group (Ali & Frederickson, 2006). One of the more widely used approaches in the UK is 'Treatment and Education of Autistic and related Communication handicapped Children' (TEACCH) (Tutt, Powell, & Thornton, 2006), with a derivative of this, called a 'structured approach', in place in the local context of the research.

The use of fluency building approaches in education, such as precision teaching, has been proposed as potentially beneficial for children with autism due to their dysfluencies and difficulties generalising skills (Weiss, 2001), however there is limited research for this population. The 'structured approach' within the local context did not incorporate fluency building procedures, and therefore the research sought to investigate whether a precision teaching framework could augment a 'structured approach' for children with autism.

A pragmatic, mixed methods approach was utilised in this research. It employed a series of three case studies, each incorporating multiple A-B single case experimental designs (SCED), in order to explore the impact of the precision teaching intervention on the pupils' learning, affect, and behaviour. A focus group provided additional information regarding the implementation of the precision teaching intervention. The SCED measures were analysed through graphical visual inspection and the focus group data was thematically analysed.

The research found that precision teaching positively augmented a structured approach for the focus children, which was particularly apparent when it was implemented consistently. Improvements were identified in the pupils' learning, affect, and behaviour. The implications of this research are discussed and opportunities for further research highlighted.

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Chapter 1: Introduction

This chapter will outline the background to, and rationale for the research, and will set out the research questions. The design of the research will also be summarised, along with the researcher's personal and professional interests in the topic area.

1.1 Background, Rationale, and Research Questions

Presented in this thesis are three case studies, examining the impact of precision teaching on a structured educational approach.

The pupils that participated in the research have a diagnosis of autism and were all, at the onset of the research, receiving much of their education through a 'structured approach'.

This research aimed to examine whether a precision teaching framework can augment the 'structured approach' for children with autism. Within this overarching aim, the research examines in particular, the effect of including a precision teaching framework on pupils' learning, behaviour and affect.

The education of children with autism is an area of growing concern for professionals, due in part to the increasing number of children identified with the condition (Ali & Frederickson, 2006). There are an increasing number of recommended educational approaches for children with autism, each claiming various levels of efficacy but mostly with very limited evidence bases (Jones, 2002). Indeed, the research that is available regarding the efficacy of recommended approaches for teaching children and young people with autism is commonly subject to bias (Jordon, Jones, & Murray, 1998). This makes it difficult for teachers of children with autism to assess the best approach to employ with a particular child.

In the United Kingdom education system there is no apparent agreement as to the most effective educational approach to employ for children with autism, with the provision varying across local authorities (Croll & Moses, 2000). As such, many schools use an eclectic mix of approaches to meet their particular circumstances (Jones, 2002). Treatment and Education of Autistic and related Communication Handicapped Children (TEACCH) is, though, one of the most widely used approaches (Tutt, Powell, & Thornton, 2006) and provides an approach which schools can adjust according to the needs of individual children. The use of structure and routine to support children with autism is said to be beneficial as it provides predictability and reduces anxiety (Kusmierski & Henckel, 2002). However, children with autism also display dysfluencies and difficulties generalising skills learnt to novel situations (Weiss, 2001) which the researcher asserts is not currently addressed through a 'structured approach'.

A derivative of the TEACCH approach, called a 'structured approach', is in operation in some of the special schools in the Local Authority in which the research was located. Training in the 'structured approach' for teachers in special school settings is provided by the educational psychology service (Staffordshire County Council, N.d.).

Precision teaching is an 'assessment through teaching' approach that draws upon principles and research from instructional psychology (Raybould & Solity, 1982). Precision teaching's key components are to set time based targets that ensure fluency for each curriculum step. Children are provided with daily opportunities to practice the skills, which are then assessed through time-based measurements, and charted on a Standard Celeration Chart. The teaching methods or task is modified in response to the data obtained to ensure that they are appropriate and effective for the pupil. The principal way in which precision teaching assesses learning is through measurement of skill fluency, i.e. the ability to perform a skill accurately, but also at speed.

Precision teaching is an intervention that supports the development of fluency. The 'instructional hierarchy' theoretical model (Haring, Lovett, Eaton, & Hansen, 1978) proposes that when learning a skill, a person needs to develop the skill to fluency before they are able to maintain, generalise and adapt it.

The researcher therefore asserts that the use of a fluency based assessment, such as precision teaching, could particularly aid children with autism, given their particular dsyfluencies and difficulties generalising newly learnt skills.

Precision teaching has a large evidence base within the mainstream school population (Boys & Lydon, 2008). It has been shown to be effective in developing children's basic skills (Boys & Lydon, 2008; Raybould & Solity, 1988; Bernard-Optiz, 2005), improving their motivation and self-concept as a learner (Raybould & Solity, 1982; Downer, 2007; Roberts & Norwich, 2010), and supporting behaviour improvements (Downer, 2007). However, there is limited research literature relating precision teaching to special schools, and more specifically, children with autism (Bernard-Optiz, 2005; Kubina, Morrison, & Lee, 2002).

Precision teaching has reportedly been successfully incorporated in applied behavioural analysis (ABA) approaches for children with autism (Tucci, Hursh, & Laitinen, 2004), and with other whole school approaches (Binder, 1993; Johnson, 1997). However, there doesn't appear to be any examples in the research literature of precision teaching being incorporated into a 'structured approach', despite the similarity of the 'structured approach' and ABA approaches, both methods drawing heavily on behavioural principles.

At the outset of this research the researcher therefore postulated that there was potential for precision teaching to positively augment a 'structured approach' to learning for children with autism.

This research undertaking, it was felt, would represent a novel approach to supporting children with autism and would certainly aid the local context in which it was taking place. It was also felt that the undertaking would help contribute to the wider evidence base regarding educational approaches for children with autism.

The research question posed was as follows;

"Can precision teaching positively augment a structured approach for children with autism?"

The researcher explored this overarching research question through four sub-questions:

"Can precision teaching lead to a positive impact on a child with autism's learning when incorporated as part of a 'structured approach'?"

"Can precision teaching lead to a positive impact on a child with autism's affect when incorporated as part of a 'structured approach'?"

"Can precision teaching lead to a positive impact on a child with autism's behaviour when incorporated as part of a 'structured approach'?"

"In what ways is precision teaching perceived to augment a 'structured approach' to teaching a child with autism?"

1.2 Structure of the Thesis

In Chapter 2, relevant literature will be explored to inform the reader of the key areas of research that informed the current research project. The reader will be presented with a number of areas of interest to the research project in an attempt to guide them through the rationale for the research and to provide a broad understanding regarding some of the pertinent concepts.

Chapter 3 will explore the methodology used to answer the research question, as well as the potential alternative approaches. The researcher will aim to provide a justification for the use of certain approaches and measures, and to inform the reader of the research process.

Chapter 4 will present the findings from the measures undertaken. Pertinent aspects of interest from the findings will be highlighted and summaries provided to support the reader in identifying the significant data.

Chapter 5 provides the discussion in relation to the findings and literature. The key findings from the research project will be discussed and analysed through the assimilation of relevant literature. Limitations and implications will also be outlined, along with the researcher's own personal reflections on the research journey.

Chapter 6 presents the main findings of the research, unique contribution, and conclusions.

1.3 Personal and Professional Interest

The research project was of personal and professional interest to the researcher for a number of reasons. Firstly, the researcher had prior experience of working in a special school setting, supporting children with autism in their learning and behaviour. The setting used a combination of approaches to support the children with autism with apparently varying degrees of success. This experience piqued the researcher's interest in developing his knowledge of autism and the various approaches that pertain to be effective in supporting children with the condition.

Precision teaching is an approach to support children in developing their basic skills that the researcher became acquainted with whilst undertaking a Doctorate in Applied Educational Psychology. The use of precision teaching whilst on placement as a trainee educational psychologist has proved invaluable, supporting a number of pupils and staff. It was an approach that the researcher wished to explore further regarding its application and theoretical underpinnings to help develop the researcher's own understanding of its strengths and limitations.

The researcher's aim was to try and incorporate two areas of interest in a way that would be unique and relevant to the educational psychology profession, and which would add to the evidence base for educational psychologists. The initial exploration of the literature suggested that the current research's focus was an area that had previously received limited attention, but which apparently held considerable potential.

Chapter 2: Literature Review

This chapter will outline some of the key literature in relation to the areas of focus for this research. A systematic review will also be presented to provide a focused and systematic search of the literature in regards to the key areas of interest.

2.1. Identification of Autism

Autism has been a recognised condition since 1943 when Kanner (1943) was the first person to define and systematically describe the condition. Early research into the condition identified three difficulties that were common across this population:

- Difficulties with social interaction
- Difficulties with communication
- Difficulties with imagination

(Kanner, 1943)

These three features ascribed to autism have subsequently been described as the 'triad of impairments' (Wing, 1998) and have remained essential to the diagnosis of autism (Evans, Castle, Barraclough, & Jones, 2001). Autism is a lifelong condition (Wing, 1998), with the onset generally agreed to be within the first 36 months of life (Jones, 2002).

Autism diagnosis are usually undertaken in line with criteria detailed in the Diagnostic and Statistical Manual for Mental Disorders (DSM IV, 2000). The DSM IV is in the process of being revised with the DSM V due for publication in 2013. The proposed criteria for an autism diagnosis is detailed below;

- Persistent deficits in social communication and social interaction across contexts and not accounted for by general developmental delays.

- Restricted, repetitive patterns of behaviour, interests, or activities.
- Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities).
- Symptoms together limit and impair everyday functioning.

Adapted from:
(http://www.dsm5.org/proposedrevisions/pages/proposedrevision.aspx?rid=94# - accessed on 31/10/2012)

The diagnosis criteria identify features that are prevalent for people with autism. However, the *extent* to which these features present and impact on individual people are very different. Vermeulen (2012) states that differences between people with autism are as great as their similarities, and they can present in a plethora of ways.

Autism is usually characterised by a difficulty in understanding and using verbal and non-verbal communication, along with a difficulty understanding social behaviour, and problems with thinking flexibly in different situations (Trevarthen, Aitken, Papoudi, & Roberts, 1996). They may also present with rigid, repetitive patterns of behaviour (Wing, 1998). The ability of people with autism to generalise their knowledge and skills can also be impeded, individuals with autism often finding it difficult to navigate between different contexts and to recognise what is required (Brown & Bebko, 2012). Holding, Bray and Kehle (2011) highlight how some of these difficulties can profoundly "reduce a child's quality of life, significantly impair educational experiences, limit participation in family and community activities, and hamper development of healthy social relationships with peers" (p.166). Other characteristics that may be apparent for children with autism are sensitivity to sounds, visual stimuli, smell, touch and taste (Evans, Castle, Barraclough, & Jones, 2001).

It should be noted at this point that the term autism will be used throughout this research to represent the features of the condition described previously. The researcher acknowledges that other terms are also used, but for ease of reading the term autism will be used to encompass the various characteristics that are sometimes described under the term 'autistic spectrum disorder'.

The following section will explore the prominent theoretical explanations of autism.

2.2 Theoretical Explanations of Autism

Autism is referred to as a neuro-developmental disorder with a genetic component (Ratajczak, 2011). Most theories of autism revolve around a genetic influence or an abnormality of the brain, caused within the body or from external stimuli (Trevarthen, Aitken, Papoudi, & Robarts, 1996).

Rutter's (1979) research identified three quarters of children with autism as having learning difficulties, defined by having an intelligent quotient score of below 70 on an intelligence test, excluding children with Asperger's Syndrome. Rutter's (1979) research suggested that autism is caused by some type of abnormality in a specific area or areas of the brain. Despite the raft of research that has explored autism in the subsequent years since Rutter's (1979) research, the mechanisms that underlay the condition remain poorly understood (Volkmar, 2011).

Genetic components of autism have been proposed due to population studies indicating that autism is more prevalent in boys that girls (Yeargin-Allsopp, Rice, Karapurka, Doernberg, Boyle, Murphy, 2003). Also, autism is more likely to occur in the brothers and sisters than in the general population (Bolton, Macdonald, Pickles, Rios, Goode, Crowson, Bailey, & Rutter, 1994), indicating a genetic component. However, Cumine, Leach, and Stevenson (2000) state, "despite extensive research into the biological nature of autism and its genetic bases, it is still not possible to pinpoint with certainty the area or areas of damage in the autistic brain, much less the pathway from the brain to the behaviours" (p.36).

There is a general agreement within the research that autism has organic origins (Schroeder, Desrocher, Bebko, & Cappadocia, 2010). Theoretical explanations of autism have developed from a neuro-cognitive perspective in collaboration with psychologists and neurologists, with three widely recognised hypotheses of autism being proposed (Vermeulan, 2012). These are:

- 'Theory of mind'
- Theory of 'executive dysfunction'
- The theory of 'weak central coherence'

'Theory of Mind'

'Theory of mind' is a concept that is readily linked to the difficulties shown by children with autism relating to other people (Cumine, Leach, & Stevenson, 2000). The 'theory of mind' concept was developed by Baron-Cohen, Leslie, & Frith (1985) and identifies a 'meta-cognitive' mechanism of the mind. It is suggested that this innate cognitive mechanism starts appearing from age two when children begin displaying symbolic pretend play, having an awareness that other people have thoughts, beliefs and intentions that influence their behaviour. The 'theory of mind' concept of autism suggests that children with autism are not able to think about other peoples' thoughts, and are therefore impaired in certain social, communication and imaginative skills (Happe, 1994). Baron-Cohen *et al.'s* (1985) research found that 80 percent of people with autism sampled failed to demonstrate a 'theory of mind'. There have been some criticisms regarding the 'theory of mind' explanation not taking into account the emotional aspect of functioning (Hobson, 1993). The implications of this potential impaired 'theory of mind' is that a child with autism may find it difficult to make sense of social behaviour, lack the motivation to please others, and have difficulty in understanding emotion.

'Executive Dysfunction'

Executive functioning impairments in children with autism is another theory proposed to account for the difficulties displayed. Baron-Cohen and Swettenham (1997) define executive function as a mechanism that allows a person to "shift attention flexibly, inhibit preponent responses, generate goal directed behaviour, and solve problems in a planful, strategic way " (p.14). Baron-Cohen and Swettenham (1997) state that the evidence indicates a difficulty in executive functioning for children with autism. However, executive function difficulties are also found in other disorders and it is not specific to autism (Volkmar, 2011).

The executive functioning theory regarding autism is still important in understanding behaviours exhibited and not accounted for by 'theory of mind' such as preservation and repetitive behaviours. Difficulties with generalising and social skills can be seen to fit this model due to a lack of flexible thinking.

'Weak Central Coherence'

The 'weak central coherence' theory of autism was put forward by Frith (Happe & Frith, 2006) as an explanation to highlight children with autism's strengths and difficulties. Central coherence is a term used to describe how people look at the 'whole' rather than individual parts. For example, people tend to be able to draw meaning from ambiguous words because they draw meaning from the context in which the word was written. Children with autism are proposed to focus on the detail and individual parts. For example, children with autism may focus on one particular part of a toy such as the wheels and not play with the whole object. The 'weak central coherence' theory suggests that children with autism will focus their attention on certain objects or aspects that may differ from other children. Therefore, this theory suggests that in the learning environment the potential difficulties for engaging a child with autism in a task will centre around their attention to individual details pertaining to a task/object/skill, to the detriment of seeing a whole.

The three theories outlined allow for a greater understanding of autism and the possible mechanisms underlying the behaviours seen. However, none of them succeed in explaining the whole picture of autism (Vermeulan, 2012). The theories focus on higher level cognitive functioning and omit certain behaviours that cannot be explained through these theories alone, such as sensory and attention problems in autism (Vermeulan, 2012). A recent theory proposed is that of 'context blindness' focusing less on the way that people with autism *think*, but more about the way that they *perceive* (Vermeulan, 2012).

'Context blindness'

The theory of context blindness is proposed as a supplement to the three previous theories described. It focuses on the low level, subcognitive processes of autism. It is proposed by Vermeulan (2012), that people with autism have difficulty with distinguishing important details from unimportant ones. The notion of context is important as it provides a person with information regarding what details are important and what details are not. People with autism, it is argued, have a reduced context sensitivity, making it difficult for them to distinguish the important information from the unimportant. 'Context blindness' is defined as "a deficit in the ability to use context spontaneously and subconsciously to determine meanings" (Vermeulan, 2012, p.204). It is suggested that context sensitivity cannot be learnt but the organisation of the environment, where people with autism are given clarity about the changing meanings in the world, can offer support (Vermeulan, 2012).

The theoretical explanations of autism outlined above assist with peoples' understanding of the condition and help to facilitate support to people with autism. The following sections will explore the prevalence of autism and consider whether it is a condition that requires further research exploration. Also, educational approaches that draw upon the theories explored in this section will be considered, as well as the current context of education for children with autism in UK schools.

2.3 Prevalence Rate for Autism

"The prevalence of autistic spectrum disorders is a matter of debate" (Evans, Castle, Barraclough, 2001, p. 4). The National Autistic Society (2011) state that it is difficult to answer the question of prevalence as there is not a central register of people diagnosed with autism and estimates are based on epidemiological surveys. Difficulties associated with the prevalence rate of children with autism can be associated with the wide presentation of behaviours that may constitute a diagnosis of autism. This array of presenting behaviours may make it difficult for clinicians to diagnose autism as a child may have a mixed presentation of strengths and difficulties that does not fall neatly within the diagnostic criteria. Presenting behaviours indicative of autism may also be suggestive of other conditions, not necessarily autism, adding to the complex issue of autism diagnoses (Gillberg & Billstedt, 2000).

Jones (2002) suggests that the number of children with autism is increasing as knowledge, understanding and awareness of this condition increases. There is a general consensus among professionals that the prevalence of autism appears to be increasing and the increase has even been considered an epidemic by some researchers (Ratajczak, 2011). What is also becoming apparent is the need to support people with autism as the prevalence rate begins to identify them as a significant group of people, for whom difficulties may arise in general daily functioning.

A recent report by the All Party Parliamentary Group On Autism (APPGA) (2012) focusing on children with autism state that it is estimated that there are 88,000 school-aged children in England, accounting for 1% of the total population (APPGA, 2012). Within the APPGA report (2012) it is stated that children with autism account for the largest group of children with special educational needs statements.

The increasing incidence of autism diagnoses has led to calls for appropriate educational provision and approaches being put in place to support children with this condition (Ali & Frederickson, 2006). The following sections will outline and evaluate the current UK educational context for children with autism, along with some of the more prominent educational approaches used to support them.

2.4 Current UK Educational Context for Children with Autism

The school environment will be one of the most challenging aspects for a child with autism due to social and sensory demands (Jones, 2002). At present in the

UK, there are a number of educational settings and provisions that a child with autism may be supported through. These include;

- Mainstream schools (with or without support)
- Generic special schools for children with learning difficulties
- Schools, units and classes specific to children with autism
- Schools or units for pupils with other types of SEN
- Home based programmes
- Advisory/outreach teams for pupils with autism

(Jones, 2002)

The local education authority and independent organisations typically offer for children with autism through one of the provisions mentioned above. However, the provision provided for children with autism can vary across authorities (Croll & Moses, 2000) and this diversity has its own strengths and weaknesses (Jones, 2002). It allows variation in provision and interventions to be explored and evaluated. However, it can be frustrating for parents who may want a particular approach for their child.

Over the past two decades the government's push for inclusive education has seen 47% of children with autism in mainstream classes and a further 11% in resourced provisions within mainstream settings (Wilkinson & Twist, 2010). However, Humphrey (2008) found that children with autism were twenty times more likely to be expelled from school than their peers, leading to increased attention on the provision provided for this population. In line with the Disability Discrimination Act (1995) schools are required to make reasonable adjustments for persons with a disability so that they are not disadvantaged. In a similar vein, school staff should adopt attitudes and processes to ensure that children have equal access to the curriculum. Recent research into the educational provision for children with autism was completed by APPGA (2012) in response to a special educational needs system that struggles to support children with autism (APPGA, 2012). It was concluded that teachers were not given enough training to support children with autism and that specialist support was difficult to access. This research relies on subjective information to inform its conclusions, however it highlights a number of aspects that are supported by other research articles such as Evans, Castle, Barraclough, and Jones (2001) research. Their research states that the actual setting for the provision is less important than the level of expertise and awareness of autism.

Given the increasing prevalence of autism and acknowledged need to appropriately support children with this condition, an increasing range of interventions have been developed. These approaches generally stem from a particular understanding or theoretical position, aiming to compensate for the perceived deficit or enhance the perceived strengths of children with autism. Educating children with autism "needs a special kind of scrutiny" (Powell, 2000, p.1), as it cannot be assumed that children with autism learn in the same way as other children (Powell, 2000). The following section will crtique some of the prominent educational approaches used in UK schools for children with autism.

2.5 Prominent Educational Approaches for Children with Autism in UK Schools

Children with autism present with a myriad of strengths and difficulties and do not make a homogenous group for which to tailor just one educational approach. Kubina, Morrison, and Lee (2002) highlight the "formidable task for teachers" (p.233) of educating students with autism. One problem for teachers is the array of intervention options, all claiming some type of efficacy (Kubina, Morrison, & Lee, 2002). However, "regardless of the interventions teachers choose, methods that evidence a rigorous scientific approach would seem a wise selection" (Kubina, Morrison, & Lee, 2002, p.234).

Tutt, Powell, and Thornton (2006) state that some approaches to educating children with autism have limited evidence bases regarding their effectiveness. Jordon, Jones, and Murray's (1998) review of the evidence base for autism specific educational approaches found that many research articles were conducted by proponents of the intervention and that the research designs were weak with no comparison or control group, often having issues of bias.

Information regarding the effectiveness of other approaches in the same context was also missing in the majority of studies.

It is also important to be aware that some educational approaches are not always employed in their purest sense, with a child often receiving a number of approaches in conjunction to try and meet their needs (Evans, Castle, Barraclough, & Jones, 2001). Educators report to favour a combination of approaches (Callahan, Shukla-Mehta, Magee, & Wie, 2010). Therefore, the ability to evaluate some of the approaches taken can have its limitations if not implemented according to the identified procedures.

Furthermore, as identified previously, children with autism are not a homogenous group and the practicalities of teaching these children may lead to the amalgamation of approaches to meet the needs of the child. It should be noted at this point that research involving children with autism is fraught with complications due to their diverse characteristics. Jones (2002) highlights the difficulties in trying to undertake research with children with autism due to the heterogeneity of this population, lack of appropriate standardised assessments, and general difficulties in testing children with autism, to name a few. 'Single case experimental designs' ('SCED') are the most frequent research approaches employed, as children with autism are not easily grouped together and the SCED approach allows a certain amount of experimental rigour but at an individual case study level.

Single case research designs allow for greater confidence in their results and provide greater empirical control (Birnbrauer, 1981). Research into educational approaches for children with autism may also benefit from this methodological approach, due to the diversity of practice used with children with autism. Further discussion regarding methodological issues and approaches for children with autism will be discussed in Chapter 3.

The following educational approaches are the most commonly used in UK schools (Tutt, Powell, & Thornton, 2006):

Daily Life Therapy (DLT)

DLT was developed in Japan in the 1960s and suggested to be a holistic approach, focusing on learning as part of a group (Tutt, Powell, & Thornton, 2006). There is a focus on developing physical strength, stabilising emotions, and normalising intellectual interests. Through working as part of a group, the aim is for the pupil to be as independent as possible by conforming to the group rather than being taught in one-to-one sessions (Tutt, Powell, & Thornton, 2006). The lessons are fast paced so that pupils have little time or opportunity to engage in self-stimulatory behaviours. This approach does not view children as having learning difficulties, therefore they are educated as a group and without differentiation, although this view is disputed by other professionals in the field (Jones, 2002).

There has been little systematic research into the effectiveness of DLT (Tutt, Powell, & Thornton, 2006). However, Larkin and Gurry (1998) found that pupils' inappropriate behaviour decreased, and their ability to respond to classroom stimuli increased. It was also highlighted in this research, that pupils' ability to comprehend was still impaired. Larkin and Gurry's (1998) research was limited by its small sample size, lack of a control group, and possible issues regarding bias due to the research being based at a university affiliated with the institution being focused on in the research. The use of physical activity to improve a pupil's behaviour and engagement was supported by Gabler-Halle, Halle, and Chung's (1993) research when they found that increased physical activity reduced stress and challenging behaviour. However, Tutt, Powell, and Thornton (2006) go on to question the rationale of insisting on a high level of conformity when the underlying aim is to promote independence and critical thought. Also, the highly structured approach appears to have little scope for individual differences. In terms of its association with psychological theory, it appears that DLT does not align itself with the popular theories of autism (Tutt, Powell, & Thornton, 2006).

Lovaas programme

The Lovaas approach is based upon applied behavioural analysis (ABA) principles, focusing on teaching specified skills and managing the behaviours that are obstructing learning. It was developed by Ivar Lovaas in the USA (Lovaas, 1987). Behavioural approaches for children with autism are widely used in the UK (Tutt, Powell, & Thornton, 2006). Within the Lovaas approach a team of therapists work with the child to target specific behaviours rather than the perceived needs arising from the autism that may need addressing. It is based on early intervention and is used with children from the age of two. The therapist works with the child on small steps, giving clear verbal instructions, with physical prompts if needed. The child is rewarded when displaying appropriate responses. Verbal praise accompanies other reinforcers such as food or favourite activities, and over time the other reinforcers can be faded out. Inappropriate behaviour is ignored or given a 'time out' (Tutt, Powell, & Thornton, 2006).

The Lovaas programme has received criticism for the teaching methods used (Jones, 2002), in particular its focus on communication and language skills out of a natural context (Koegel, 2000). Tutt, Powell and Thornton (2006) also highlight that the Lovaas approach is primarily an auditory one, even though children with autism are commonly thought to have better visual processing skills. They also discuss the lack of flexibility in regards to individual personality and needs, and little attempt to build up relationships. In terms of psychological theory surrounding autism, Tutt, Powell and Thornton (2006) state that there is little in common between the Lovaas approach and the most noted psychological understandings of autism. However, Jones (2002) comments on the potential strengths of a Lovass programme. These are early intervention, individual teaching sessions, structure and consistency, and its links with parents.

Treatment and Education of Autistic and related Communication handicapped Children (TEACCH)

TEACCH is a structured teaching approach to supporting children with autism, developed in North Carolina by Schopler and Mesibov in the 1970s (Mesibov, Shea, & Schopler, 2004). Structured teaching is the educational element of TEACCH. Mesibov, Shea and Schopler (2004) state that TEACCH is a method of instruction for children with autism that focuses on each individual's skills, interests and needs. The environment and activities are organised to facilitate and emphasise meaningfulness to the child. The aim of TEACCH is to develop appropriate communication and facilitated autonomy rather than reducing problem behaviours (Trevarthen, Aitkin, Papoudi, & Robarts, 1996). Mesibov and Shea (2010) state that the essential mechanisms of structured teaching are:

- Structuring the environment and activities so that they are understandable to the pupil.
- Using pupils' relative strengths in visual processing and interest in visual detail to supplement relatively weaker skills
- Using a pupil's own interests to engage them in learning
- Supporting self-initiated use of meaningful communication

The TEACCH approach incorporates a variety of methods to provide a holistic program of service for children with autism (Trevarthen, Aitkin, Papoudi, & Robarts, 1996). Structured teaching's main principle is to modify the environment to accommodate the needs of pupils with autism. The four main components of structured teaching are:

- Physical organisation/structure
- Scheduling – daily schedules or timetables, showing the pupil what they should be doing and when.
- Work systems – independent work areas that inform the pupil what they need to do, for how long and what happens next.
- Task organisation – visual instructions for the task

Structured teaching adopts a number of principles in its approach. Modifying the environment is a central tenet of structured teaching and this is supported by Erba (2000) who states that children with autism require structure and task analysed goals in order to learn. Kusmierski and Henckel (2002) go on to state that "a structured environment for individuals with autism can provide consistency and predictability, encouraging self-control and independent function" (p.475). The use of visual support also complements children with autisms' strength in visual rather than auditory learning (Kusmierski & Henckel, 2002).

Kusmierski and Henckel (2002) found that TEACCH helped to decrease maladaptive behaviours in one case, and increase independent functioning in another case. The hypothesis for the positive changes seen were the improved consistency and predictability that TEACCH allows, encouraging self-control and independent function. However, this research was limited by small participant numbers and the research design that did not adequately take into account the individual differences of the participants when looking to match participants. The research was also limited by the intervention integrity, with some participants receiving limited and inconsistent versions of TEACCH. The ability to generalise the findings is severely impeded due to the sample size and limitations discussed.

Bennett, Reichow, and Wolery's (2011) research explored the use of structured teaching through a structured work system, including organisation of the physical environment, visual schedule, and predictable routines. The findings from the research indicated that this approach increased task engagement, along with the speed and accuracy of task completion. The authors state that structured teaching is an approach with multiple components and the active component is not yet known. The research employed a single-case experimental design which therefore limits the ability to generalise the findings. However, the single case design used for the case study was relatively robust, employing withdrawal techniques helping to negate maturation effects and establishing a causal intervention effect. Single case designs were also utilised in other research studies focusing on TEACCH and found improved behaviour following the intervention (Hume & Odem, 2007; Francke & Geist, 2003). Hume and Odem (2007) and Francke and Geist (2003) research findings found improvements in on-task behaviours.

It should be noted that TEACCH represents a 'model' for teachers to follow, and must be adapted to meet the needs of the child that it is looking to support. Also, the skill and knowledge of those implementing the approach is likely to have an effect on the research outcome (Roberts & Prior, 2006). Therefore, research evaluating the effectiveness of TEACCH may be difficult to compare and limit the generalisations made for this approach.

Tutt, Powell and Thornton's (2006) comparison with some of the popular psychological theories of autism suggest that the TEACCH approach is aligned with these, although not overtly. The 'weak central coherence' can be seen to be addressed with clearly marked areas and use of work stations to focus on the relevant information. The 'impairments in executive functioning' is potentially met through providing optimal conditions for problem solving, and the emphasis on developing social and communication skills could be seen to be addressing the 'theory of mind' deficit.

A number of educational approaches have been discussed, however the TEACCH approach has a wide application in UK schools and is arguably the most widely used approach for children with autism in the UK (Jones, 2002). Although, it is rare for a school to adopt and follow one approach exclusively, usually choosing an eclectic mix of techniques and strategies (Jones, 2002). The use of TEACCH strategies can be widely seen in UK schools, especially with regard to the use of structure and visual cues to support children with autism, although there is limited research to measure its effectiveness (Jones, 2002). As TEACCH provides a 'starting model' to adjust according to the needs of the child, the researcher asserts that its application in UK schools is likely to be popular as it may be less rigid than other approaches, however the flexibility in the approach subsequently makes measuring the outcomes difficult due to the variations in practice. The following section will explore the TEACCH approach in relation to the current research's educational context.

2.6 Current Research's Educational Context

A derivative of TEACCH's structured teaching approach is in use in the local authority in which this research is based. Training is provided by educational psychologists for special school settings in a 'structured approach', drawing upon principles and practices of the TEACCH approach with regard to facilitating teaching and learning. This training was developed due to the commitment of the local authority to support the training and development of staff expertise in the use of a range of specialised teaching and learning approaches for young people with special educational needs. As part of this commitment, training has been provided to schools within the local area in a particular 'structured approach' for children with autism. The 'structured approach' employed within the current local authority context shares the same principles with TEACCH. These are:

- Improved adaptation - developing skills and modifying the environment to accommodate deficits.
- Structured teaching – providing children with autism a more structured educational environment.
- Assessment – leading to the development of individual educational programmes that are regularly reviewed.
- Skill enhancement – emerging skills are identified and focused upon.

In line with the principles identified, the environment is structured in a number of ways to support access to learning. These include, routine, physical structure, schedules, work systems, and visual structure. The curriculum is appropriately differentiated and tasks presented in a visually clear, structured way. Positive behavioural approaches are also employed and a 'structured approach' ensures that the environment is meaningful, reducing the associated stress of a confusing and unpredictable world. The methods used for a 'structured approach' in the current local authority is closely linked to those identified in TEACCH.

The preceding sections have attempted to give an overview of autism, how it presents, prevalence, theoretical explanations and educational approaches for autism. The context in which the current research takes place has also been discussed in relation to children with autism and educational approaches employed. The following sections will continue the discussion regarding approaches for children with autism, focusing specifically on behavioural methods due to its relevance with this research project.

2.7 Key Aspects of Applied Behavioural Analysis (ABA)

ABA was discussed briefly in a preceding section when examining the Lovaas approach to education. Behavioural approaches have a long history in special education, including children with autism, and many approaches for autism use behavioural techniques within their methods (Jordan & Jones, 1998). ABA will therefore now be explored in more detail as it underpins some key concepts associated with this research project.

ABA is an outgrowth of behavioural psychology focusing on overt behaviour rather than presumed mental states (Leaf, Baker, & McEachin, 2008). Observable data is relied upon to remain objective and to make treatment decisions rather than subjective interpretations (Leaf, Baker, & McEachin, 2008). ABA is not an approach only used for children with autism but has been used with a multitude of disabilities and disorders (Leaf, Baker, & McEachin, 2008).

Kearney (2008) states that the three most important characteristics of ABA are: firstly, behaviours that are targeted for change have real-life applications for that person; secondly, behaviours worked with are real, observable and measureable rather than abstract diagnoses; thirdly, decisions are based on objective data that is collected to understand what effect, if any, the interventions used are actually having on the targeted behaviour. As such, ABA shares many features of an 'assessment through teaching' approach such as precision teaching, which will be considered in more detail shortly. Kearney (2008) states that it is useful to view ABA as an ongoing experiment, making adjustments to the interventions in line with the information received.

Lovaas' work in the 1960's investigated the use of ABA for children with autism and found it effective in reducing problematic behaviours (Lovaas, Freitag, Gold, & Kassorla, 1965). Lovaas hypothesised that disruptive behaviours were not random but served a purpose or array of purposes for the individual displaying them. Lovaas' work also highlighted the use of positive and negative reinforcement, and the use of a systematic teaching approach for a range of behaviours through the use of discrete trial teaching (DTT). Harris and Delmolino (2002) state that ABA is effective in altering the developmental trajectory of some young children with autism and that is has enabled a significant number to enter mainstream education, achieving normal intellectual functioning.

Jordan and Jones (1998) state that criticisms of the behavioural approach, in particular DTT, is that it produces dependent learning styles and a failure to generalise the skills learnt to other situations.

Discrete Trial Teaching (DTT)

DTT is one of the most commonly used techniques used by ABA practitioners (Leaf, Baker, & McEachin, 2008). DTT involves;

- Identifying needed skills
- Breaking complex skills into smaller parts
- Teaching one component skill at a time until mastered
- Allowing repeated practice within a concentrated period of time
- Providing prompting and prompt fading as necessary
- Using reinforcement procedures
- Facilitating generalisation of skills into the natural environment
  (Leaf, Baker, & McEachin, 2008)

Lovaas' use of negative reinforcement has been eliminated as more sophisticated practices have been developed. Lovaas never intended his techniques to be a specific set of techniques but a set of principles to inform practice (Leaf, Baker, & McEachin, 2008). Harris and Delmolino (2002) highlight the important work of Lovaas (1966) and his contribution to teaching children with autism and the subsequent research that has built upon these principles of applied behaviour analysis, helping to transform the treatment of children with autism. DTT is considered one of the most important methods of teaching children with autism in the history of autism treatment (Smith, 2001). However, criticisms have been levelled at DTT regarding its ability to transfer to untrained situations and stimuli, as well as its ability to retain the skill taught (Holding, Bray, & Kehle, 2008). Kubina, Morrison, and Lee (2002) propose the use of fluency training, also based on ABA principles, as an alternative method of working with children with autism.

Fluency Training

The precise definition of 'fluency' is important as this term has become increasingly popular in discussions of teaching and learning (Johnson & Layng, 1996). Johnson and Layng (1996) define fluency as 'flowing, effortless, well-practiced, and accurate performance' (p.281). They go on to say that free-operant performance rather than discrete trial responding is a critical feature of behavioural fluency and that the roots of the concept lie in precision teaching. In DTT the experimenter controls the occurrence of discriminative stimulus whereby in fluency building free-operant performance is defined as continuous responding in the presence of discriminative stimuli (Johnson & Layng, 1996).

Holding, Bray and Kehle (2011) found that fluency training was superior to DTT for acquisition, generalisation, and retention of the skill learnt for children with autism. Weiss (2001) highlights that while DTT methodology is extremely effective for building skills, there are additional approaches that may further enhance outcomes such as fluency based instruction. Weiss (2001) states that while fluency based procedures have been used within ABA practices for many years, its application to children with autism is rather recent. There is a potential benefit for children with autism to undertake fluency building procedures as they exhibit many dysfluencies and as a result miss social and educational opportunities because of their long latencies to respond.

Bonser's (2002) research explored behavioural fluency for young children with autism and found that fluency can be promoted by building the frequency of accurate responses to high rates. He also goes on to state that children undertaking DTT fail to achieve RESAA (retention, endurance, stability, applied and adduces) outcomes and may benefit from frequency building instruction.

Bonser's (2002) research findings found that the autistic population achieved similar gains to non-autistic populations, achieving greater gains in generalisation in comparison to DTT, and they also found the process more enjoyable than DTT.

2.7.1 Fluency and the 'Instructional Hierarchy'

An important model to acknowledge in relation to acquisition and fluency of skills is the 'instructional hierarchy'. Haring, Lovett, Eaton, and Hansen (1978) developed the 'instructional hierarchy' based on what was known about a pupils' development of skills.

Pupils learning new skills, it is suggested, move through different levels of competency as they learn and develop the new skill. The various stages, and the 'instructional hierarchy' itself, are set out below in Table 2.1.

Stage	Description
Acquisition	Acquisition is when a pupil is learning to develop the skill and undertake it correctly, with the goal of this stage focusing on undertaking the skill accurately.
Fluency	The pupil is able to undertake the target skill accurately and they are developing their ability of increasing their response rate so that they are fluent
Maintenance	The pupil has reached a stage where s/he can maintain a level of accuracy and fluency.
Generalisation	The pupil is able to accurately and fluently use their skill. Within this stage the aim is for the pupil to use their newly acquired skill in new situations and be able to discriminate between their skill and similar skills.
Adaptation	The goal of this stage is for the pupil to modify or adapt the skill in new and novel situations.

Table 2.1 Table showing the stages of 'Instructional hierarchy' and descriptive features adapted from Haring, Lovett, Eaton, and Hansen (1978).

Daly III, Lentz, and Boyer (1996) argue that using the 'instructional hierarchy' conceptual framework makes it easier to identify appropriate intervention targets and have a greater chance of improving skills. They go on to state that instead of merely focusing on one aspect of student responding such as accuracy, interventions can be tailored depending on their level of skill development. Bucklin, Dickinson and Brethower's (2000) research findings support the 'instructional hierarchy' framework, with fluency training producing faster response rates, better accuracy 4-6 weeks after the intervention, and less deterioration after 16 weeks.

The importance of building fluency for children with autism can therefore be seen within the 'instructional hierarchy' model. Developing fluency aids in a pupils ability to generalise, maintain and adapt their skill. Children with autisms' difficulty with generalising skills learnt "may be corrected if students with autism are taught prerequisite skills to fluency and functional use (versus only to acquisition rates) before progressing to more complex skills" (Hume, 2007, p.4).

The following section will explore a particular technique used to develop fluency and the theoretical underpinnings.

2.9 Instructional Psychology and Precision Teaching

Intervention approaches that look to increase fluency are dominated by the use of precision teaching. Precision teaching's theoretical underpinnings come from instructional psychology. Snow and Swanson (1982) define instructional psychology as;

"... the science of human learning in situations explicitly designed to promote it; its goals are to understand knowledge and skill acquisition and to devise principles of effective instructional treatment" (p.583-584)

Solity, Deavers, Kerfoot, Crane and Cannon (1999) go on to state that instructional psychology draws upon rational analysis, direct instruction and behavioural psychology. It is acknowledged that these theories differ in a number of ways but within instructional psychology the focus is on the learning environment rather than pupil's individual differences when exploring how they learn. Solity *et al.* (1999) state that the attention is on the organisation of the curriculum, teaching approaches and classroom organisation in such a way that the pupils are able to generalise the skills learnt.

Solity *et al.* (1999) discuss the distinctive instructional principles within instructional psychology. These are: distributed rather than mass practice; skills learnt to high fluency levels; learning to generalize skills; and interleaved learning (Solity *et al.*, 1999). De Corte (2000) states that research into learning and instruction "have substantially advanced our understanding of the processes of knowledge and skill acquisition" (p.249). However, the implementation of this research into the classroom has been slow and there is a need to bridge the gap between theory and practice (De Corte, 2000).

'Assessment through teaching' is an approach to assessment that has been limited in its implementation in schools (Stiggins, 2002) but supports the principles of instructional psychology. Snow and Swanson (1982) state in their article that an undercurrent of their review into instructional psychology is the need for improved assessment. Steering pupils towards optimal learning is facilitated by effective assessment procedures that provide feedback regarding the students' performance and instructional effects (Snow and Swanson, 1982). One such approach that has arisen from instructional psychology and adheres to the instructional principles is precision teaching.

Precision Teaching

Precision teaching was developed in the 1960s by Ogden Lindsley (Bernard-Optiz, 2005) and can be characterised as fluency building strategies that allow teaching effectiveness to be measured (Ragnarsdottir, 2007). Binder (1993) states that Lindsley and his colleagues moved away from measuring accuracy in favour of using rate or frequency measures (rate per minute) to assess pupils' responses to tasks on a daily basis. Binder (1993) goes on to state that Lindsley's premise for this change in approach was that their sensitive measures would yield important information on which teachers could base their educational decisions. Haughton (1972) was an early contributor to precision teaching and its practices and developed the idea of 'aim rates', proposing that specifying relatively high 'aim rates' helps a pupil gain competence and independence in that skill. Barrett's (1979) research found that rate per minute measures discriminate competencies, something that percentage accuracy cannot. Haughton (1972) also used the Standard Celeration Chart to record the daily measures to aid in teachers' and students' analysis of their performance and learning.

Overlearning is a term synonymous with precision teaching. It generally refers to the continued practice of a skill once the criteria for learning has been met (Kearney, 2008). The hoped for result of overlearning is that it leads to a greater retention of information, better recall, and fluency of that particular skill (Kearney, 2008). The measurement of fluency in precision teaching is, in effect, a method of assessing the effects of overlearning (Binder, 1993). It is important to point out that precision teaching is not an instructional system of curriculum in itself, but it is a way of evaluating the instructional effectiveness and supporting educational decisions (Potts, Eshleman, & Cooper, 1993).

Binder (1993) states that evidence from precision teaching and other research into behavioural fluency suggests that there are three categories of outcomes associated with it. These are:

- Retention and maintenance of skill and knowledge.
- Endurance or resistance to distraction.
- Application or transfer of skill.

The key components of precision teaching are:

- To set time based targets for mastery criteria for each curriculum step.
- To provide daily opportunities to practice the skill.
- To provide time measurements.
- To chart on a Standard Celeration Chart.
- To modify the teaching or task in response to the feedback data.

(Binder, 1988)

The Standard Celeration Chart was developed by Lindsley in what was originally called the Standard Behavior Chart (Calkin, 2005) (see Figure 2.1). The Standard Celeration Chart displays human behaviour in various time periods and aids in learning. Calkin (2005) states that the Standard Celeration Chart has two critical elements. Firstly, behaviour grows by multiplying and not adding. Secondly, the chart displays not only the frequency of the behaviour but also the growth of learning over time.

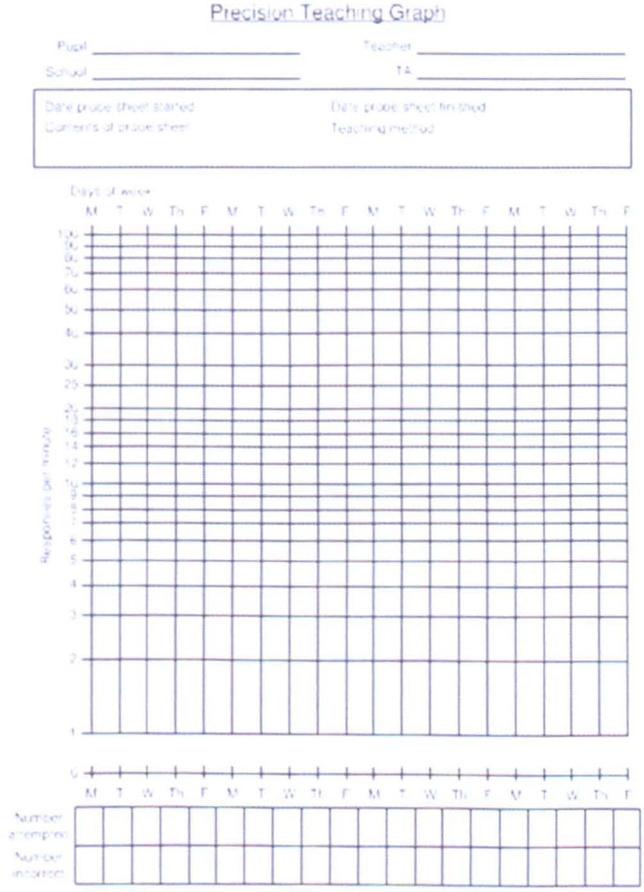


Figure 2.1 Example of a Standard Celeration Chart.

2.9.1 Precision Teaching Evidence Base

Instructional psychology focuses on the learning environment and precision teaching adheres to this principle as it allows teachers to examine their own instruction before inferring cause on the child (Raybould and Solity, 1982).

Through precision teaching small changes can be identified and also the small steps made by the child can be acknowledged. Boys and Lydon (2008) review paper highlighted the strong evidence base of precision teaching, stating that most authors would agree that precision teaching increases the acquisition and maintenance of basic skills. Generalisation is also one of the products of precision teaching by breaking teaching into manageable components, making learning easy, and enhancing speed of production and endurance (Bernard-Optiz, 2005). Bernard-Optiz (2005) state that "teachers and parents rave about improved learning, less effort in spontaneous responding and better generalisations" (p.9). Downer's (2007) research study also found that the benefits of precision teaching were often generalised to other areas of the curriculum, hypothesising due to the increase in confidence and self-esteem. Downer's (2007) research was a mixed methods design, including a relatively large sample of children across seven schools. However, the study lacked a comparison group and selection criteria, and pupils' perspectives were obtained second-hand from teaching assistants, possibly reducing the validity of the data. Research evidence presented by Lindsley (1992) showed that precision teaching had almost doubled student learning. However, the details regarding this research were limited making it difficult to evaluate the evidence and therefore tentative conclusions can only be made.

Lindsley (1992) recommends the use of precision teaching in special and mainstream education. Precision teaching is particularly aimed at those children that have fallen behind their peers and require support to accelerate their rate of acquisition (Raybould & Solity, 1982). In particular, it supports children who have had difficulty in acquiring their basic skills (Raybould & Solity, 1982), although it is debated whether precision teaching can be used for more complex skills (Aubrey, 1987; Boys & Lydon, 2008). Lindsley's (1992) article highlighted the limited use of precision teaching and other effective behavioural methods in North America. Lindsley (1992) states "... any educational approach that smacks of discipline and requires regular practice is ... avoided. Most educators have bought the myth that academic learning does not require discipline – that the best learning is easy and fun" (p.22-23).

Raybould and Solity's (1982) 'real world' study highlighted the motivational aspect of the Standard Celeration Chart, whereby a child can see the progress they are making, however they are not compared to their peers – a comparison which might often be de-motivating. Although anecdotal in nature, this research provides ecological validity and a useful insight into its implementation in a 'real world' setting. Kessissoglou and Farrell's (1995) experimental research supports the motivational impact assertion regarding charting. Their research utilised a randomized controlled trial design but used a relatively small sample size. The length of time between the intervention and follow up period was also short making it difficult to assess the maintenance of the intervention effects. The small sample size also makes generalising difficult due to the limited representation of the wider population.

It is stated that there is an important emotional aspect of precision teaching for children who had experienced consistent failure (Downer, 2007). Accessing consistent daily intervention, with clear objectives, praise and evidence of visual success is highly motivating (Downer, 2007). Roberts and Norwich (2010) state that precision teaching allows students to develop a positive view of themselves as learners. Also, the precision teaching method means that teaching is individualised and, as such, pupils are able to access the curriculum in a way that they may not have been able to do previously. The increased self-efficacy may allow greater confidence and willingness to try new and more challenging work. Downer (2007) also found that children experienced gains in attainment and in some cases positive behavioural changes possibly due to increased confidence and self-esteem. "The current study suggests that by means of a simple version of precision teaching…real change – both academic and emotional – can be accomplished for substantial numbers of individual children by methods both economical in time and requiring minimal training of TAs" (Downer, 2007, p.141). Despite some of the methodological flaws apparent in Downer's (2007) research, as discussed previously, the findings bring to light possible benefits of precision teaching regarding how learning is intertwined with behaviour and affective aspects.

Boys and Lydon (2008) state that precision teaching can be easily aligned with government initiatives and fits in with the SEN Code of Practice (DfES, 2004) as it can be used alongside many of the Wave 3 Interventions. Potts, Eshleman, & Cooper (1993) state that due to precision teaching being an evaluative tool, it can be combined with "all other methods of measurably effective behavioral instruction that focus on behavior acquisition" (p.188). They go on to predict an accelerating learning trend when partnering precision teaching with other measurably effective instructional methods. However, it is not clear from the literature how widespread the use of precision teaching is today, and in what settings it is predominantly used.

2.9.2 Precision Teaching – Populations and Settings

As indicated previously, there is a substantial research base purporting the effectiveness of precision teaching for learning, affect, and behaviour (Ragnarsdottir, 2007; Bonser, 2002, Holding, Bray, & Kehle, 2011; Downer, 2007). However, this research base does not indicate the populations and settings for which precision teaching is most effective. Potentially, as it is a tool for assessing and charting the current teaching approach and performance, it may be effective for all populations and settings. Merbitz, Vieitez, Merbitz, and Pennypacker (2004) state that precision teaching is a unique approach, " it has no fixed curriculum, subject-matter areas, types of students, or grade-levels" (p.59). One area in particular that has had limited research regarding precision teaching is for children with autism (Bernard-Opitz, 2005).

2.9.3 Precision Teaching – Children with Autism

Bernard-Opitz (2005) states that the research base of precision teaching for children with autism has yet to reach mainstream journals. This view is also supported by Kubina *et al.* (2002) who state that a large database for the application of precision teaching has yet to develop. However, precision teaching is a potentially valuable tool for children with autism. Kubina *et al.*

(2002) state that precision teaching provides a tool for teachers to frequently assess performance, support educational decisions, and develop fluency – augmenting their current instructional methods. The variety of learning characteristics presented by children with autism can make providing a suitable teaching approach difficult for teachers. The use of precision teaching will help assess and support this process (Kubina *et al.,* 2002). Kubina and Wolfe (2005) argue "that fluency increases the functionality of skills for students with autism and should be systematically programmed into a curriculum" (p.35). Research that has focused on using precision teaching with children with autism has seen positive results such as fluency and retention of the target skill (Schirmer, Almon-Morris, Fabrizio, Abrahamson, & Chevalier, 2007; Ragnarsdottir, 2007; Holding, Bray, & Kehle, 2011; Almon-Morris & Diakite, 2007).

The application of precision teaching for children with autism can therefore be seen as a potentially useful approach given the slow response latencies, dysfluencies, and difficulties in generalising of such children (Weiss, 2001). Limited research has been conducted in this area even though some positive initial findings have been reported. It is an area in which further research may provide important information in supporting children with autism. The next section reports key research regarding the use of precision teaching used within whole school educational approaches.

2.9.4 Precision Teaching – Whole School Approaches

The Precision Teaching Project that took place during the 1970s in Great Falls, Montana, is one of the most regularly cited studies of precision teaching (Binder, 1993). This project added 20 to 30 minutes of precision teaching to an otherwise conventional educational programme in one elementary school. The findings of this project were that over a three year period students rose between 20 and 41 percentile points on the Iowa Test of Basic Skills in comparison to all the other schools in the district. A number of whole schools approaches incorporating precision teaching have been developed and will be discussed.

Morningside Model of Generative Instruction

The Morningside Model of Generative Instruction is another example of the effectiveness of precision teaching within a whole school approach. The Morningside Academy is a school built upon the principles of precision teaching and direct instruction (Johnson & Laynge, 1996). It is for pupils aged 5 to 18 who typically perform below their potential in school due to a variety of reasons (Johnson, 1997). The children that attend have a variety of difficulties such as diagnoses of learning difficulties and Attention Deficit Hyperactivity Disorder (Johnson, 1997). Evaluation of this approach by staff at Morningside Academy state that "ten years of standardized test data support gains in reading, language, arts, and math averaging over two years gain per academic year" (Johnson, 1997, p.31). However, there is a limited evidence base and research conducted has tended to come from proponents of the approach leading to issues of bias.

Intensive Model (Autism) of Generative Instruction Excellence (IMAGINE)

The Intensive Model (Autism) of Generative Instruction Excellence (IMAGINE) is a programme based on precision teaching that is run in Australia and New Zealand. This programme is an early intervention educational programme for children with autism in the hope that these children will be able to attend mainstream school. Research into this programme found that children received significantly higher rates of instruction, praise/feedback, and more time on task than children with autism in mainstream schools (Anderson, Fletcher-Flinn, Godfrey, & Moore, 2002). However, there were limitations regarding the validity of the measures used and there does not appear to be additional independent research exploring IMAGINE.

Competent Learner Model (CLM)

The CLM merges ABA, direct instruction and precision teaching and is predominantly used to support children with autism. Tucci, Hursh, and Laitinen (2004) state that the ABA, direct instruction and precision teaching have not been readily adopted by educators due to lack of marketing and dissemination of these approaches. They go on to state that the CLM aims for educators to master the implementation of ABA, direct instruction and precision teaching, as well as motivating them to use these approaches in their classrooms on a daily basis. This model proposes that pupils are required to develop seven competent learner repertoires for them to progress through educational settings and to function in daily life (Tucci, Hursh, & Laitinen, 2004). Tucci, Hursh, and Laitinen (2004) state that the Competent Learner Model has had success in moving pupils into less restrictive environments in education and daily life, for a range of children with a plethora of difficulties and diagnosis, helping them function effectively. Research is drawn from the various approaches amalgamated (ABA, direct instruction, and precision teaching) to illustrate its potential effectiveness. However, research regarding CLM has been undertaken by people associated with the programme and therefore prone to bias. There appears to be little independent, empirical research into this programme so conclusions drawn from it are limited and should be treated with caution.

2.10 Rationale for Current Research Focus

The previous sections have explored the various educational approaches and interventions for children with autism. It is apparent that research into this area is difficult due to the heterogeneous population and some of the popular approaches for children with autism appear to have limited evidence bases. Precision teaching is an approach that has a solid research base regarding its effectiveness, however there has been little research regarding its application for children with autism. The benefits of precision teaching are associated with better fluency, generalisation, and retention of skills or information learnt. For children with autism this is a potentially valuable tool to support their learning as they have particular dysfluencies and find it difficult to apply information to novel situations. The combination of fluency based methods such as precision teaching has started to filter into current educational approaches for children with autism, notably ABA, with promising results (Tucci, Hursh, & Laitinen, 2004). The local context in which this research is based is one in which a derivative of TEACCH is employed. Precision teaching can be applied to any curriculum or approach and it is therefore suggested that it may be beneficial to augment the current local educational 'structured approach' for children with autism with precision teaching.

2.11 Systematic Review of the Literature

The purpose of this review is to systematically evaluate the evidence regarding the use of precision teaching for children with autism and its application within a structured teaching approach.

A postpositivist epistemological stance was used to evaluate the evidence obtained due to the focus of the review questions being on evaluative evidence. A pragmatic paradigm, as detailed in Chapter 3, allows the researcher to utilise difference epistemological stances depending on the question to be answered. The systematic review looks to draw upon evaluative research exploring the effectiveness of the intervention in various circumstances which lends itself to a postposivitist, quantitative approach when exploring the research base in this instance.

This review will evaluate the research studies identified using Gough's 'Weight of Evidence' framework (2007). This approach to evaluating research evidence has four different 'Weight's of Evidence'. These are:

- *Weight of Evidence A* – Methodological quality, coherence and integrity of the evidence.
- *Weight of Evidence B* – The appropriateness of the research design in answering the research question.
- *Weight of Evidence C* – The relevance of the focus of the evidence in answering the review question.
- *Weight of Evidence D* – The combined judgements from the three previous 'Weight's of Evidence'. Providing an overall assessment of how the evidence contributes to answering the review question.

2.11.1 Focus of the Systematic Review

The focus of this systematic review is to answer the following questions:

- How effective is the use of precision teaching and fluency building methods for children with autism?
- Has precision teaching been effectively used to augment a structured teaching approach for children with autism?

2.11.2 Search Strategy

The systematic review was completed using key search terms within a number of relevant databases. The search terms used to explore the effectiveness of precision teaching for children with autism were:

- 'Precision teaching' and 'autis*'

Due to the rationale of this research project it was also decided to use the search terms:

- 'fluency' and 'autis*'

The second phase of the systematic literature review focused on precision teaching being incorporated into a structured teaching approach. The key search terms were:

- 'structured teaching' and 'precision teaching'
- 'structured teaching' and 'fluency'
- 'TEACCH' and 'precision teaching'
- 'TEACCH' and 'fluency'

The databases in which these searches were carried out were PsychINFO, Google Scholar, and ERIC (Education Resources Information Centre). Due to the plethora of results generated with Google Scholar, key terms were only used in the journal titles, whereas the key search terms were used in all areas for the two other databases.

2.11.3 Systematic Review 1

How effective is the use of precision teaching and fluency building methods for children with autism?

2.11.3.1 Inclusion and Exclusion Criteria

A number of results were generated within the initial search. Only journal articles that were primary research and had an experimental design were included in the review. The key search terms also had to be present in the title or abstract for all databases used. The use of 'fluency' was also used in the search terms, and those studies that used fluency methods similar to precision teaching were included due to the ability to infer the findings to this research project.

Nine studies met the inclusion criteria (see table 2.1) and 17 studies were excluded (see appendix 1). The majority of those that were excluded were not focused on fluency interventions and were therefore excluded as they bore little similarity to a precision teaching approach.

Study	Research Design	Findings
Fabrizio, Schirmer, King, Diakite, & Stovel (2007)	Case study	Precision teaching used to develop foundational motor skill. Findings suggest accelerated progress in target area

		but no empirical evidence for fluency.
Schirmer, Almon-Morris, Fabrizio, Abrahamson & Chevalier (2007)	Case study	Precision teaching aided in fluency and retention of skill.
Solis, Derby, & McLaughlin (2003)	AB Single Case Design	Precision teaching for problem behaviour (pounding tables and mouthing). Reduction of problem behaviour, although PT intervention combined with functional communication training.
Ragnarsdottir (2007)	Pre- Post- Test Single Case Design	Developed literacy skill to fluent level and retained the skill in a one-year follow up.
Bonser, D.J. (2002)	ABACA Single Case Design	Seven pupils. Results suggest that they all responded to fluency building procedures that were consistent with a non-autistic population. It produced better generalisation than discrete trial teaching and it was more enjoyable for the students.
Holding, Bray, & Kehle (2011)	ABC Single Case Design	Fluency training was superior to discrete trial training for acquisition, generalisation, and

		retention of noun labels.
Weiss, Fabrizio, & Bamond (2008)	Single case post-test design	Frequency building procedures were used and showed a high level of skill retention at 1-2-3- and 6 month post mastery points.
Almon-Morris & Diakite (2007)	Case studies	Use of precision teaching to teach emotions. Findings indicated fluent levels of identifying emotions and fairly high retention rates.
Freshci, D.F. (1973)*	Case studies	Prevocational training project in which precision teaching was an integral part. Children made 'note-worthy' gains.

Table 2.2: Table showing the research design and findings of the studies that met the selection criteria for systematic review 1.

*abstract only

2.11.3.2 Research Designs

A number of research designs were used by the studies included in this review. This review of literature focused on a postpositivist view of evidence, with empirically validated quantitative data being assessed as high quality evidence. A case study approach was used for 4 of the studies (Fabrizio, Schirmer, King, Diakite, & Stovel, 2007; Schirmer, Almon-Morris, Fabrizio, Abrahamson & Chevalier, 2007; Almon-Morris & Diakite, 2007; Freshci, 1973). This approach was deemed to provide a low weight of evidence for the review question as it is difficult to generalise this information. Also, there are issues of bias with this type of approach as findings are partially based on subjective accounts of progress in the pupil. Some of these case studies (Fabrizio, Schirmer, King, Diakite, & Stovel, 2007; Schirmer, Almon-Morris, Fabrizio, Abrahamson & Chevalier, 2007; Almon-Morris & Diakite, 2007) did provide quantitative information via the precision teaching Standard Celeration Chart which helped strengthen their findings further. One study (Weiss, Fabrizio, & Bamond, 2008) provided further quantitative information regarding the intervention's efficacy through the use of post-intervention analysis. However, the ability to infer causation with the intervention and findings is limited due to its lack of external validity. A pre and post-test analysis of data was provided by Ragnarsdottir's (2007) study which further strengthens the ability to infer casual effect regarding the use of precision teaching. However, there are still limitations regarding the control of external variables.

Studies that provided more robust empirical data regarding the effectiveness of precision teaching for children with autism used a single case research design, incorporating a baseline period to act as a control for the intervention (Solis, Derby, & McLaughlin, 2003; Bonser, 2002; Holding, Bray, & Kehle, 2011). This research design provided greater external validity and greater confidence in the research findings. Those that provided further phases through added intervention or withdrawal of intervention increased the external validity (Bonser, 2002; Holding, Bray, & Kehle, 2011). Limitations of this method are the use of a single subject and ability to generalise the findings.

2.11.3.3 Procedural Information

The quality of information regarding the research design procedures differed between each paper. Three articles (Fabrizio, Schirmer, King, Diakite, & Stovel, 2007; Schirmer, Almon-Morris, Fabrizio, Abrahamson & Chevalier, 2007; Almon-Morris & Diakite, 2007) provided a narrative account of the intervention. However, there was little detail regarding the procedures of precision teaching and treatment integrity measures were also omitted for all of these studies. Clear procedural information was provided by a number of articles (Weiss, Fabrizio, & Bamond, 2008; Bonser, 2002; Solis, Derby, & McLaughlin, 2003; Ragnarsdottir, 2007), some providing information on the selection of participants, interventions used and measures. Some research articles did not provide detailed information regarding the participants (Weiss, Fabrizio, & Bamond, 2008) which was deemed necessary for single case research. There was also a lack of treatment integrity checks (Weiss, Fabrizio, & Bamond, 2008; Solis, Derby, & McLaughlin, 2003; Ragnarsdottir, 2007) and interrater reliability for measures taken (Weiss, Fabrizio, & Bamond, 2008; Solis, Derby, & McLaughlin, 2003; Ragnarsdottir, 2007). Due to Freshci's (1973) paper being reviewed via an abstract there was limited information regarding the procedures used in the research.

2.11.3.4 Outcome Measures

The outcome measures used for the articles selected differed depending on the research design and focus of the question. The use of the Standard Celeration Chart and rate of acceleration as the main outcome measure was seen in the case study approaches to measure the effectiveness of precision in developing certain skills (Fabrizio, Schirmer, King, Diakite, & Stovel, 2007; Schirmer, Almon-Morris, Fabrizio, Abrahamson & Chevalier, 2007; Almon-Morris & Diakite, 2007; Holding, Bray, & Kehle, 2011; Weiss, Fabrizio, and Bamond, 2008). The use of the Standard Celeration Chart provides useful data but it is limited as it is not independent from the intervention. Ragnarsdottir (2007) also used chart data as one of their key outcome measures but combined with pre and post literacy assessment to measure the affect of direct instruction and precision teaching on the literacy skills of a child with autism. Observational data was used in Solis, Derby, and McLaughlin's (2003) study to measure behaviour change in response to a precision teaching approach to reducing problem behaviour. Bonser (2002) used a number of measures to answer the three research questions which included the use of the Standard Celeration Chart and observational data with inter-rater reliability measures to explore behavioural fluency for children with autism.

2.11.3.5 Results

The majority of the research articles explored the explicit use of precision teaching to teach a skill. This included foundational motor skills (Fabrizio, Schirmer, King, Diakite, & Stovel, 2007); story telling (Schirmer, Almon-Morris, Fabrizio, Abrahamson & Chevalier, 2007); literacy skills (Ragnarsdottir, 2007); and recognition of emotions (Almon-Morris & Diakite, 2007). These highlight the functionality of precision teaching being incorporated into a variety of curriculum to aid in the development of the target skill. These studies showed accelerated progress (Fabrizio, Schirmer, King, Diakite, & Stovel, 2007; Schirmer, Almon-Morris, Fabrizio, Abrahamson & Chevalier, 2007), however due to their research designs the ability to link this with the precision teaching approach is limited.

Research articles also compared the use of precision teaching against other approaches such as discrete trial teaching (Bonser, 2002; Holding, Bray, & Kehle, 2011), finding precision teaching superior to the alternative approach in producing better generalisation results (Bonser, 2002; Holding, Bray & Kehle, 2011), more student enjoyment (Bonser, 2002), acquisition (Holding, Bray, & Kehle, 2011), and retention (Holding, Bray, & Kehle, 2011). Retention of information was also a specific focus for Weiss, Fabrizio, and Bamond (2008) showing high levels of skill retention at 1-, 2-, 3-, and 6-month points. However, due to the lack of comparison data the ability to infer casual effect to precision teaching is limited.

The augmentation of precision teaching with another intervention was the focus for three studies (Solis, Derby, & McLaughlin, 2003; Ragnarsdottir, 2007; Freshci, 1973). These included precision teaching augmented with functional communication training (Solis, Derby, & McLaughlin, 2003), direct instruction (Ragnarsdottir, 2007), and prevocational training (Freshci, 1973). The findings of these studies found a reduction in problem behaviour (Solis, Derby, & McLaughlin, 2003), literacy skills were more fluent and retained at one year follow up (Ragnarsdottir, 2007), and 'note-worthy gains' (Freshci, 1973).

Freshci's (1973) research was reviewed via an abstract only and there was not an elaboration of 'note-worthy gains'. These research articles all indicate that precision teaching can be successfully augmented with a range of approaches to produce promising findings.

The research focus of these papers all explored the use of precision teaching and fluency based assessment methods as part of an educational approach for children with autism. The research designs of some of these papers make inferences difficult due to lack of empirical control as discussed in the previous section. However, researching this population is fraught with difficulties due to their heterogeneous characteristics and the ability to provide a 'gold standard' randomised controlled trial (Robson, 2002). The use of single case experimental designs, as used in some of the selected papers, provides a useful compromise. However, the ability to generalise from these research articles is also compromised due to the use of single case designs. Further research into this area will allow a bigger picture to be built regarding the specifics of precision teaching and it potential effectiveness as an intervention for children with autism.

Table 2.3 evaluates the research articles selected in line with Gough's (2007) 'Weight of Evidence'.

Study	Weight of Evidence A	Weight of Evidence B	Weight of Evidence C	Weight of Evidence D
Fabrizio, Schirmer, King, Diakite, & Stovel (2007)	Low	low	high	Low
Schirmer, Almon-Morris, Fabrizio, Abrahamson	Low	low	high	low

& Chevalier (2007)				
Solis, Derby, & McLaughlin (2003)	Medium	high	medium	medium
Ragnarsdottir (2007)	Medium	low	high	medium
Bonser, D.J. (2002)	Medium	high	medium	medium
Holding, Bray, & Kehle (2011)	Medium	high	high	high
Weiss, Fabrizio, & Bamond (2008)	Low	low	medium	low
Almon-Morris & Diakite (2007)	Low	low	medium	low
Freshci, D.F. (1973)	Low	low	low	low

Table 2.3: Table showing the evaluation of the studies included in systematic review 1, in line with Gough's (2007) 'Weight of Evidence.'

Table 2.3 indicates that the majority of studies that were evaluated were of low 'weight of evidence'. The research design and lack of empirical control meant that the ability to infer findings to the review question was limited. One study was deemed as providing a high weight of evidence (Holding, Bray, & Kehle, 2011) due to its research design controlling for the extraneous variables whilst exploring the effectiveness of precision teaching in comparison to a similar behavioural intervention for children with autism. The studies that were deemed as having medium weight of evidence (Solis, Derby, & McLaughlin, 2003; Ragnarsdottir, 2007; Bonser, 2002) had either more robust research designs or a greater relevance to the review question, namely the effectiveness of precision teaching for children with autism.

Overall, the systematic review of the literature indicated that the use of precision teaching for a child with autism is potentially a useful approach. The ability to make more confident claims is limited due to the research designs of the reviewed studies and also the difficulties of researching a heterogeneous population. The research articles suggest that precision teaching aids in improved fluency and retention of targeted skills for children with autism, and that it can be combined with various different curriculum and approaches in an effective way.

2.11.4 Systematic Review 2

Has precision teaching been effectively augmented with a structured teaching approach for children with autism?

2.11.4.1 Inclusion and Exclusion Criteria

Only primary research articles were included in this review. The key search terms used to answer the second review question produced minimal results. PsychInfo produced 0 results on all combinations of search terms used and 1 article was found using ERIC and included in this review. The initial Google Scholar search focused on the key search terms in the title due to the other search option focusing on the entire document. However, this produced 0 results too so the key terms were searched in the whole article. This produced 33 results which was reduced to 1 by exploring the abstracts and reviewing the articles where there was specific research focus of fluency or precision teaching with a structured teaching / TEACCH approach (see appendix 1 for excluded studies and reason for exclusion).

The two articles included in the review are summarised in the table 2.4.

Study	Research Design	Findings
Hume (2007)	Multi-baseline single case experimental design	The use of an individual work station, an element of structured teaching, resulted in higher levels of independent functioning, fluency, and generalisation.
Hung, Rotman, Cosentino, and MacMillan (1983) *	Between groups experimental design	Experimental group excelled in functional skills for 3 consecutive 6 month periods.

Table 2.4: Table showing the research design and findings of the studies that met the selection criteria for systematic review 2.

*abstract only

2.11.4.2 Research Design

The two research articles used differing research designs: Hung, Rotman, Cosentino, and MacMillan (1983) used a between groups experimental design, whereas Hume (2007) used a multiple baseline single case experimental design. Between groups experimental design holds greater experimental control than a multiple baseline single case design and could therefore be suggested to hold a greater 'weight of evidence.' However, due to the heterogeneous characteristics of children with autism, the ability to group these children together is fraught with difficulties. Group designs assume that the groups are homogenous which is very difficult to achieve with this population, therefore the measures may be evaluating something other than the intervention. The use of a single case experiment design as used in Hume's (2007) research is more commonly used due to the disparate characteristics of this population. The individual effectively acts as his or her own comparison through the use of a baseline and intervention period. This can also be enhanced through the withdrawal of the intervention in an A-B-A design. Hume's (2007) research incorporated a multiple baseline approach which helps mitigate against external variables due to different participants having their intervention periods at different points.

It should be noted that Hung, Rotman, Cosentino, and MacMillan's (1983) research was evaluated via the abstract so there were difficulties exploring the procedures used to match groups and rationales for the design used.

2.11.4.3 Procedural Information

The level of information accessed for the two studies reviewed varied greatly. Due to only the abstract being accessed for Hung, Rotman, Cosentino, and MacMillan's (1983) there is an obvious lack of information to evaluate how their research was conducted. Hume's (2007) article provided a detailed account of the procedures used. This included clear information regarding how participants were selected, further assessments to confirm diagnosis of autism, detailed information about each participant, and clear procedures for the intervention. Treatment integrity measures were taken as well as inter-observer reliability for the measures.

2.11.4.4 Outcome Measures

Hung, Rotman, Cosentino, and MacMillan's (1983) study focused on the acquisition and maintenance of functional skills. These were measured in six monthly assessments and compared against two other educational approaches. It was not clear from the abstract how this data was collected. Hume's (2007) outcome measures focused on independent functioning, fluency and generalisation. This was obtained via observational procedures, with inter-observer agreement for judgements made. However, it should be noted that rate of task completion was not used as a measure for fluency, instead increases in accuracy and decreased task completion duration was used. It could be argued that this is not a true measure of fluency.

2.11.4.5 Results

Hung, Rotman, Cosentino, and MacMillan's (1983) study explored the use of an educational approach for autism using aspects of structured teaching and precision teaching. Their findings suggested that this approach produced pupils who excelled in functional skills at various follow up points in comparison to other educational approaches. Hume's (2007) research explored the use of an individual work station, an aspect of structured teaching, to generate task fluency and generalisation in children with autism. Hume's (2007) research indicated that the individual work stations resulted in higher levels of independent functioning, fluency and generalisation for all participants.

Table 2.5 uses Gough's (2007) 'Weight of Evidence' to evaluate the research in relation to the review question.

Study	Weight of Evidence A	Weight of Evidence B	Weight of Evidence C	Weight of Evidence D
Hume (2007)	medium	high	low	medium
Hung, Rotman, Cosentino, & MacMillan (1983)	low	medium	medium	medium

Table 2.5: Table showing the evaluation of the studies included in systematic review 2, in line with Gough's (2007) 'Weight of Evidence.'

Table 2.5 indicates that the two papers were of medium 'weight' in regards to answering the review question. Hume's (2007) research article was judged to be of medium weight due to its focus on fluency within the TEACCH approach and empirical control that related to the review question. However, it did not explore the use of augmenting precision teaching within its design. However, it obtained an overall medium 'weight' of evidence as it explored the use of precision teaching in conjunction with a structured teaching approach for children with autism.

Overall, there were a limited number of papers of relevance to the review question. Those selected had some relevance but did not entirely link with the focus of the review question. It is apparent that there appears to be little or no research into the augmentation of precision teaching within a structured teaching approach for children with autism. Hume's (2007) research suggests that there are already methods in place that support fluency in a structured teaching approach, however the means of measuring fluency in the study could be disputed. Hung, Rotman, Cosentino, and MacMillan's (1983) research highlighted how precision teaching and structured teaching can be effectively combined to produce promising results.

2.11.5 Evaluation of the Systematic Reviews

The two reviews highlight the area of fluency building procedures for children with autism as being a valuable area for research. Some promising results regarding acquisition, generalisation and retention of a number of skills are reported. Fluency building procedures are able to accommodate any curriculum or approach and be a useful addition. Research has also shown that fluency building procedures, such as precision teaching, has augmented ABA successfully and produced superior results to the traditional DTT approach (Bonser, 2002). The research into precision teaching's application with a structured teaching approach is very limited and there has been no identified research that has explored this. However, the indications from the systematic review are that it would be a useful area to explore. Since a 'structured approach' is the approach adopted in the local context, there is an opportunity to explore this question and potential to improve service.

2.12 Rationale and Research Questions

Precision teaching has a large evidence base to support its efficacy in developing pupils' basic skills (Boys & Lydon, 2008). The emphasis on building skills to fluency has meant that students have shown greater ability to generalise the information and retain it (Boys & Lydon, 2008). It has also been shown to have a positive impact on behaviour and affective states (Downer, 2007).

Children with autism have difficulties generalising information to novel situations and the use of fluency building procedures have been shown to support generalisation and retention of information (Bernard-Optiz, 2005). Precision teaching has augmented an educational approach for autism, namely ABA, with promising results (Tucci, Hursh, & Laitinen, 2004).

Precision teaching can be applied to any curriculum or approach (Merbitz *et al.* 2004). The application of precision teaching within a 'structured approach' has not yet been researched and there is a need to develop more effective educational approaches for children with autism and add to the evidence base. Due to the educational context in which this research is taking place, the gap in the research, and the indications regarding its effectiveness, this research proposes to explore the augmentation of a structured teaching approach for children with autism with precision teaching.

The specific research question is therefore:

"Can precision teaching beneficially augment a 'structured approach' for children with autism?"

Within this question there will three sub-questions:

"Can precision teaching lead to a positive impact on a child with autism's learning when incorporated as part of a 'structured approach'?"

"Can precision teaching lead to a positive impact on a child with autism's affect when incorporated as part of a 'structured approach'?"

"Can precision teaching lead to a positive impact on a child with autism's behaviour when incorporated as part of a 'structured approach'?"

An additional sub-question, focusing on qualitative information, was also posed to obtain information regarding the perceptions of staff on the impact of precision teaching within the 'structured approach'.

"In what ways is precision teaching perceived to augment a 'structured approach' to teaching a child with autism?"

Chapter 3: Methodology

3.1 Introduction

This section will inform the reader of the methodological considerations explored by the researcher and of the procedures used in answering the research questions. In particular, the philosophical considerations that underpin this research will be discussed in relation to other stances that may have been adopted and how they have influenced the practical undertaking of this research. The specific research methods are outlined with consideration being given to alternative approaches and the rationale for the chosen procedures. The various measures utilised will be acknowledged in terms of their validity and reliability in reference to the research questions. Ethical considerations are an integral part of this research and comment will be made regarding the impact of such ethical considerations on the decisions made through the process of the research.

3.2 Real World Research

Burden (1997) states that the need for good educational research has never been greater and that educational psychologists are in the best position to investigate issues within the education system. Educational psychologists, it is proposed, work as scientist-practitioners (Burden, 1997), studying real-world problems and contextualising the issues. Real world research though, carries with it a number of challenges. Robson (2002) states that the principle challenge of real world research "lies in seeking to say something sensible about a complex, relatively poorly controlled and generally 'messy' situation" (p.4), in contrast with research conducted in a laboratory which is often able to control for extraneous variables. Robson (2002) goes on to suggest that real world enquiry is about solving problems rather than simply gaining knowledge and obtaining large effects.

3.3 Major Paradigms within Educational and Psychological Research

"A paradigm provides a tool to identify one's own worldview or, in research terminology, identify one's paradigm: a metaphysical construct associated with specific philosophical assumptions that describes one's worldview." (Mertens, 2007, p. 215)

It is a very complex task to try and categorise all educational and psychological research into a few paradigms (Mertens, 2010). Researchers are urged to locate their research within a particular paradigm as they influence "how we know, our interpretations of reality, and our values and methodology in research" (Doyle, Brady, & Byrne, 2009, p.176). These elements are usually identified as epistemology, ontology, and methodology, and will be discussed in subsequent sections. A researcher will expose their underlying beliefs and assumptions through their interpretations of the research findings (Feilzer, 2009).

Mertens (2010) identifies four major paradigms within the area of educational and psychological research. These include postpositivism, constructivist, transformative, and pragmatic.

- Postpositivism is based upon positivism, a paradigm that guided early educational and psychological research. Positivism assumes that the social world can be studied in a similar manner to the natural world (Mertens, 2010). Postpositivism contends that there is a single reality and seeks to identify causal relationships through objective measurement and quantifiable analysis (Doyle, Brady, & Byrne, 2009). However, in contrast to positivism there is the acceptance that the theories, hypotheses, background knowledge, and values of the researcher can affect the research and that reality may be known only imperfectly due to the researcher's limitations (Robson, 2002).

- The constructivist perspective is based upon the view that there are multiple realities and various interpretations can be made through any research. Researchers working within this paradigm seek to illuminate the reality of others through detailed descriptions of their experiences (Doyle, Brady, & Byrne, 2009), as well as acknowledging their own subjective perspective.

- The transformative perspective is that there are multiple realities. The central importance of this paradigm centres on the lives and communities that are pushed to the margins of society (Mertens, 2007).

- The pragmatic paradigm focuses on the problem to be researched and the consequences of the research (Feilzer, 2009). It proposes that there are multiple realities, and that any knowledge produced is relative and not absolute (Feilzer, 2009).

The three theoretical underpinnings associated with each paradigm that will be discussed are:

- Ontology
- Epistemology
- Methodology

3.3.1 Ontological Considerations

Ontology is concerned with the nature of reality and how it is viewed:

- A postpositivist paradigm would propose there being one reality, and this reality being acknowledged to a certain level of probability.
- The constructivist paradigm suggests that there are multiple, socially constructed realities.
- The transformative paradigm also proposes that there are multiple realities that are socially constructed, but holds that various versions of

social reality are based on social positioning and that there is a conscious awareness that certain realities may be more privileged.

- The pragmatic paradigm asserts a multiple reality, with all individuals having their own unique interpretation of reality.

3.3.2 Epistemological Considerations

Epistemological considerations are influenced by the ontological stance taken by the researcher. These considerations are concerned with the nature of knowledge and the relationship between the researcher and their pursuit of this knowledge. A researcher can be guided by a number of epistemological approaches.

- A postpositivist position would state that objectivity is important, and the researcher manipulates and observes in an objective and dispassionate manner.
- Constructivists state that there is an interactive link between the researcher and participants, where the participants aid in constructing the 'reality' with the researcher.
- The transformative paradigm also states that there is an interactive link between the researcher and participants, but acknowledge that knowledge is socially and historically situated, and that there is a need to address issues of power and trust.
- A pragmatic approach asserts that the relationships to be explored regarding the pursuit of knowledge is determined by the researcher and what is appropriate to that particular study.

3.3.3 Methodological Considerations

The methodological considerations behind a piece of research is concerned with how a researcher will approach the systematic enquiry. Such considerations are underpinned by the paradigm in which the researcher is aligned.

- A postpositivist methodological approach is primarily quantitative and interventionist, looking to provide an objective measure and quantifiable analysis.
- A constructivist approach is primarily qualitative, detailing contextual information.
- Transformative approaches also tend to employ qualitative methods, although mixed methods can also be used. Contextual information is described, particularly in relation to oppression that may be apparent.
- The pragmatic paradigm states that the methods used are specific to the research questions and purposes. The researcher can work between approaches depending on the requirements of the research questions and purposes.

3.3.4 Perspective of Current Research

In undertaking the present research, the researcher is working within the pragmatic paradigm. As such, it is the pragmatic paradigm which underpins the decisions made and which informs the methods used within the research. In essence, the pragmatic paradigm is open to a variety of methods as long as they have the potential to answer the research question. A mixed methods approach was therefore used to answer the research questions.

3.4 Mixed Methods Research

To summarise then, the research was guided by the pragmatic paradigm, with a mixed methods approach being taken.

Mixed methods research has been increasingly recognised as a valuable approach to research as it capitalises on the strengths of both qualitative and quantitative methods (Ostlund, Kidd, Wengstrom, & Rowa-Dewar, 2011; Fidel, 2008). Using a pragmatic paradigm, the focus of the researcher is on the research questions, discussions around the purity of the different methodological approaches are postponed (Fidel, 2008). It is recognised by the researcher using mixed methods, that phenomena are complex and multi-faceted, and that the use of one single approach may not address the situation completely (Fidel, 2008).

A pragmatic approach accepts that there are singular and multiple realities that are open to enquiry and that these are solved through a range of methods that focuses on the problem to be researched (Felizer, 2010). There is an acknowledgement when taking a pragmatist stance that there are unpredictable elements to research and that researchers are required to be open and flexible to unexpected data (Feilizer, 2010). Thus, pragmatism allows researchers to embrace complex situations through the use of methods that are suitable in answering 'what they want to know'.

3.5 Research Design

This research employed a series of case studies, each incorporating a single case experimental design (SCED). There were three case studies in total.

Case study methodology allows researchers to investigate a particular phenomenon whist retaining the holistic and meaningful characteristics of real-life events (Yin, 2003). A particular advantage identified by Yin (2003) is the case study's ability to deal with a range of evidence to help answer and inform the research question. Yin (2003) defined a case study as "an empirical inquiry that

- Investigates a contemporary phenomenon within its real-life context, especially when
- The boundaries between phenomenon and context are not clearly evident." (p.13)

Case studies are not limited to one type of approach but can be based on a mix of quantitative and qualitative evidence.

An embedded multiple-case design was used for this research, with a focus on three participants. A number of factors were analysed within the context of a precision teaching intervention and a 'structured approach'. Each case study incorporated both quantitative and qualitative methods.

A single case experimental design (SCED) was used within each case study. Typically SCED's involve collecting data from one participant and exploring the changes that occur in response to the manipulation of one or more variable through repeated measures over time (Barker, McCarthy, Jones and Moran, 2011). In SCED research a target variable is measured repeatedly, and prior to the experimental condition a baseline "established, so that trends and changes in the data can be examined as the treatment is introduced" (Barker, McCarthy, Jones and Moran, 2011, p.5). The participant is in effect their own control, with the researcher comparing changes between the different phases.

An A-B design was used in this research and is essentially a two-condition design: the first condition is described as the baseline phase and the second condition refers to the intervention phase. The researcher looks for a clear distinction in pattern of performance between the two phases. The use of a stable baseline phase is recommended to support the interpretation of data through comparison of phases, although in practice this is not always possible (Robson, 2002). Stable baselines are typically described as showing absence of variability or trend and are required to satisfy predictive functions of the research (Barlow, Nock, & Hersen, 2009).

3.5.1 Alternative SCED Designs

Alternative SCED designs that were considered include A-B-A, A-B-A-B, and multiple baseline designs. The A-B-A design includes a reversal phase where the researcher removes the intervention and looks to examine any shift back to baseline performance. A return to baseline performance allows the researcher to have greater confidence that any changes seen in the intervention phase were due to the intervention rather than extraneous variables. However, ethical considerations need to be taken into account regarding withdrawing a potentially effective intervention from a child.

The A-B-A-B design has a second intervention phase added which alleviates the potential ethical issues of finishing on a base-line phase. There can therefore be added confidence regarding the causal relationship between the intervention and outcome. However, this design still requires the intervention to be withdrawn, which could still pose ethical issues when an intervention is found to be effective.

Multiple baseline design is another alternative approach to single case designs. This involves the application of the intervention at different points of time to different baseline conditions. This may be across settings, behaviours, or participants. If there is a change in the phase when the intervention is implemented and no change in the other conditions at that time, the researcher can be more confident that the observed change is causally related to the treatment.

For the present research it was decided that an A-B design offered the most appropriate way forward, principally due to ethical considerations, though also due to time constraints. It was deemed by the researcher that withdrawal of an effective treatment would not be appropriate, particularly when some of the participants may find change particularly difficult due to their autism. The use of a multiple baseline was also not deemed feasible due to the intervention occurring in one class and difficulty applying it at different times for class staff. Also, time constraints meant that applying the intervention at different times was not practical.

3.5.2 Alternative Research Designs

A number of alternative research designs were considered in addition to SCED's. Randomised controlled trial (RCT) is considered the 'gold standard' in many fields of applied research (Robson, 2002). RCT's randomise participants to either an intervention or control group. RCT's assume that the participants are a homogenous group and can be compared through randomising the participants to different groups, subsequently comparing the data between them. However, due to children with autism being a heterogeneous population, it would be difficult to undertake comparisons, and the basic assumptions of the RCT design would not be met potentially producing invalid findings.

A matched pairs design was also considered. Matched pairs design match participants according to certain criteria, one participant is then randomly assigned to the intervention group and the other participant to a comparison group. The difficulty associated with this type of research design is the appropriate matching of participants. For the current research, the matching of participants was not deemed viable by the researcher, as children with autism have a diverse range of characteristics that would be difficult to match for an appropriate comparison of findings to be valid.

3.5.3 Rationale for Research Design

A case study approach, incorporating a single case experimental design (SCED) was used due to the heterogeneous characteristics of the participants to be studied in this project and the difficulty in adequately grouping together participants that are not comparable. Yin (2003) highlights this rationale for using single case methodology when the case represents a unique case such as a person with autism. Yin (2003) went on to describe the benefits of using a single case methodology when exploring a well-tested theory or intervention, and when the researcher is attempting to extend the theory or intervention. Using multiple single cases is considered more compelling and evidence more robust (Yin, 2003). Feuer, Towne and Shavelson (2002) state that the use of single-subject research methods within a traditional case study approach provides a greater level of experimental rigour that can be used to establish evidence-based practices. Using qualitative case study approaches can also enhance research as they allow the researcher to explore and describe a phenomenon in context and using a variety of sources (Baxter & Jack, 2008).

Reason and Morfidi (2001) highlight the potential use of a single case experimental design (SCED) as a sophisticated methodology for monitoring rates of progress in response to intervention whilst maintaining empirical control. It is difficult to generalise findings from SCED's, however SCED's can be more flexible and attend to individual experiences of the participant. As such they can be highly appropriate within an educational psychologist's practice, particularly in examining interventions and evaluating at the level of the individual.

3.6 Stakeholder Involvement

The research was planned with a number of stakeholders in mind. These included:

- The University of Nottingham.
- The Educational Psychology Service that provided the researcher's placement at the time of the study.
- The school in which the research took place.
- The researcher, a trainee educational psychologist and doctoral student.

3.7 Study Variables

For the experimental aspect of the research, the independent variable was the precision teaching intervention.

The dependent variables were:

- Participant's learning
- Participant's affect
- Participant's behaviour

3.8 Participants

3.8.1 Sampling Strategy

A purposive sampling strategy was applied to this research to ensure that the participants matched the specific needs of the project. This approach to sampling strategy was used as it fitted the research design and allowed the researcher to select participants from a particular population that matched the needs of the research question and rationale. The purpose of the research was not to make generalisations but to investigate the interaction between the instruction under investigation and the unique characteristics of the participants being studied.

The type of purposive sampling technique used was homogeneous sampling. This approach attempts to study a sample of participants who share similar characteristics or traits as required by the research question. This approach was used in this research as the questions are specific to a group of participants in a particular setting.

3.8.2 Population

The population from which the participants were drawn, were children who had a diagnosis of autism and who also attended a local primary special school where a 'structured approach' was utilised.

3.8.3 Sampling Frame

The researcher developed a number of inclusion criteria to ascertain whether a pupil was eligible for the study and to meet the needs of the research question.

The criteria for inclusion in the research included:

1. Diagnosis of Autism
2. Pupil attending a special school
3. Pupil attending a class that uses a 'structured approach'
4. Pupil to have expressive language skills

3.8.3 Rationale for Criteria 1, 2 and 3.

The purpose of the study was to investigate the implementation of precision teaching for a particular population, alongside a particular teaching approach. In this case, it was the use of precision teaching for children with autism, attending a special school that utilized a 'structured approach'. The justification for these criteria was discussed within Chapter 2.

3.8.4 Rationale for Criteria 4.

The precision teaching intervention focused on the development of the pupil's learning, in particular, their ability to read. Therefore, it was deemed necessary, to include only children who could demonstrate their ability to read through spoken language.

3.8.5 Selection of Participants

Participants were selected from one special school in the locality where the researcher was based on placement. Selecting all participants from this school made it more feasible to implement the intervention, take measures and support the school. It was also known that staff at the selected school had previously received a two-day training event on a 'structured approach', facilitated by educational psychologists within the local authority, and that they were now using this approach in their classes.

The participants were selected in consultation with school staff and in accordance with the selection criteria. Three pupils selected for the research were from the same class, which was felt to be advantageous by the researcher as it would be easier to monitor the influence of external variables. Also, it allowed the researcher to train a smaller number of staff whilst subsequently being able to spend more time supporting the intervention implementation. Using participants from one class also allowed the researcher and class staff to gain greater insight into the integration of precision teaching into a 'structured approach.'

The participants all had to meet the criteria as detailed previously. Further description of the chosen participants is provided in Chapter 4, with the pupils being allocated a letter to protect their identity and ensure confidentiality.

3.9 Ethical Considerations

The research adhered to a number of ethical guidelines and principles of various relevant professional bodies.

The British Psychological Society's (2004) general principles for standards in psychological research outline a number of key aspects that need to be considered when undertaking research:

- Ethical approval for research – ethical approval should be sought and gained for all research conducted.

- Protection of participants – researchers are obliged to protect their participants from any potential harm. The participants' dignity and rights should be protected, as well as their anonymity and confidentiality.
- Informed consent – consent should be obtained from the participant or their guardians prior to research commencing, ensuring that they have a full understanding of the research to be undertaken.
- No coercion – there should be no coercion in the recruitment of participants for research.
- The right to withdraw – participants have the right to withdraw from the research at any time for any reason. Their information will also be destroyed.
- Anonymity and confidentiality – participants must be assured that their information will remain confidential and their anonymity protected.
- Appropriate exclusion criteria – an exclusion criteria should be in place to protect the health and well-being of participants in the study.
- Monitoring – researchers should monitor participants regarding adverse effects on their health and well-being.
- Duty of care – there is a duty of care on researchers to change any adverse effects of the research that may occur.
- Additional safeguards for research with vulnerable populations – special safeguards need to be put into place when working with vulnerable populations such as children.
- Appropriate supervision – student investigators must be under the supervision of academic staff.

A supplement to the British Psychological Society's (2004) *Guidelines for Minimum Standards of Ethical Approval in Psychological Research* is the British Psychological Society's (2011) *Code of Human Research Ethics.* The principles outlined on these documents provide a basis for researchers to make reasoned judgments when undertaking research. The *Code of Human Research Ethics* (BPS, 2011) highlights four underlying principles:

- Respect for autonomy and dignity of persons
- Scientific value

- Social responsibility
- Maximising benefit and minimising harm

The British Psychological Society's (2009) *Code of Ethics and Conduct* also sets out a number of ethical principles to guide all psychologists' in their professional work. The four ethical principles are:

- Respect – valuing the dignity and worth of all people and mindful of the potential authority or influence over clients.
- Competence – to work within the boundaries of professional skill, experience and competence. To value continuing development and maintenance of high standards.
- Responsibility – to value the responsibilities to clients, general public, profession and science of Psychology, and the avoidance of harm and potential misuse of contributions to society.
- Integrity – to value honesty, accuracy, clarity, and fairness in interactions with all people.

This research adheres to the principles identified by the British Psychological Society (2004; 2011) as well as that of the host institution's own research and ethics guidance. The University of Nottingham's (2010) *Code of Research Ethics and Research Conduct* was abided by and approval was sought prior to the undertaking of the research and obtained from the University of Nottingham Ethics Committee (see appendix 2).

The research was undertaken with consideration to all the guidelines and principles detailed to ensure that decisions made had a sound ethical base.

Robson (2002) discusses the particular ethical issues when working with particularly vulnerable groups such as children. The population in which this research focused posed some particular difficulties in obtaining informed consent. Robson (2002) states that 'in the case of legally under-age children, and others who may not be in a position to appreciate what is involved, the parents or guardians should be asked for their consent' (p.70). However, Robson goes on to state that participants should be asked directly in addition to their parents or guardians, as they will be able to appreciate at least some part of what is involved. Written parental permission was sought and obtained for all participants involved in the research (see appendix 3). Prior to the research beginning, the researcher spoke to the whole class regarding the research project and what it would entail to help inform all the children of the purpose of the researcher's presence in their class, so as to reduce potential anxiety. The pupils selected to participate in the research were spoken to on an individual basis in the first meeting with the researcher. The researcher explained the research focus and what would happen on a weekly basis. They were advised that it was voluntary and that they could withdraw from the sessions if they wished. A staff member was also present to ensure that the pupils understood the information given. The researcher and class staff also liaised on a weekly basis to ensure that the pupil's were enjoying the sessions with the researcher and to discuss whether it was suitable for them to participate in the session that day. Written consent was not obtained from the participants as it was deemed that their understanding was not adequate to fully appreciate what they were signing.

All pupil information was anonymised to ensure confidentiality. Information pertaining to the participants was stored securely and in accordance with data protection requirements.

3.10 Measures

There were a number of measures chosen to address the research questions. These were implemented over three stages, as set out in Figure 3.1.

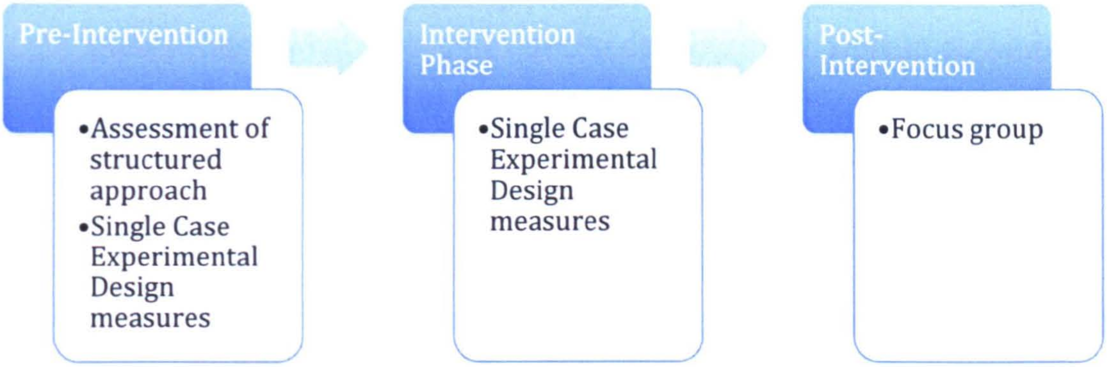


Figure 3.1 A figure showing the three stages of measures undertaken in this current research.

3.10.1 Identification of a 'Structured Approach' for Each Case Study

The classroom environment was assessed regarding its adherence to structured teaching as detailed in Chapter 2.

The 'structured approach' was defined according to the training delivered by Staffordshire County Council educational psychologists and through the Staffordshire County Council publication, *Support through Structure for Autism Spectrum Disorder (ASD)* (n.d.). At the outset of the research, the researcher sought to verify that the 'structured approach' in place was representative of a structured teaching approach more generally. This involved a classroom observation by the researcher and a questionnaire completed by the class teacher. The focus of this measure was on:

- Routines – clear routines and structures.
- Physical structure – the way that the physical environment is set up and organised.

- Schedules – visual cues to indicate what activities will occur and in what sequence.
- Work systems – work systems are a meaningful routine that allows a pupil to know what work they need to do, how much work to do, when the work is finished and what to do next.
- Visual structure – using visual cues to tell the pupil how to complete the task.

This measure allowed the researcher to assess and define the type of 'structured approach' that the intervention would be incorporated within. A description of the 'structured approach' employed for each participant will be detailed in Chapter 4.

3.10.2 Quantitative (Single Case Experimental Design)

The quantitative element of the research project, as discussed previously, focused on learning, affect, and behaviour.

3.9.2.1 Learning

Two variables were used to assess the impact of the literacy focused precision teaching programme on pupils' learning. Proxy measures were used to assess learning, focusing particularly on the participants' reading fluency.

Reading fluency can be measured by computing the number of words read correctly per minute, as described by Eckert, Ardoin, Daisey, and Scarola (2000). Reading fluency is suggested to be a meaningful measure for the construct of reading and a useful indicator of basic reading skills (Eckert, Ardoin, Daisey, and Scarola, 2000; Good and Jefferson, 1998). As part of this repeated measure, and in consultation with class staff, pupils were therefore required to read passages from their reading scheme book (Oxford Reading Tree) for one minute. The researcher was then able to calculate reading fluency by recording the number of words read correctly per minute.

Using reading scheme books to measure reading fluency also allowed the researcher to assess whether pupils were generalising the skills learnt from the precision teaching sessions.

Class staff regularly assess the pupils regarding the words that they are able to read and also have a good knowledge of their reading ability due to regular one to one reading sessions between staff and pupils. The specific assessment books were therefore chosen in consultation with class staff, so as to ensure the pupil was able to read the majority of the words in the book, whilst also ensuring that there was 'room' for the pupil to be able to demonstrate progress. When a child finished a chosen assessment reading book, another book was chosen and assessed using the Gunning fog index (1952) to ensure that the two books were comparable in terms of difficulty. The Gunning fog index (1952) provides an indication of reading difficulty and comparability of reading texts by using a calculation of sentence length and complex words used (see appendix 4).

Choosing a book from their reading scheme also meant that the children were familiar with the style of writing, and characters used in the books helping to reduce external variables that may affect their interaction with the text.

As a second measure of reading fluency, a probe sheet was also used to ascertain progress (see appendix 6). This was felt by the researcher to be a more sensitive than the passage word reading measure. Approximately 50% of the words on the probe sheet were words that the class teacher had assessed the pupil as being secure with. The remaining 50% were words that they would be 'working towards'. This limited the degree of challenge, and potential failure, in the measure while also providing 'scope for improvement'. The pupils' had a structured programme in place for learning words that systematically introduced new words when they had achieved a certain level of competency in reading and spelling of their current words. Essentially, the researcher used the words that the pupils were assessed as being secure in, and those that they would be moving on to, to ensure that they were motivated at attempting to read the words and not experiencing failure.

3.10.2.1.1 Reliability and Validity of the Learning Measures

The learning variable used proxy measures as an indication of learning outcomes. It is acknowledged by the researcher that this may not be representative of an overall learning concept and difficulties may arise when attempting to extrapolate to a more general concept. Qualitative methods were also used to triangulate the information regarding the intervention's effect on a pupil's learning.

The measures also attempt to ensure that the pupils' responses were representative of their ability through the careful selection of texts and words used. Pupils were provided with passages and individual words that were familiar but challenging, so as to not stifle their responding through a lack of motivation. This also limited any potential extraneous variables that may affect their interaction with the text.

3.10.2.2 Affect

An adaptation of the *Terrible-Delighted Scales* (Andrews & Withey, 1976 – accessed from Psychology in Education Portfolio, Frederickson and Cameron, 1999) was used to assess within-person change associated with the research project. This measure has a strong visual aspect to its presentation that was felt to be more beneficial for the pupils in the research study. The *Terrible-Delighted Scales* use a 7-point smiley face scale and was used to assess four aspects of the pupils' affect. The term 'affect' will be used to include measures of a pupil's self-concept as a learner. The evidence base for precision teaching highlighted the potentially positive impact on a pupil's self-concept as a learner (Roberts & Norwich, 2010). Therefore, the researcher felt that it would be a useful concept to investigate and it was decided to incorporate it within the affect measure due to its related concepts. The four aspects of affect explored were:

- Reading enjoyment
- Reading ability
- Enjoyment at learning new things
- Ability regarding learning new things

These four aspects were chosen to explore the intervention's initial aim of improved reading skills and whether this translated to the child's enjoyment of reading and their self-concept around proficiency in reading. The second two aspects looked to explore whether the intervention had wider reaching effects on a pupil's concept as a learner and explored a more general concept of learning.

This measure was developed in consultation with teaching staff to ensure the level of understanding of each pupil would be sufficient to appropriately respond to the question. The seven-point smiley face scale had a statement at each end of the scale (see appendix 7). For example:

'I enjoy reading' - 'I do not enjoy reading'

Each time this measure was taken, the statements and scale were explained, and the pupils were asked if they understood.

One pupil initially undertook the measure but it was deemed, in consultation with staff, that his understanding of the question or construct being measured was not sufficient to accurately give a true representation of his thoughts and feelings.

3.10.2.2.1 Reliability and Validity of the Affect Measures

The strengths to this type of measure are that they are quick to administer and easy to comprehend, particularly important when participants have special educational needs. It may be suggested that this measure oversimplifies a complex construct, however it is used here as a starting point to be enhanced with qualitative information. These measures are subjective and rely on the child having a reasonable understanding of the question and construct being assessed. It is acknowledged that the validity of the measure is reliant on the pupil's understanding

3.10.2.3 Behaviour

The *Interpersonal Competence Scale* (Cairns, Leung, Gest, & Cairns, 1995 - accessed from Psychology in Education Portfolio, Frederickson and Cameron, 1999) was used to assess the impact of precision teaching on the participants' behaviour (see appendix 8). This measure was completed by the same class staff member on a weekly basis, focusing on the pupil's behaviour over the past week. The measure is described as a profile of social accomplishment and emotional presentation rather than an in-depth assessment of social skills or emotional difficulties. It is used within this research project as a broad measure to assess the child's behaviour in a number of different aspects. The scale consists of 18 items, with the person completing asked to tick a box on a seven-point bi-polar scale for each attribute. The scale covers a number of areas that can be isolated and examined to provide potentially useful information regarding a pupil's competence in that area or as a whole. There are six subscales:

- Peer social acceptance – assessing the pupil's popularity among their peers and whether they have a large number of friends.
- Aggressive patterns – assessment of argumentativeness, readiness to fight and difficulties follow rules.
- Academic performance – perceived competence for maths and spelling.
- Affiliative tendencies – a measure of a pupil's outgoingness and confidence to approach others or to be relaxed in the company of others.

- Status with respect to socially admired characteristics of children – assessment of characteristics that are likely to draw the admiration of others. E.g. success in sport, physical appearance.
- Internalising – assessing the inclination of a pupil to worry or to be unhappy.

The six subscale scores combine to provide an indication of the pupil's social competence.

3.10.2.3.1 Reliability and Validity of the Behaviour Measure

The *Interpersonal Competence Scale* test-retest reliability was deemed to be good (Cairns *et al.* 1995) and provided a useful repeatable measure to be used. The researcher felt the questionnaire was a reliable measure of behaviour as it provided a broad sweep of observations whilst covering positive, as well as negative attributes. As the measure represented a broader theme of 'behaviour', there were potential limitations regarding its application to the overarching concept. However, the researcher felt that the questions focused on a broad range of behaviours that would give a useful indication of any potential change as a result of the intervention.

The measure was undertaken by class staff and prone to potential bias. However, class staff worked closely with the participants and were deemed, by the researcher, to have a good knowledge of their behaviour. Despite the potential limitation of bias, the researcher felt that people undertaking the measure who knew the participants well would provide more valid data.

3.10.3 Qualitative Research Methods

3.10.3.1 Focus Group

Qualitative data was deemed important by the researcher in answering the research questions due to the varied presentation of children with autism, and the myriad ways of undertaking and responding to tasks that may not be captured in the quantitative data. The information was deemed to enhance the quantitative measures by drawing out pertinent information through exploring the perceptions of staff members in relation to the precision teaching intervention .

Focus groups are broadly defined as a research technique that obtains data through group interaction on a topic determined by the researcher (Morgan, 1997). Alternative approaches for qualitative data gathering include the use of observation and interview (Morgan, 1997). The use of a focus group was chosen in preference to the alternative methods as they act as a compromise between the strengths of observations and interviews. Focus groups allow perspectives and experiences to be revealed that may not be as accessible without the group interaction (Litosseliti, 2003; Morgan, 1997). The dynamic nature of focus group interactions allow participants' beliefs, attitudes, experiences and feelings to be revealed (Litosseliti, 2003; Morgan, 1997).

The focus group consisted of three staff members that worked in the class where the participants were located. The three staff members consisted of one class teacher and two teaching assistants. All staff members had received the training in precision teaching from the researcher. The precision teaching sessions were undertaken by teaching assistants, but there was regular discussion with the class teacher regarding the progress of the pupils.

The focus group topic was directed by the researcher and focused initially on the intervention in general, and then narrowed down in focus to the individual participants. The focus group were initially asked to discuss the precision teaching intervention, outlining their thoughts and reflections on its incorporation into their current teaching approach. Subsequently, they were directed by the researcher to focus on the impact on the individual participants.

The researcher drew key elements together from the focus group and reflected back the main themes that were emerging to check for validation from the group. Morgan (1997) highlights that what participants think is important in their discussion, and should be built into the data collection itself and not left to the researcher's post-hoc analysis. Therefore, the approach taken by the researcher allowed for the focus group participants to confirm or reject the emergent themes reflected back to them and consequently produce data that was representative of the discussion and the participants' views. The data was separated into general views on precision teaching and its incorporation into their 'structured approach' to teaching, and data on the impact of precision teaching on the individual pupils.

3.11 Procedure

The pre-intervention phase of the research project ascertained the features of a 'structured approach' for each participant. As previously stated, this was undertaken via a researcher observation and through teacher questionnaire. The pre-intervention phase also involved the undertaking of baseline data for the SCED phase of the research as described in the measures. Baseline data was taken prior to the intervention being implemented and training of staff. All class pupils were informed of the research project prior to any measures being taken. The researcher spoke to the class about the research aim and that some pupils would be asked to take part in the project. The initial explanation of the project to the class aimed to inform the students regarding the project and also to help reduce any anxiety that may occur if asked to participate.

Participants were chosen in collaboration with the school staff. Parental consent was obtained prior to any measures being taken. When parental consent was obtained the researcher began baseline measures. The initial session with the pupils was held with a teaching assistant present. The research project's aims were discussed again and the pupil was informed that they were able to decline to participate in a session or the project if they wished. The teaching assistant was present to help ensure that the pupil understood the information regarding the research, and that they understood the questions asked within the measures. Class staff were consulted prior to each data gathering session being undertaken to ensure that it remained appropriate for pupils to take part, and that the sessions did not appear detrimental to the pupils.

The data gathering sessions usually involved the pupil working one to one with the researcher in a quiet area. Sessions generally took place on the same day each week. Each session started with the researcher reinforcing what would happen in the session and checking for understanding from the pupil. The individual word reading measure was undertaken first with the pupil being prompted to try and be both accurate and fluent. The pupil was then asked to read from the chosen reading book, starting at the point that they had previously reached. Again, it was reinforced that they should be accurate and fluent. The final measure undertaken in the session involved the 7-point rating scale. Pupils' were asked to take their time and think about where they thought they were on the scale in relation to the statements. In addition to the measures undertaken with the researcher, class staff were also asked to fill in the *interpersonal social competence* checklist on a weekly basis. These measures occurred throughout both the pre-intervention and intervention phases.

Staff were trained in precision teaching at the end of the pre-intervention phase. This training was provided by the researcher and consisted of a two hour training session using precision teaching materials adapted from Raybould (2003) (see appendix 5). Staff were provided with information and materials required to set up a precision teaching programme for their pupils. The training incorporated activities for staff to undertake and practice the precision teaching procedures and to problem solve any difficulties or questions that they experienced. Staff were aware of the children that would be receiving the precision teaching intervention and were able to discuss the application of it with the specific child. Staff were supported by the researcher on weekly school visits. These visits allowed any difficulties in setting up precision teaching to be resolved and to ensure the intervention delivery was consistent with the training received. The follow up visits were an important aspect of the researcher's role due to initial inconsistent implementation of the precision teaching intervention. An additional training session was required for staff to ensure that the precision teaching intervention was implemented in a manner consistent with the training.

It is acknowledged by the researcher that the initial training may not have been adequate in providing the staff with the sufficient knowledge and skills to implement the intervention effectively. Staff may have benefitted from receiving a training session in greater length to explore the theoretical and practical issues associated with the training. The follow up support visits aided this to an extent but the clarity of the information in the training session may also require refinement.

The pre-intervention phase was initially planned to last until the baseline data presented as stable. However, due to time constraints an entirely stable baseline was not possible for all of the measures and will be discussed in Chapter 4.

The intervention phase of the research involved the implementation of the precision teaching intervention on a daily basis. The researcher's data gathering sessions continued throughout the intervention phase. The post-intervention phase focused on providing further qualitative information for the case studies. This was through the process of a focus group with the class staff, facilitated by the researcher.

The focus group consisted of two, one hour sessions with staff members that worked in the class where the precision teaching intervention was implemented. The researcher facilitated the focus group to ensure that all members of the group were able to express their thoughts and feelings on the subject matter. Staff were given the topic to discuss by the researcher and subsequent input from the researcher was minimal. The researcher occasionally interjected in the discussion to clarify points and to summarise information. The focus group was initially asked to discuss their views on precision teaching within their classroom setting. The topic was left relatively broad to allow staff the opportunity to discuss aspects of precision teaching and its application within their classroom that they felt was relevant and not influenced by the researcher. The focus group was additionally asked to discuss the use of precision teaching in relation to each targeted pupil. The process used for the focus group was deemed advantageous as it allowed information to be gleaned from the group that may not have surfaced with a more structured, researcher led approach to the discussion. The researcher was also aware of group dynamics and potential issues, attempting to negate these through careful interjection and awareness of group processes. Throughout the focus group session, the researcher recorded the main themes that emerged (as detailed in 3.10.3.1).

3.12 Treatment Integrity Measures

The researcher met with the class staff once a week during the research period. These meetings held two purposes: to provide support regarding any difficulties arising from implementing the intervention; and secondly to ensure that the intervention was being implemented in a manner consistent with the training received. The targets for the pupils were discussed and the Standard Celeration Chart was examined. The researcher also undertook observations of the intervention in practice to assess the integrity of the sessions being conducted.

It became apparent to the researcher during initial school visits that the intervention was in fact, not initially being implemented in a manner consistent with the training received. The intervention sessions were not being held regularly and the targets were not being monitored sufficiently to ensure that they were specific for the child. Therefore an additional training session occurred in October 2012, midway through the experimental phase, to ensure a greater concordance with the training received.

3.13 Reliability and Validity Issues within the Current Research Study

There were a number of considerations within this research study concerning issues of reliability and validity. The following section will explore some of these issues and how the researcher attempted to address them.

3.13.1 Reliability

Reliability within a research project is concerned with a measure that is stable and consistent over time (Mitchell & Jolley, 2010). The less reliable a measure is the more random error a measure contains (Mitchell & Jolley, 2010), with an increased potential for the outcomes to be related to a variable other than the independent variable.

The research project aimed to address the issues of reliability through different methods depending on the measure. Where staff members completed the measure they were advised to complete it on the same day and in the same manner every time. The SCED measures were to be conducted on the same day, at the same time each week to minimise random error.

3.13.2 Validity

Validity refers to the accuracy of the findings and whether they represent what they are meant to capture. There are a number of threats to validity and key threats that may have had an impact on the findings produced discussed below.

'History effects' refers to aspects in a participant's environment that may have changed, other than those forming a part of the research project, which may affect the findings. 'Maturation effects' refers to growth, change or development in the participant, unrelated to the research project. These issues are particularly pertinent in SCED methodology as the participant, is in essence, their own 'control'. Therefore, a stable baseline is required to provide a greater degree of confidence that any experimental phase changes are as a result of the intervention. A stable baseline ensures that the participant's responding is consistent, and predictions can be made regarding the pattern of responding from which to compare the experimental phase. The addition of qualitative information that staff were able to provide through the focus group also helps to identify any potential history effects that may threaten the validity of the study.

Testing effects are a particular issue with repeated measures. However, the researcher deemed that the use of measures on a weekly basis allowed for adequate time to reduce some of these concerns. Furthermore, the researcher did not provide any teaching or instruction during these weekly measure sessions, thus aiming to minimise any testing effects. Staff were asked to undertake weekly questionnaires relating to the participants' behaviour, focusing on the participants' behaviour for the previous week.

The use of qualitative measures also brought with it issues regarding reliability and validity. Three key threats to validity identified are description, interpretation, and theory (Robson, 2002). Description relates to providing a valid description of the data obtained. Interpretation relates to imposing a particular meaning to data rather than what emerges during the researcher's involvement. Theory relates to not considering alternative explanations or theories that may justify the data obtained. The researcher chose to address these issues through obtaining information from a variety of methods so as to triangulate the data. Information obtained through qualitative means were 'reflected back' to those who provided it to ensure that the researcher's interpretation was accurate. Other issues that may also have been a threat to validity relate to researcher and respondent biases. During the qualitative aspects of the research, the researcher carefully selected key areas to prompt the staff members to ensure that the discussion focused on the research question. The use of a focus group meant that the group would engage with each other to discuss the issues that were most pertinent to them. The researcher acted as a facilitator of this group, providing a structure to the discussions. It is acknowledged that the respondents may have felt a need to respond in a certain way that was favourable to the researcher. The researcher tried to minimise these issues through clearly describing the purpose of the focus group and to illicit views and information that were based on their own thoughts, feelings, and experiences.

3.14 Data Analysis

3.14.1 Single Case Experimental Design Data Analysis

Visual analysis is the method of analysis that is most widely used in single case experimental designs and that is widely promoted in the literature for single case designs (Huitema, 2011; Matyas & Greenwood, 1990). Statistical tests are becoming more prominent in single case analysis but are not the normal method of analysis where single case designs are used (Huitema, 2011; Kazdin, 2003). Non-statistical methods of data collection usually refer to the visual inspection of data (Kazdin, 2003). The use of statistical testing for single case designs has been increasing over the past two decades and it has been recommended as a supplement to visual analysis (Brossart, Parker, Olson, & Mahadevan, 2006; Harbst, Ottenbacher, Harris, 1991).

3.14.1.1 Visual Analysis of Single Case Designs

The analysis of data *non-statistically* has the same objective as analysing it *statistically*, i.e. to identify if the effects seen are consistent, reliable and unlikely to have occurred from extraneous variables (Kazdin, 2003). The use of visual analysis of single case data is based on subjective judgement (Kazdin, 2003) and therefore prone to bias, however, visual analysis is argued to yield lower error rates, and judgements of identifying effects is suggested to be conservative (Brossart, Parker, Olson, & Mahadevan, 2006). Judgements are suggested to be conservative as only large effects are likely to be recognised (Brossart, Parker, Olson, & Mahadevan, 2006). In contrast, Matyas & Greenwood's (1990) study found visual analysts were not conservative in their judgements, with false alarm rates being found to be relatively high.

It is argued that the identification of a weak treatment effect is less likely to occur through the use of visual analysis (Baer, 1977). Therefore, the use of visual analysis ensures that only large treatment effects with obvious significance will be identified. Baer (1977) argues that visual analysis reduces the probability of Type 1 errors below that of 0.05% as used in statistical testing. Conversely, reducing the probability of Type 1 errors increases the probability of Type 2 errors. Subsequently, single case design researchers 'learn about fewer variables, but these variables are typically more powerful, general, dependable, and – very important – sometimes actionable' (Baer, 1977, p.171).

Visual analysis of single case designs involves the systematic examination of data within and between conditions through changes in level, trend, and variability of performance (Horner, Carr, Halle, McGee, Odom, & Wolery, 2005). Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf, and Shadish (2010) propose a number of steps to visual analysis. The first step in visual analysis is to ensure that the initial baseline phase shows a pattern that has a sufficient consistent level and variability to allow a comparison with the intervention phase. The second step involves assessing the data within each phase to ensure that the data is consistent and able to demonstrate a predictable pattern. The third step is to compare the data from each adjacent phase to assess if the introduction of the intervention was associated with an effect seen. Kratochwill *et al.* (2010) propose six features to examine within and between data patterns. These are highlighted in the table below:

Feature	Definition
Level	Mean score for the data within a phase
Trend	Slope of the best fitting straight line for the data within a phase
Variability	The range of data about the best fitting line
Immediacy of effect	The change in level between the last three data points in one phase and the first three data points of the next.
Overlap	The proportion of data from one phase that overlaps with data from the previous phase.

Consistency of data patterns across similar phases	The consistency of data within the same condition.

Table 3.1 A table showing the features for visual analysis of SCED graphs – adapted from Kratochwill *et al.* (2010).

3.14.1.2 Statistical Analysis of Single Case Experimental Designs

Many statistical analyses have been proposed for use with single case research, however there is no clear statistical approach that is popular in the disciplines that use single case designs (Huitema, 2009). Several types of statistical analyses for single case designs include multilevel models, advanced regression models, and simpler non-parametric models (Parker, Vannest, & Davis, 2011).

Huitema (2011) provides three justifications for the use of statistical analysis of single case designs. These include:

- Appropriate analyses have high creditability among the scientific community.
- Many granting agencies and journals require statistical analysis.
- Single case studies that do not report effect sizes are likely to be ignored by meta-analyses.

The use of statistical tests can be problematic for single case designs due to the problem of serial dependence and autocorrelation. Serial dependence is present when data can be predicted due to its own values or from the passage of time (Matyas and Greenwood, 1996). Serial dependence is examined through the presence of autocorrelation. Difficulties with autocorrelation are the potential to increase Type 1 errors (Brossart, Parker, Olson, & Mehadevan, 2006). Brossart, Parker, Olson and Mahadevan (2006) state that the most highly recommended method of removing autocorrelations from time series data is the Autoregressive Integrated Moving Average (ARIMA) modelling. However, a regularly cited limitation of this approach is the relatively large data points recommended (Brossart, Parker, Olson, & Mehadevan, 2006).

The majority of statistical methods for single case designs incorporate a regression based approach to analysing the data (Brossart, Parker, Olson, Mehadevan, 2006). Research into these types of approaches has shown little relationship with visual analysis (Brossart, Parker, Olsen, & Mahadevan, 2006). Faith, Allison, and Gorman (1996) state that regression techniques are the best available approach for single case data but there is no 'gold standard' yet. Other methods of statistical analysis measure the percentage of non-overlapping data and standardised mean differences. 'Percentage of non-overlapping data' analyses the number of data points in phase B (intervention phase) that exceed the most extreme data point in phase A (baseline phase). This approach was affected by trend and ceiling effects and it was suggested by some authors that a visual inspection of data was required prior to the statistical procedure (Nourbakhsh & Ottenbacher, 1994). The standardised mean difference methods explore the means of two samples, baseline and intervention, converting to a standard deviation value. Depending on the assumptions of the data this can be calculated in a few ways. The standardised mean difference methods were suggested to be better at differentiating between effective and non-effective interventions than regression techniques but can be affected by general trend in the data (Manolov & Solanas, 2008).

The use of statistical analysis on A-B designs may not be appropriate due to the limitations of the research design. Barlow, Nock and Hersen (2009) describe the use of an A-B design as quasi-experimental due to the difficulty in applying a statement of causality which cannot be made with an A-B design due to internal and external validity issues, and therefore does not require a full experimental analysis. The current research employs an A-B design and may therefore not be appropriate for statistical testing.

3.14.1.3 Single Case Experimental Design Analysis Used in the Current Research

The use of visual analysis with single case designs is well documented in the literature (Horner *et al.*, 2005). Statistical tests have been recommended to support visual analysis due to the reasons identified in the previous section. However, investigators such as Baer (1977) state that the use of statistical tests are harmful to the development of knowledge in a clinically based discipline as it produces confusion between clinical and statistical significance.

The current research will use a visual analysis approach to analysing the single case experimental design data due to visual analysis being the most prevalent method of analysis for this experimental design. Visual analysis' limitation of Type 1 errors was deemed advantageous and the acknowledgement in the literature that there is not currently a 'gold standard' in statistical testing was also deemed relevant. Also, there are still questions regarding the use of statistical tests with single case designs due to their limited use, in particular when to use a particular statistical technique and the equivalence of different techniques.

3.14.2 Data Analysis – Thematic Analysis

The focus group data was analysed using a thematic analysis approach. Thematic analysis is a process of encoding qualitative data through the use of explicit codes (Boyatzis, 1998). It allows researchers to work though the information systematically and increases their sensitivity in understanding the data (Boyatzis, 1998). Braun and Clarke (2006) state that thematic analysis is a flexible and useful tool that can provide a rich and detailed account of the data, as well as highlighting the complexities. They also highlight that thematic analysis, unlike alternative approaches such as interpretative phenomenological analysis (IPA), conversation analysis (CA) or discourse analysis (DA), can be applied across a range of approaches as it is essentially independent of theory and epistemology. The use of thematic analysis was chosen as it allowed the researcher a method from which to analyse the qualitative data that wasn't constrained by theory or epistemology. It also had the added benefit of being accessible for those new to this type of analysis (Braun & Clarke, 2006).

The procedures outlined in Braun and Clarke's (2006) paper were followed in undertaking the analysis. As discussed previously, the data was truncated by the researcher who reflected back the themes that appeared to be emerging whilst facilitating the focus group. Braun and Clarke (2006) detail six phases of thematic analysis as shown in Table 3.2. These procedures were followed by the researcher when analyzing the focus group data (see appendix).

Phase	Description of Process
1. Familiarising yourself with the data.	Reading data and noting down initial ideas. *Throughout the focus group discussion the researcher summarized and noted down the main areas of discussion that were developing. The discussion data was truncated into 'chunks' of data by the researcher. (See appendix 13 for raw data 'chunks').*
2. Generating initial codes	Coding interesting features of the data in a systematic fashion. *The researcher reflected back key features of the discussion to ensure that the most pertinent points were emerging and being recorded accurately. Focus group participants had the opportunity to validate, reject or add further thoughts. (See appendix 13 for raw data 'chunks').*
3. Searching for themes	Collating data into potential themes and gathering data for each potential theme. *The 'chunks' of data from the focus group were reviewed by the researcher with potential themes sought. Notes were made by the researcher next to different data*

	'chunks' regarding potential themes. These were coded using numbers and a list made of themes emerging. It should be noted that the themes emerging were potentially classified against more than one data 'chunk'. This process was repeated more than once to ensure that a full exploration of the data was undertaken, and a wide range of potential themes were considered and noted. (Please refer to appendix 9 for example data of this process)
4. Reviewing themes	Checking if the themes work in relation to the coded extracts and generating a thematic 'map' of the analysis. *The researcher went through the emerging themes and extracts to check for their validity. Relationships between themes were considered and groupings made according to the researchers interpretation and knowledge of the raw data. The themes were grouped together in a 'thematic map'. Initial 'thematic maps' were identified by the researcher according to the formulated relationships between the themes, and initial theme names were identified. (Please refer to appendix 9 for example data of this process)*
5.Defining and naming themes	Ongoing analysis to define the specifics of each theme. Generating clear definitions and names for each theme. *The researcher continued to review the themes and extracts, ensuring that they worked with the data set. The initial 'thematic maps' were analysed thoroughly through the review of themes and data extracts. Refined 'thematic maps' were generated as the maps evolved. Overarching themes were identified and named. The researcher*

	continued to ensure that themes were representative of the raw data through regular review and reflection of the emergent themes and raw data. The overarching themes were the resultant final 'thematic maps' identified through this process. (Please refer to appendix 9 for example data of this process)
6. Producing the report	Final opportunity for analysis. Selecting vivid and compelling extract examples for the themes generated. *The final themes were checked to ensure they represented the data. Key extracts were selected to illustrate the themes and to provide compelling extract examples of the generated themes. (Please refer to Chapter 4)*

Table 3.2 A table showing the phases of thematic analysis with the researcher's actions – adapted from Braun and Clarke (2006).

3.14.3 Interrater Reliability

The quantitative and qualitative data analysis within the research project was prone to subjective biases. Therefore, checks were completed to explore the interrater reliability for the single case experimental design visual analysis and the focus group thematic analysis.

3.14.3.1 Single Case Experimental Design Analysis Interrater Reliability

In an attempt to try and reduce the subjective bias in visual analysis of the single case experimental design graphs, the researcher employed a technique to obtain a level of interrater agreement between two analysts. The researcher and a fellow trainee educational psychologist, familiar with visual analyses of single case experimental design graphs, examined the graphs and rated them on a scale of 1-10 (1 = strongly disagree; 10 = strongly agree) to the following statements;

'*There is a significant change in performance when the precision teaching intervention is introduced*'

'*There is a significant change in performance when the precision teaching intervention is implemented consistently*'

The first question applied to the A-B design graphs and the second question applied to the A-B1-B2 graphs.

The researcher and fellow trainee educational psychologist completed this task for each measure within the single case experimental design. Both had access to the graphs that explored mean, trend, variability, and overlap, to support their analysis.

The findings were then analysed according to Barlow, Nock and Herson's (2009) description of inter-observer agreement (IOA). Barlow, Nock and Herson (2009) state that although there is no definitive agreement on the level of IOA required, an IOA of 80% or higher is conventional and 90% is preferred. High IOA's allow for greater confidence in the inferences made of data analysed. IOA was calculated in this research by dividing the smaller rating by the larger rating and multiplying the result by 100.

3.14.3.2 Thematic Analysis Interrater Reliability

To ensure that the themes identified from the thematic analysis were valid and reliable the researcher sought to examine the interrater reliability of the themes. A fellow trainee educational psychologist, familiar with thematic analysis, was approached to examine the codes and themes identified. The trainee educational psychologist was given the coded extracts and asked to place them under one of the themes that had been identified by the researcher. The researcher then calculated the percentage of coded data that corresponded to the researcher's analysis. Joffe (2011) states that a high level of concordance between coders provides a rigorous and transparent analysis of data. A concordance above 75% is considered to be a reliable coding frame.

3.15 Overview of Research Process

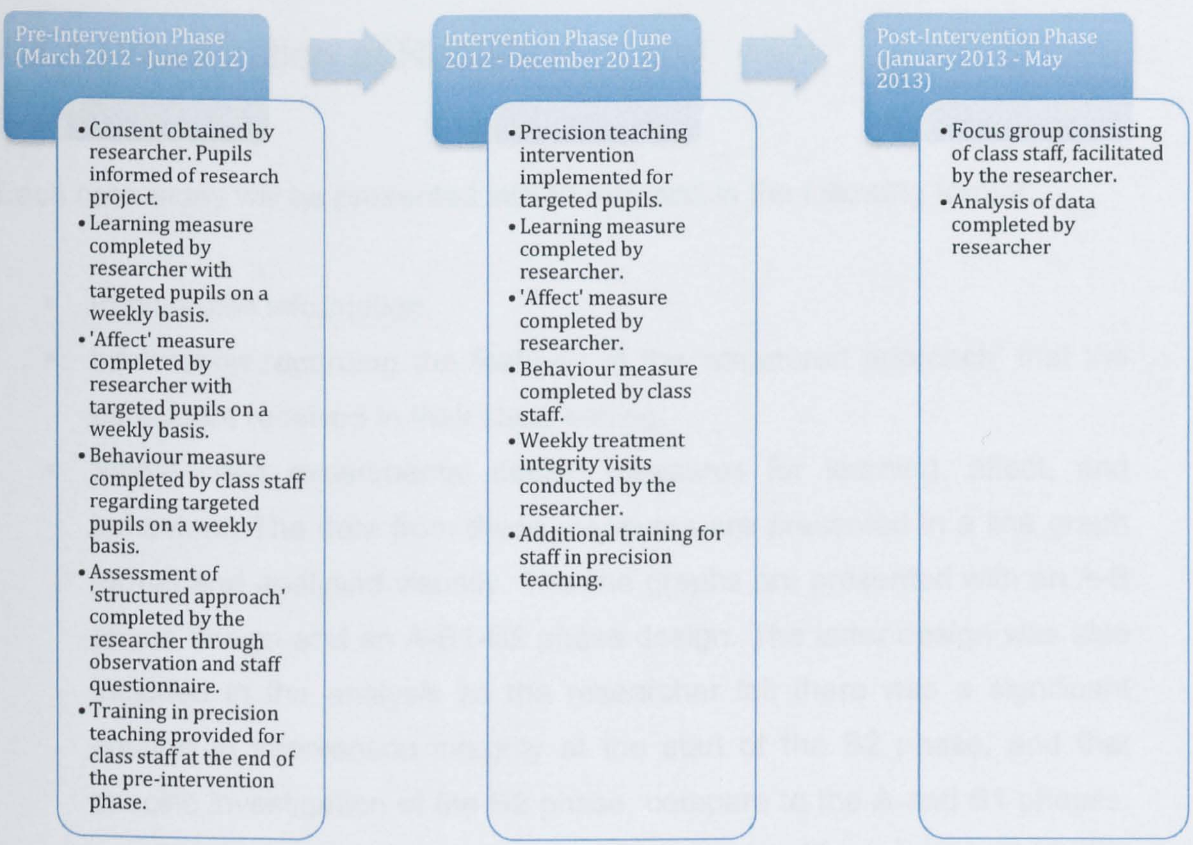


Figure 3.2 Figure showing an overview of the research process.

Chapter 4: Results

4.1 Introduction

The results chapter will present data relating to three case studies. Data for each of the case studies will be analysed to explore intervention effects (see appendix 10,11, & 12 for the SCED raw data).

4.1.1 Presentation of Results

Each case study will be presented individually and in the following format:

- Pupil profile information.
- Information regarding the features of the 'structured approach' that the participant received in their class setting.
- Single case experimental design measures for learning, affect, and behaviour. The data from these measures are presented in a line graph format and analysed visually. The line graphs are presented with an A-B phase design and an A-B1-B2 phase design. The latter design was also included in the analysis as the researcher felt there was a significant change in intervention integrity at the start of the B2 phase, and that specific investigation of the B2 phase, compare to the A and B1 phases, could therefore prove to be important. It should also be noted that measures were taken across the summer holiday period, this being denoted with a dashed line. Also, the *affect* measures present positive outcomes with a falling slope from left to right, in contrast to the other measure's graphs.
- Thematic analysis of focus group discussion for each participant.

4.2. Case Study 1

4.2.1 Child A Profile

Sex: Male Age: 9.9 years (at onset of the research)

Child A has a diagnosis of autism. Child A is reported to have difficulty with his social skills and social interaction, displaying challenging behaviour such as tantrums when he meets with problems or when he does not get his own way. Child A occasionally challenged the authority of adults in school and sometimes experiences difficulties accepting behavioural expectations. Child A also has language and communication difficulties, with immature speech and receptive language difficulties. Child A is able to understand visually presented information easier than verbally presented information. Child A's academic skills in all areas of the curriculum are behind that expected for his age. He currently attends a primary special school that caters for pupils with a wide range of learning difficulties.

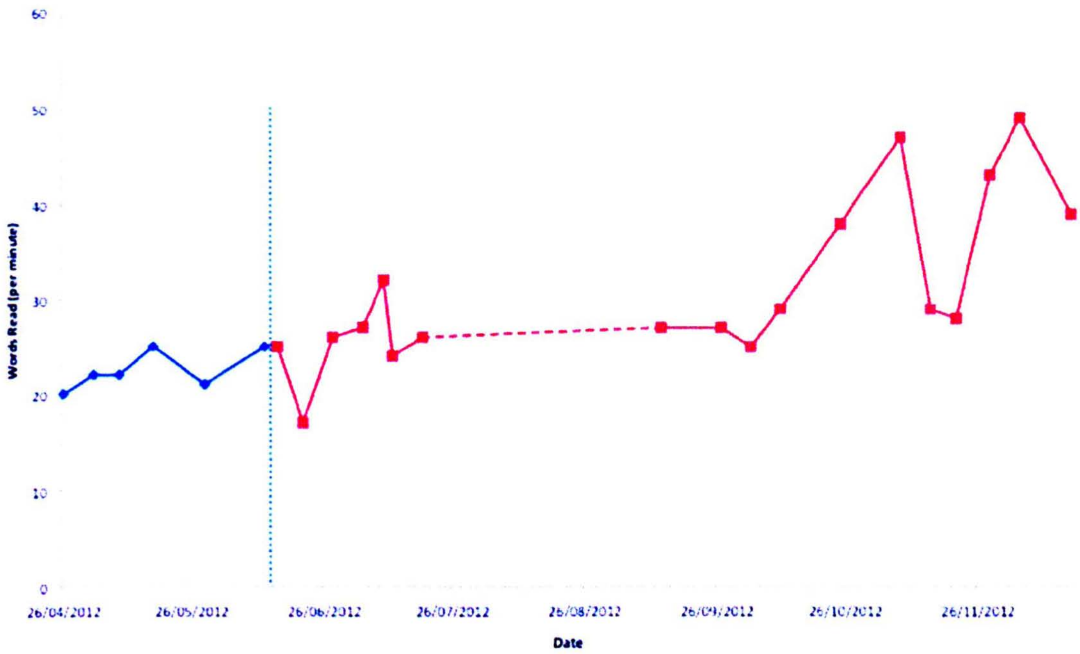
4.2.2. Assessment of a 'Structured Approach' to Learning (Child A)

Structured Teaching		
Structured Environment	Routines	Activities in class are kept as consistent as possible. There are routines for transitioning between activities and within activities.
	Physical structure	Child A has a particular seat that he sits on when in class. He sits on a table with other pupils for the majority of the activities that he undertakes. The classroom is arranged to ensure clear physical and visual boundaries.
	Visual schedules and timetables	There is a class visual timetable that is referred to at the start of the day and throughout the day. Child A does not have an individual timetable as it is deemed by class staff that he is able to follow the class timetable.
	Work systems	Child A does not have an individual work system to complete class work. Child A is able to undertake class work in a small group setting without the need for additional supports such as work systems.
	Visual structure	Key concepts are presented visually by the class teacher. Child A has some tasks presented visually but also has tasks presented verbally. Instructions are presented with visual clarity, e.g. left to right. The classroom has visual labels for classroom objects. Class rules are also presented visually, along with reward and sanction systems.
Curriculum	Differentiated	Class work is differentiated to meet the learning needs of the child. Pupils undertake structured assessments to ensure appropriate differentiation.
Behaviour Approaches	There are a number of systems in place to manage behaviour. There is a visual points system for good work and following rules. There is a tick board for good behaviour. Also, there is a separate behaviour chart presented visually in a hierarchical fashion for undesirable behaviour. Pupils are also able to express their feelings and place their names on a visual feelings thermometer. Staff try to maintain a calm environment, and behaviour difficulties are dealt with by a calm but assertive approach. Pupils are also able to access a time-out space when they have become distressed. Child A can display behaviour difficulties when there are unpredictable events, the above strategies are used to manage his behaviour.	

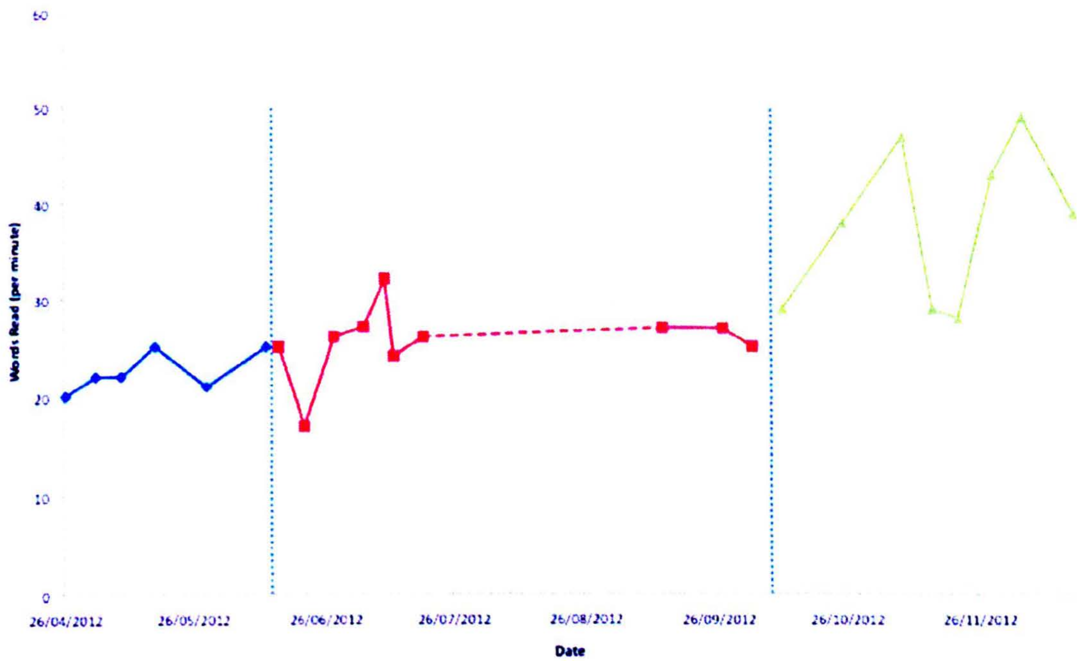
Table 4.1. A table showing the features of a 'structured approach' for Child A.

4.2.3. Single Case Experimental Design – Learning

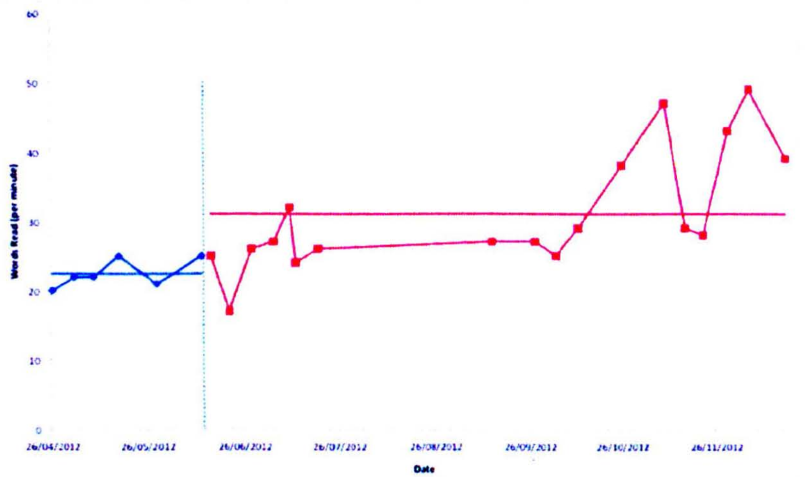
4.2.3.1 Number of Individual Words Read (per minute) (Child A)



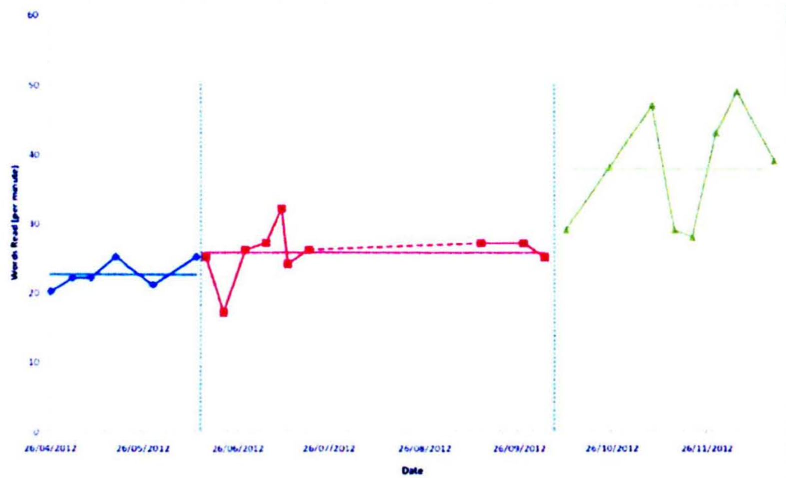
Graph 4.1 A line graph showing the number of individual words read (per minute) across A and B phases (Child A).



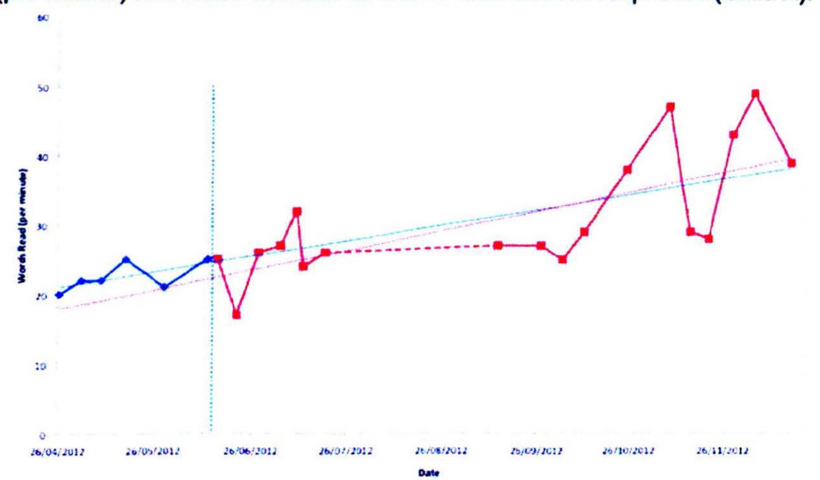
Graph 4.2 A line graph showing the number of individual words read (per minute) across A, B1, and B2 phases (Child A).



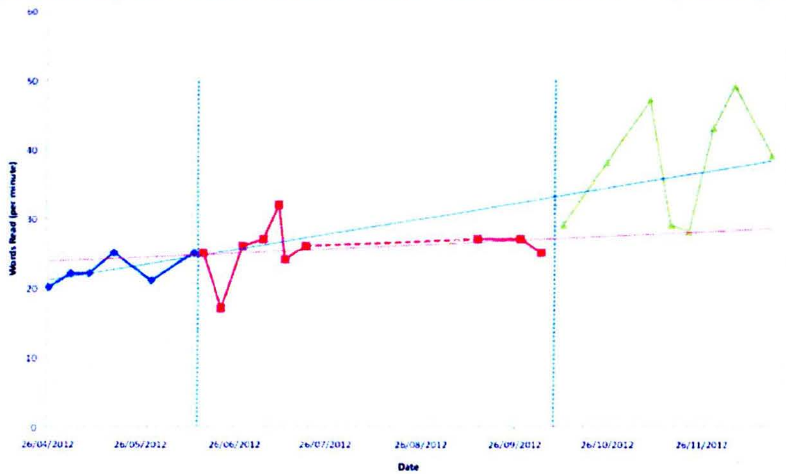
Graph 4.3 A line graph showing the number of individual words read (per minute) and **mean number of words** read across A-B phases (Child A).



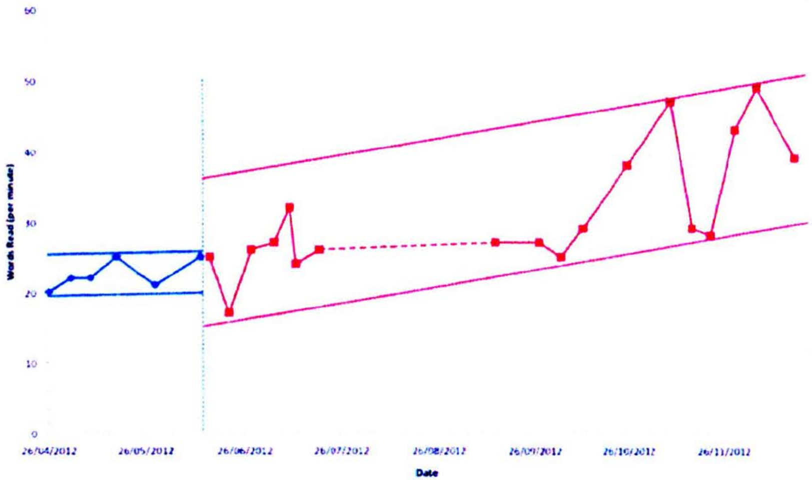
Graph 4.4 A line graph showing the number of individual words read (per minute) and **mean number of words read** across A-B1-B2 phases (Child A).



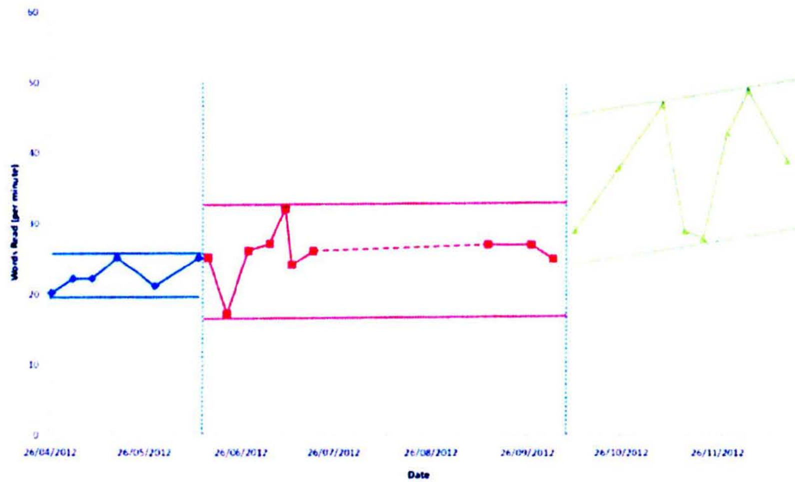
Graph 4.5 A line graph showing the number of individual words read (per minute) with **trend lines** across A-B phases (Child A).



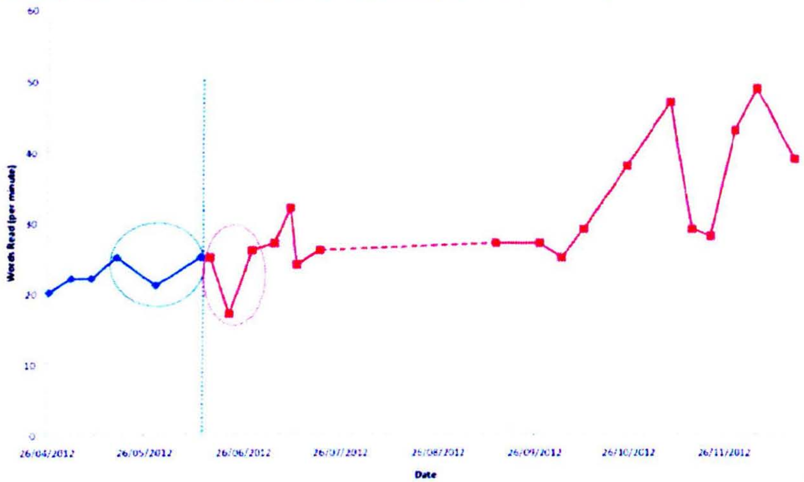
Graph 4.6 A line graph showing the number of individual words read (per minute) with **trend lines** across A-B1-B2 phases (Child A).



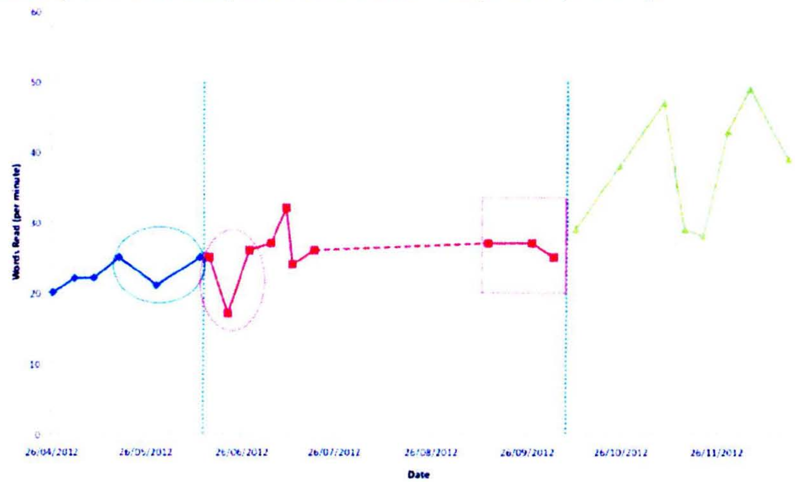
Graph 4.7 A line graph showing the number of individual words read (per minute) with **variability lines** across A-B phases (Child A).



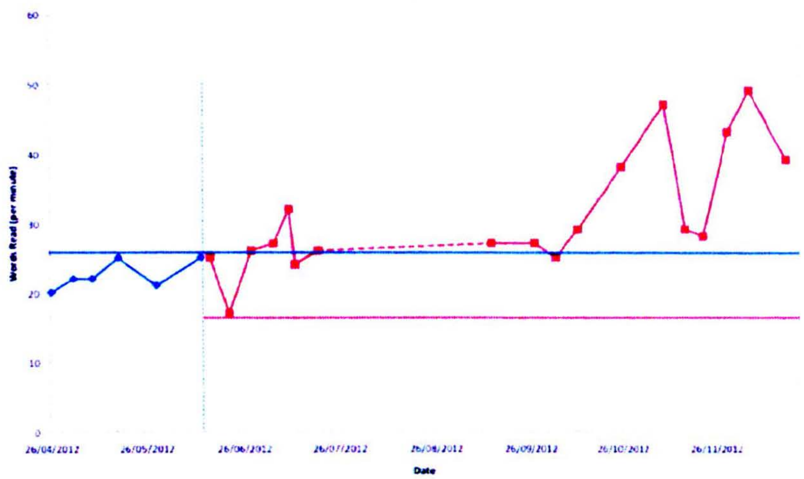
Graph 4.8 A line graph showing the number of individual words read (per minute) with **variability lines** across A-B1-B2 phases (Child A).



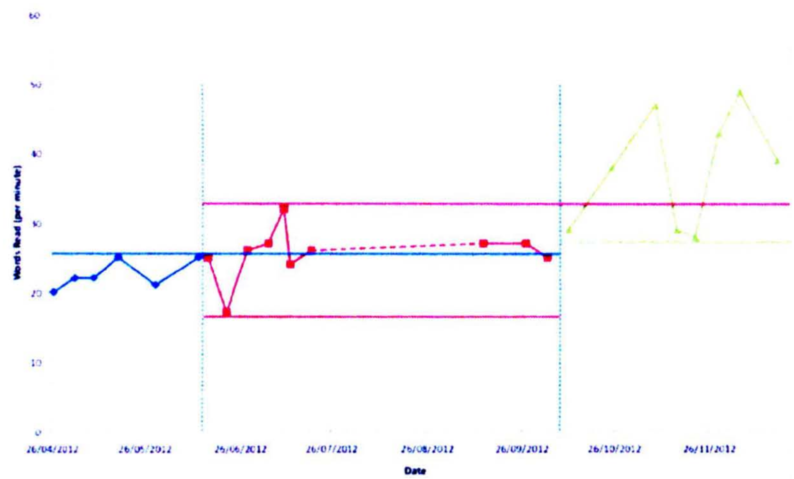
Graph 4.9. A line graph showing the number of probe individual read (per minute) and **immediacy of effect** across A-B phases (Child A).



Graph 4.10 A line graph showing the number of individual words read (per minute) and **immediacy of effect** across A-B1-B2 phases (Child A).



Graph 4.11 A line graph showing the number of individual words read (per minute) and **overlap between data points** of phase A and B (Child A).



Graph 4.12 A line graph showing the number of individual words read (per minute) and **overlap between data points** of phase A, B1 and B2 (Child A).

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.3 shows a mean level increase from phase A(22.5) to phase B(31). This is a +8.5 shift increase between the two phases. Graph 4.4 shows the mean level across the three phases increasing, from phase A(22.5), to phase B1(25.6), and to phase B2(37.75). There was a +3.1 increase from A to B1, and +12.15 increase from B1 to B2 phases.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.5 shows phase A and B having relatively similar angle of incline. Graph 4.6 shows B1 to have a fairly horizontal trend line, and B2 to have an incline greater than phase A.
Variability (*The range of data about the best fitting line*)	Graph 4.7 shows phase A to have a fairly stable range of data. Phase B has a large variation of data from the best fitting line. Graph 4.8 shows B1 and B2 to have a fairly large variation of data from the best fitting line.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.9 show little difference in level between the last three data points in phase A and the first three data points in phase B. Graph 4.10 shows a substantial positive change in level between B1 and B2 phases.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.11 shows a few data points from phase B overlapping with phase A. Graph 4.12 shows approximately half the data points overlapping between phase B1 and phase A. Phase B2 has approximately a third of its data points overlapping with B1.

Table 4.2 A summary of the outcome of the visual analysis of Child A's individual word reading graphs.

4.2.3.1 Inter-Observer Agreement (IOA)

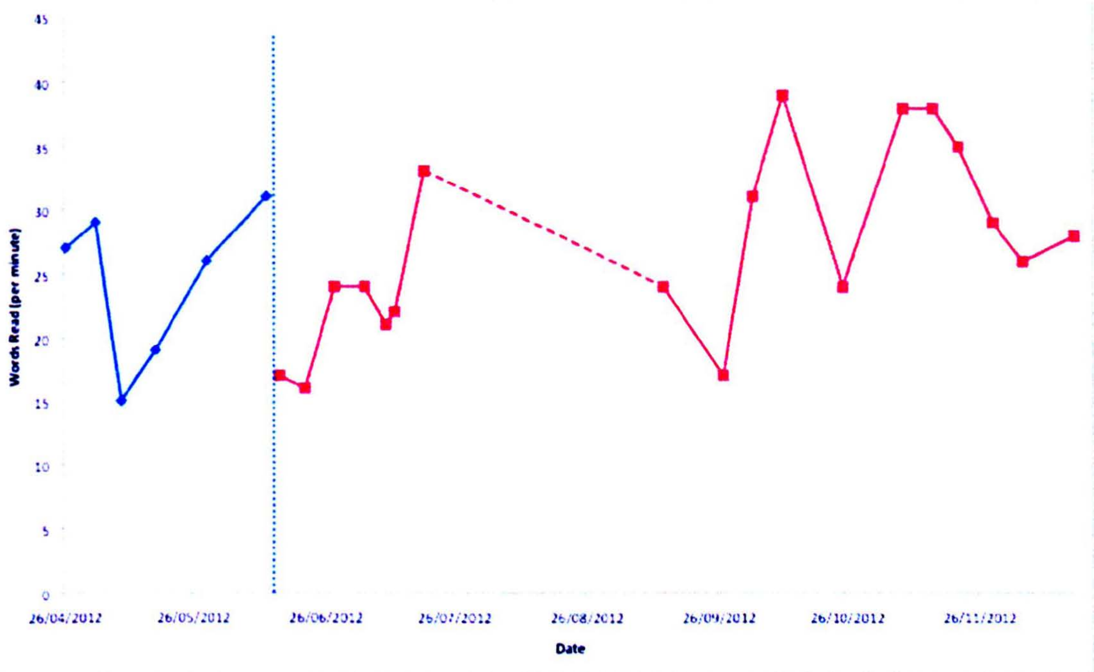
'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 88%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 89%

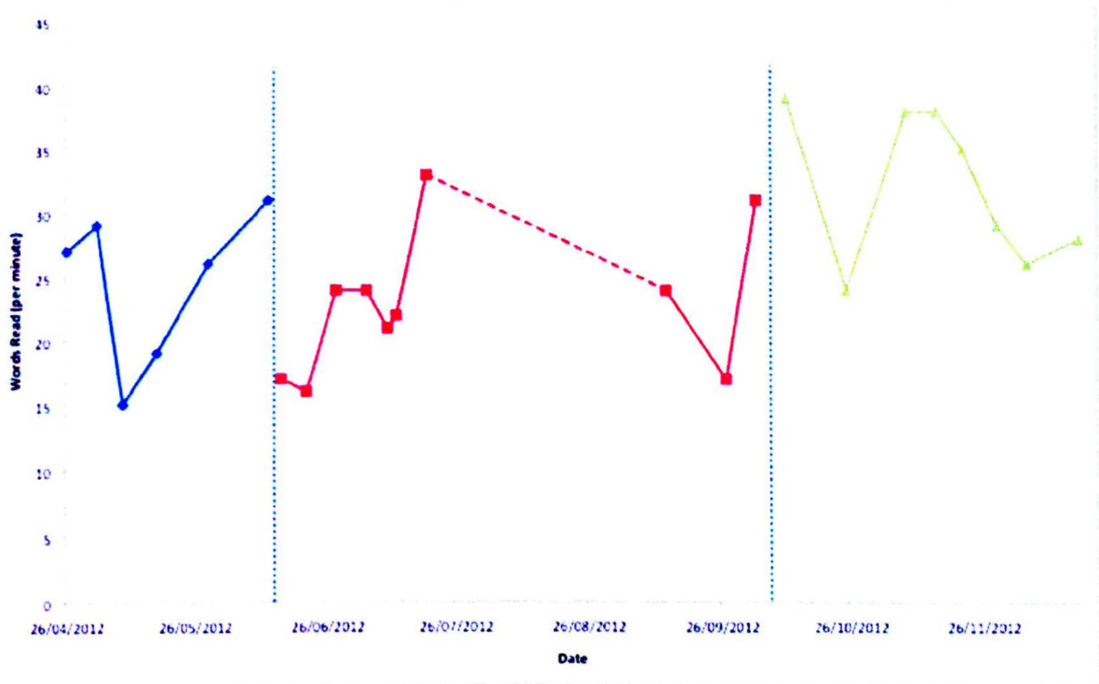
4.2.3.2 Summary (Child A)

The visual analysis of Child A's individual word reading ability suggests that when comparing phase A and B there is limited evidence to suggest an effect of the intervention. The mean level increased but the trend lines suggested that it was in line with the baseline progression. Approximately half of the data points in phase B overlapped with phase A, suggesting a limited effect, and the large variation in phase B makes it difficult to draw definite conclusions regarding the interventions effect. When the data was analysed through an A-B1-B2 design the graphs indicated an effect in phase B2. There was a substantial change in mean between phase B1 and B2. The trend line also indicates an accelerated progress in individual words read with only approximately a third of data overlapping with the previous phase. The immediacy of effect also appeared significant with a definite change of level of the initial data points in phase B2. However, the variability of phase B1 and B2 data makes it difficult to draw firm conclusions about the changes seen being due to intervention.

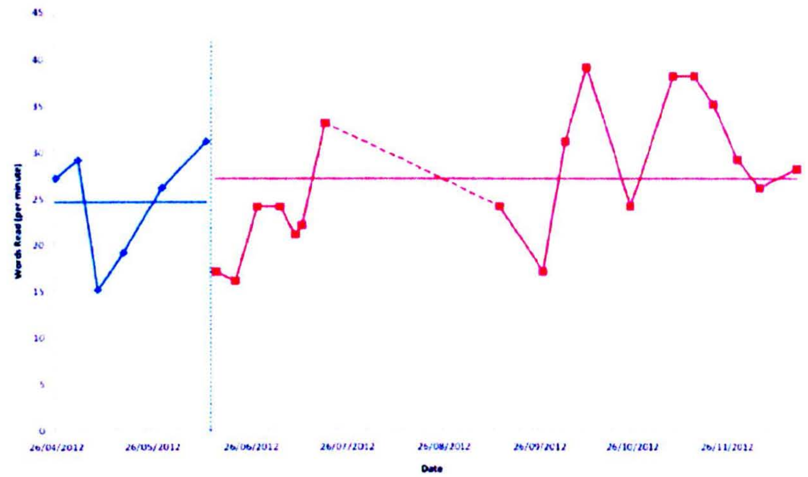
4.2.3.2 Number of Words Read in a Passage (per minute) (Child A)



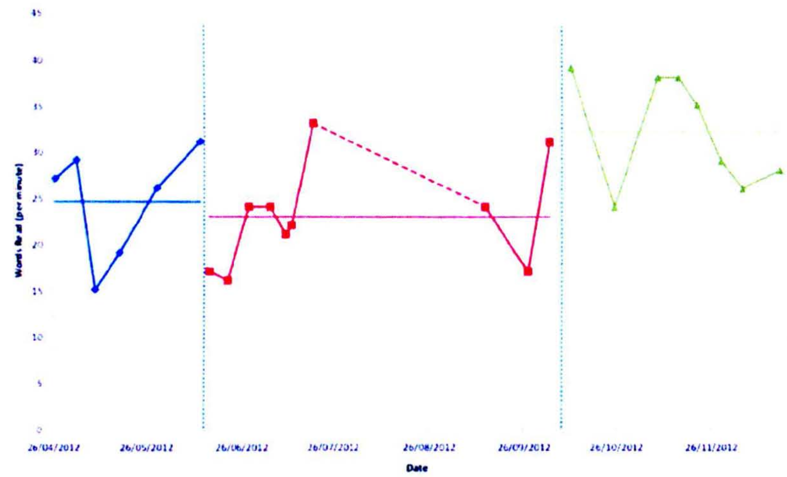
Graph 4.13 A line graph showing the number of words read in a passage (per minute) across A-B phases (Child A).



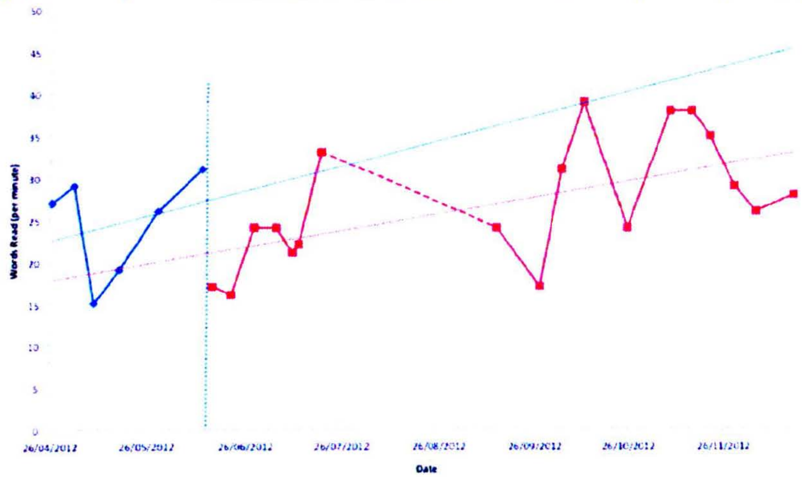
Graph 4.14 A line graph showing the number of words read in a passage (per minute) across A-B1-B2 phases (Child A).



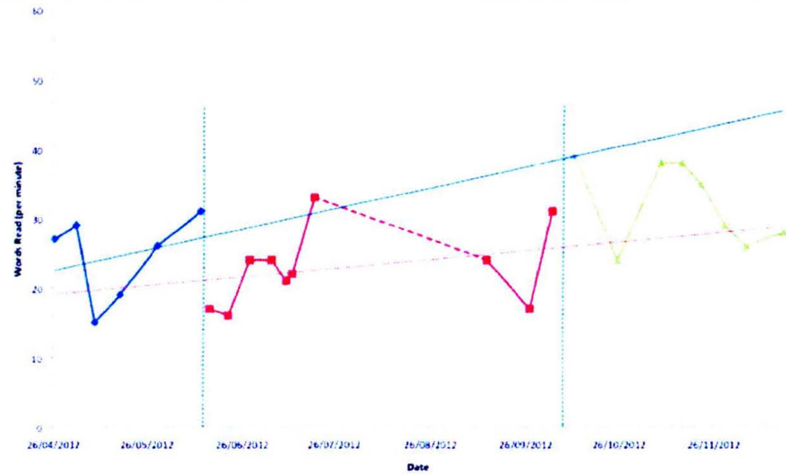
Graph 4.15 A line graph showing the number of words read in a passage (per minute) and **mean number of words** read across A-B phases (Child A).



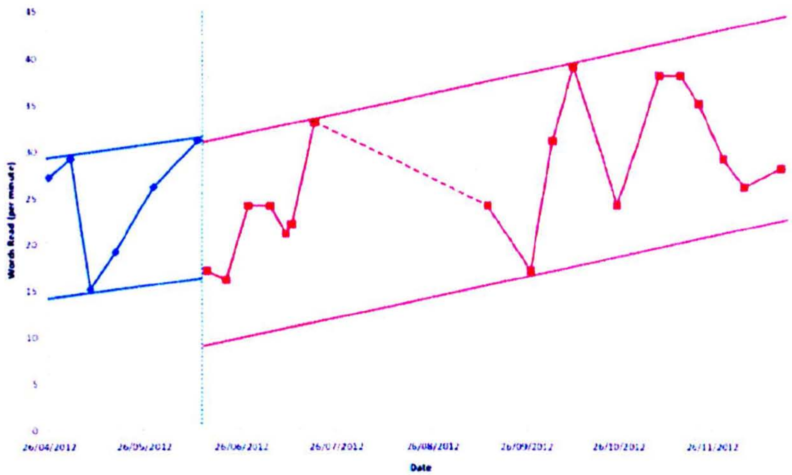
Graph 4.16 A line graph showing the number of words read in a passage (per minute) and **mean number of words** read across A-B1-B2 phases (Child A).



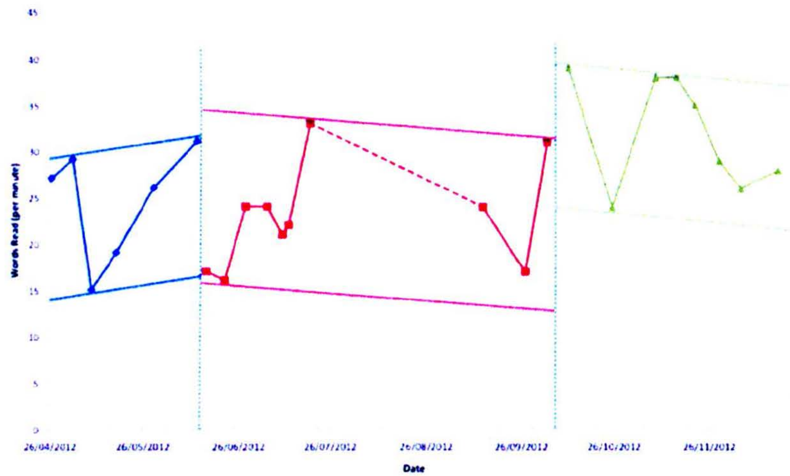
Graph 4.17 A line graph showing the number of words read in a passage (per minute) with **trend lines** across A-B phases (Child A).



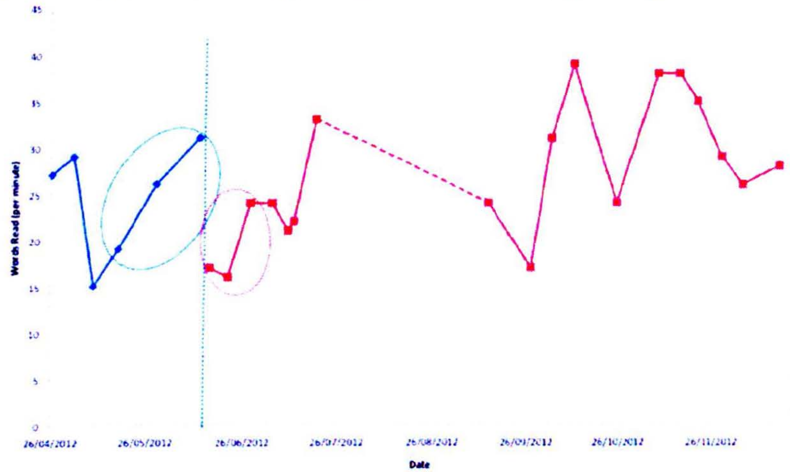
Graph 4.18 A line graph showing the number of words read in a passage (per minute) with **trend lines** across A-B1-B2 phases (Child A).



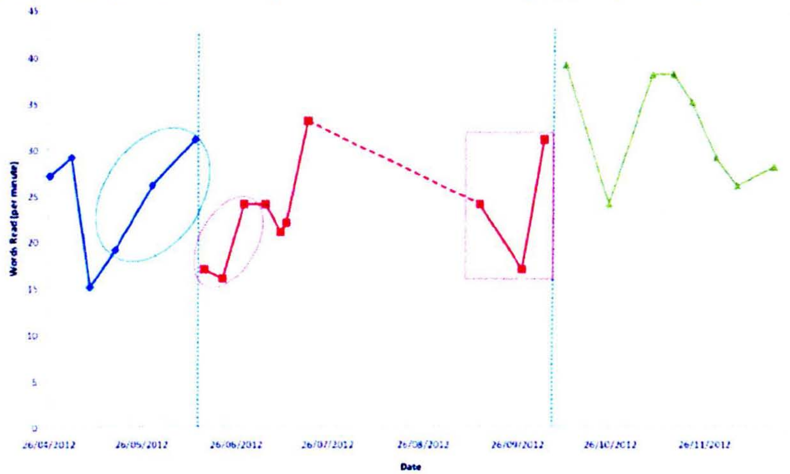
Graph 4.19 A line graph showing the number of words read in a passage (per minute) and **variability lines** across A-B phases (Child A).



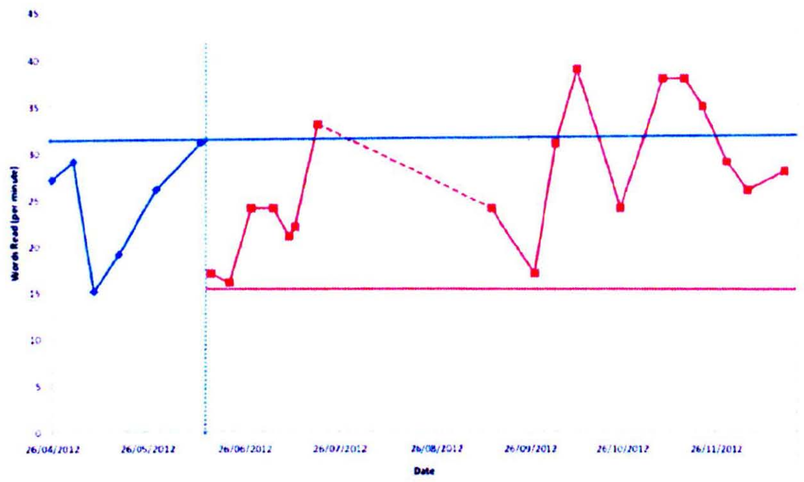
Graph 4.20 A line graph showing the number of words read in a passage (per minute) and **variability lines** across A-B1-B2 phases (Child A).



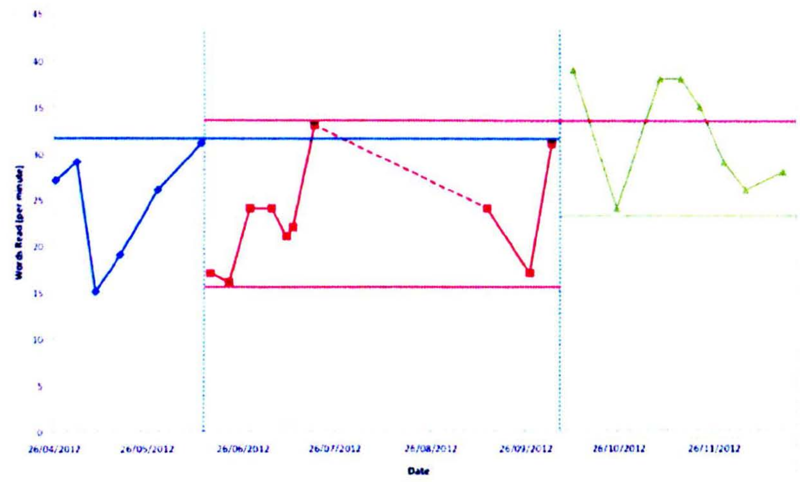
Graph 4.21 A line graph showing the number of words read in a passage (per minute) and **immediacy of effect** across A-B phases (Child A).



Graph 4.22 A line graph showing the number of words read in a passage (per minute) and **immediacy of effect** across A-B1-B2 phases (Child A).



Graph 4.23 A line graph showing the number of words read in a passage (per minute) and **overlap between data points** of phase A and B (Child A).



Graph 4.24 A line graph showing the number of words read in a passage (per minute) and **overlap between data points** of phase A, B1 and B2 (Child A).

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.15 shows the mean level increasing slightly from A (24.5) to B (27) phase. This equates to a +2.5 shift in the mean between the baseline and intervention phase. When A phase is compared with B1 and B2 (Graph 4.16), the mean decreases slightly for B1 (22.9) and then shows a substantial increase in B2 (32.1) phase. Phase A to B1 shows a -1.6 shift, and +9.2 shift from B1 to B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	The trend line for both A and B phases show an increasing trend (Graph 4.17). The trend line for the baseline phase has a steeper incline than the intervention phase. When A-B1-B2 phases are compared (Graph 4.18), the trend lines for A and B1 show an incline, whereas B2 shows a declining trend line.
Variability (*The range of data about the best fitting line*)	Graph 4.19 shows fairly large variability in A and B phase. B phase shows a greater variability than A phase. Graph 4.20 shows a fairly large variability within all three phases, with B1 showing the greater amount of variability.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.21 shows a slight decrease in level between the end of the baseline phase and the start of the B phase. Graph 4.22 shows a larger change in level between phase B1 and phase B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.23 shows a large proportion of data that overlaps between A and B phase. Graph 4.24 shows the majority of data overlapping between phase A and phase B1. Phase B1 and B2 shows some overlap of half the data points.

Table 4.3 A summary of the outcome of visual analysis of Child A's passage word reading graphs.

4.2.3.2.1 Inter-Observed Agreement (IOA)

There is a significant change in performance when the precision teaching intervention is introduced': IOA = 83%

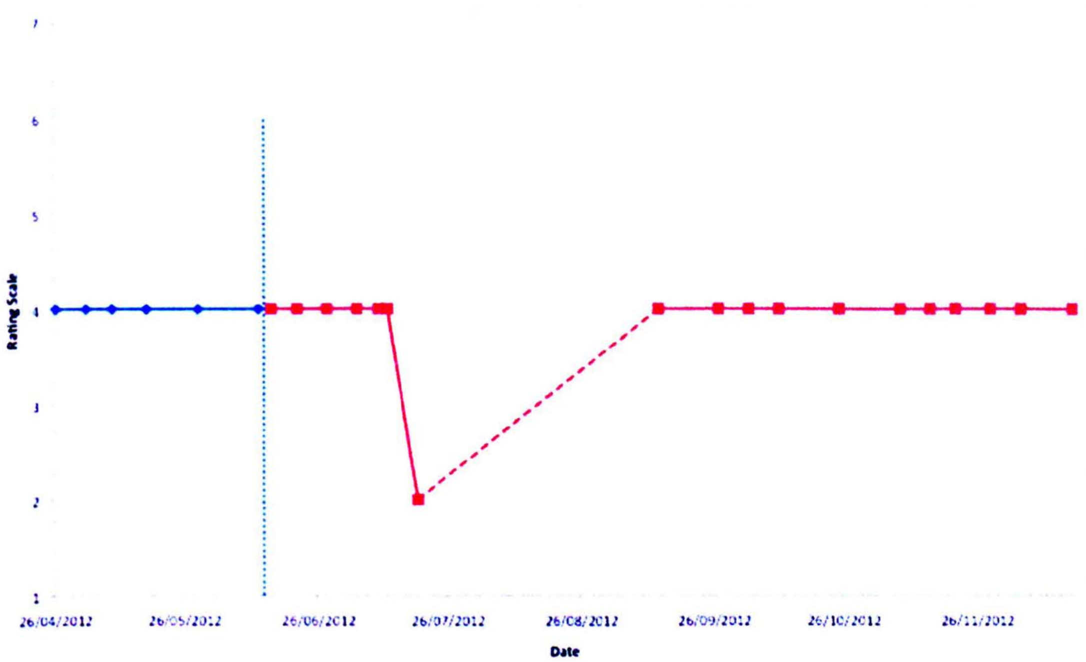
'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 100%

4.2.3.2.2 Summary (Child A)

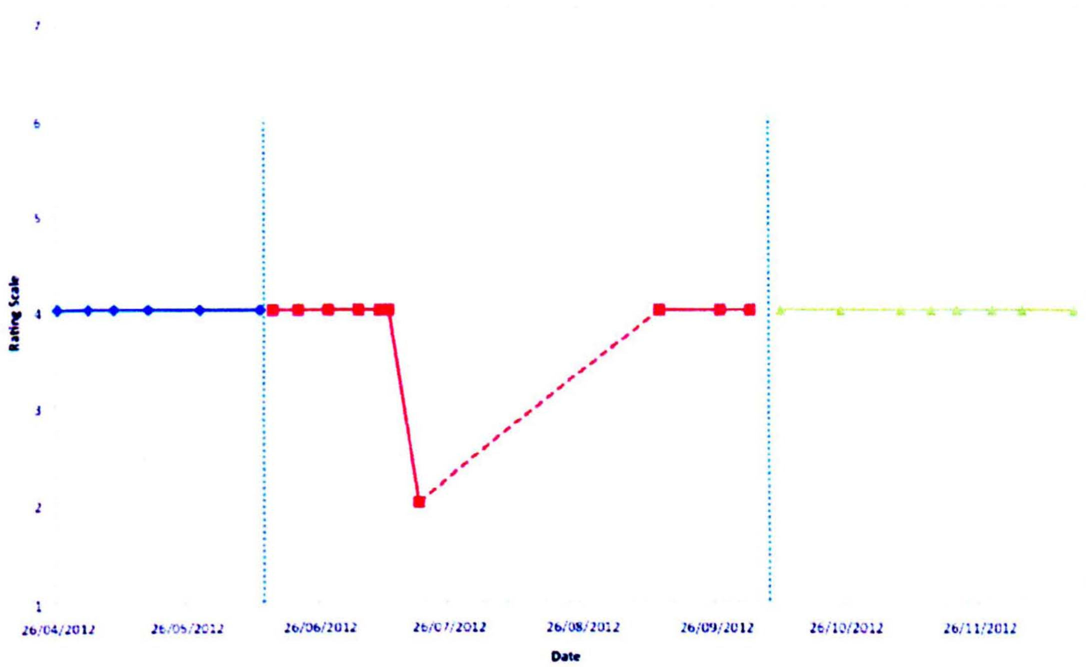
The information obtained from the visual analysis of Child A's reading ability in relation to passage words read across phase A and B suggests that there was not a significant effect of the intervention. The mean increased in phase B, however this was fairly minimal and on most areas of analysis there was not a clear indication of an effect of the intervention. When comparing phases A, B1 and B2 there is more cause to suggest a possible effect in phase B2. The mean increases a large amount in comparison to B1, there is limited overlap in data with B1, and the immediacy of effect is more apparent than between phase A and B1. However, in all phases the variability is relatively large and so it is difficult to identify a *definite* causal relationship between the variables.

4.2.4 Single Case Experimental Design – Affect

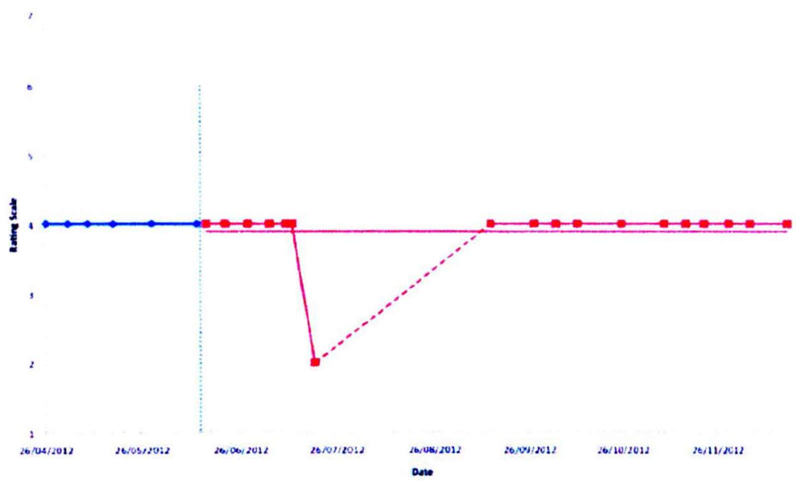
4.2.4.1 Child A's Self-Rating Regarding Reading Enjoyment



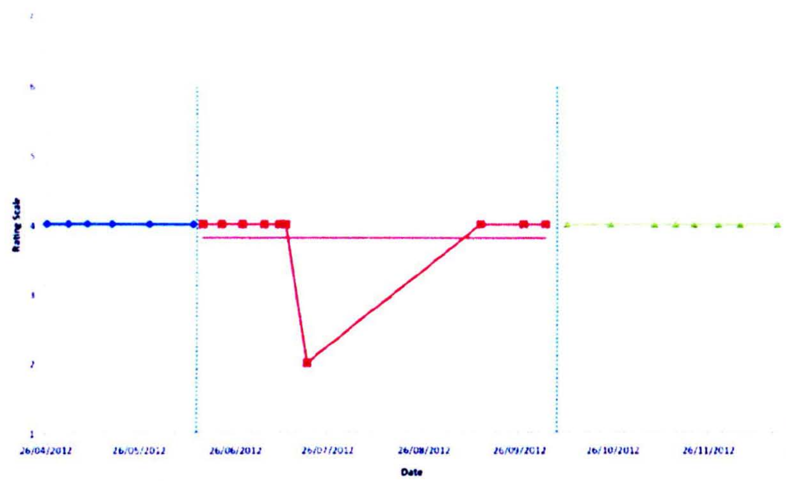
Graph 4.25 A line graph showing Child A's self-rating scores of his reading enjoyment across phase A and B.



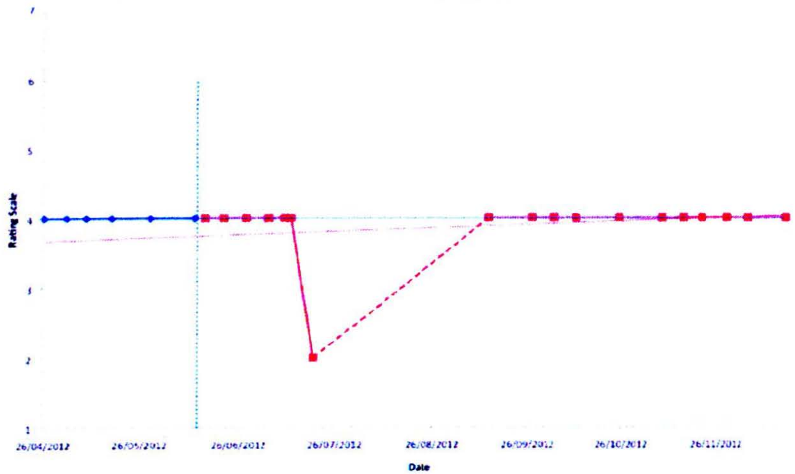
Graph 4.26 A line graph showing Child A's self-rating scores of his reading enjoyment across phase A, B1 and B2.



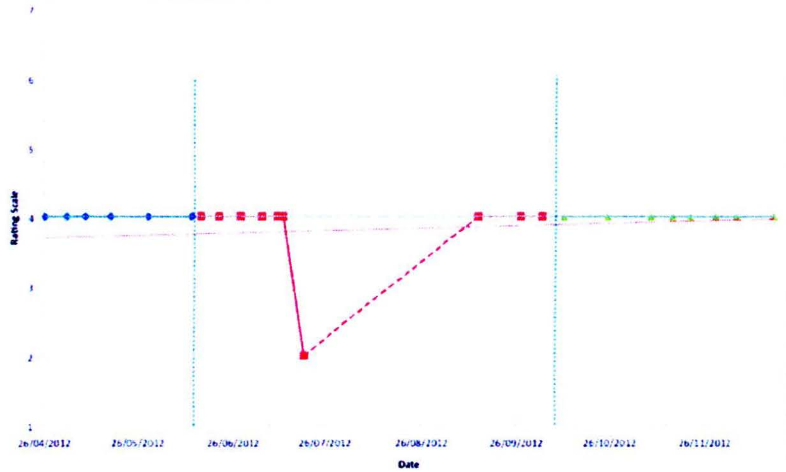
Graph 4.27 A line graph showing Child A's self-rating scores of his reading enjoyment and **mean scores** across A-B phases.



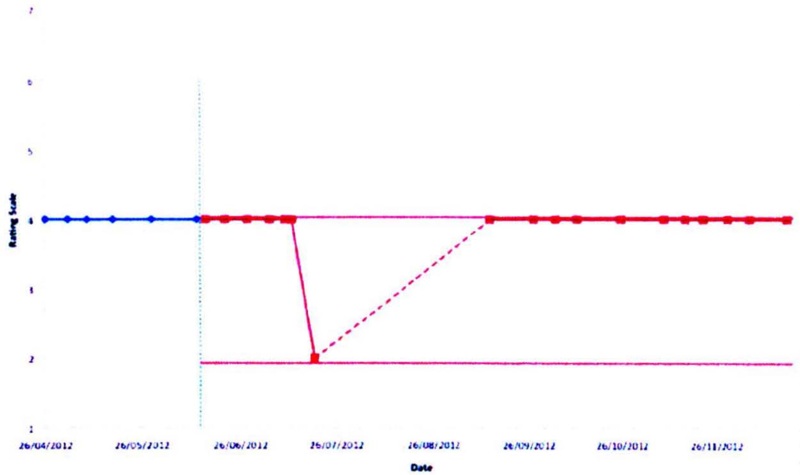
Graph 4.28 A line graph showing Child A's self-rating scores of his reading enjoyment and **mean scores** across A-B1-B2 phases.



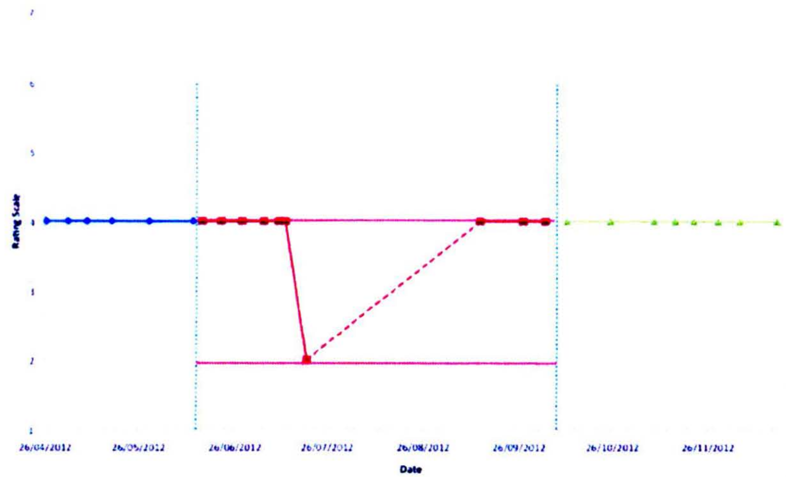
Graph 4.29 A line graph showing Child A's self-rating scores of his reading enjoyment and **trend lines** across A-B phases.



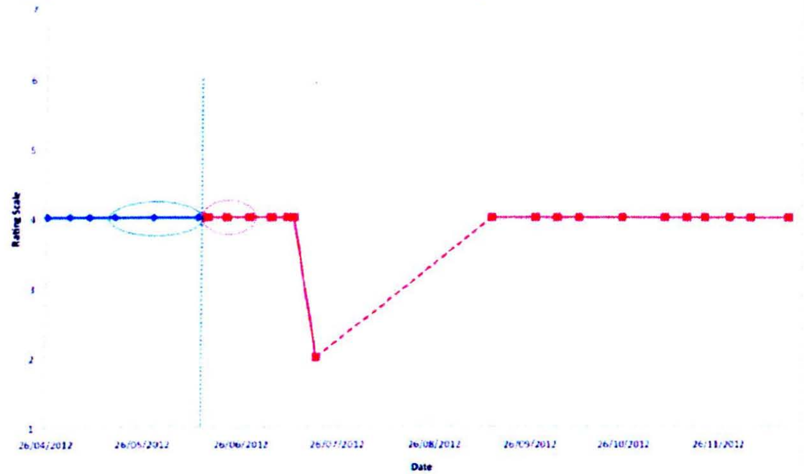
Graph 4.30 A line graph showing Child A's self-rating scores of his reading enjoyment and **trend lines** across A-B1-B2 phases.



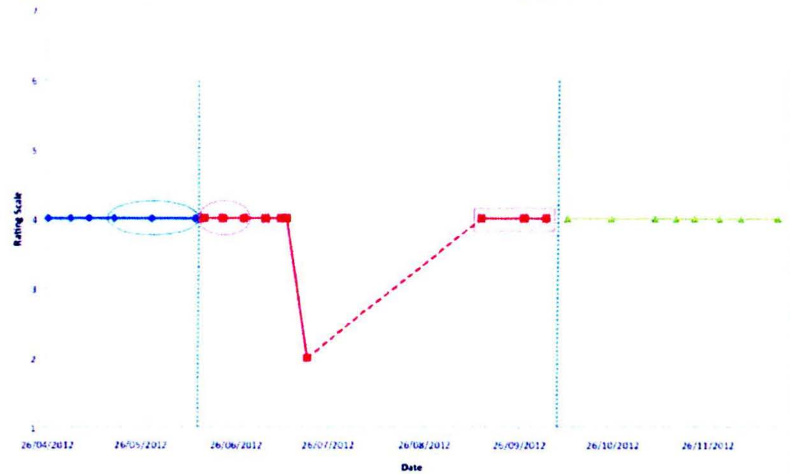
Graph 4.31 A line graph showing Child A's self-rating scores of his reading enjoyment and **variance lines** between A-B phases.



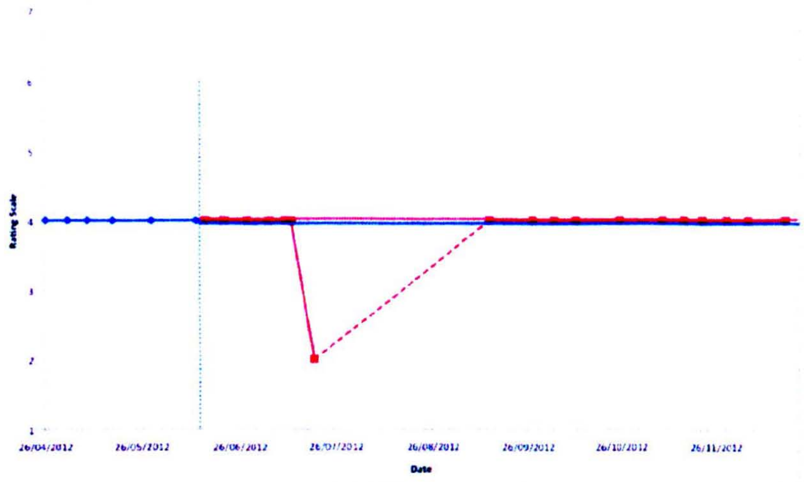
Graph 4.32 A line graph showing Child A's self-rating scores of his reading enjoyment and **variance lines** between A-B1-B2 phases.



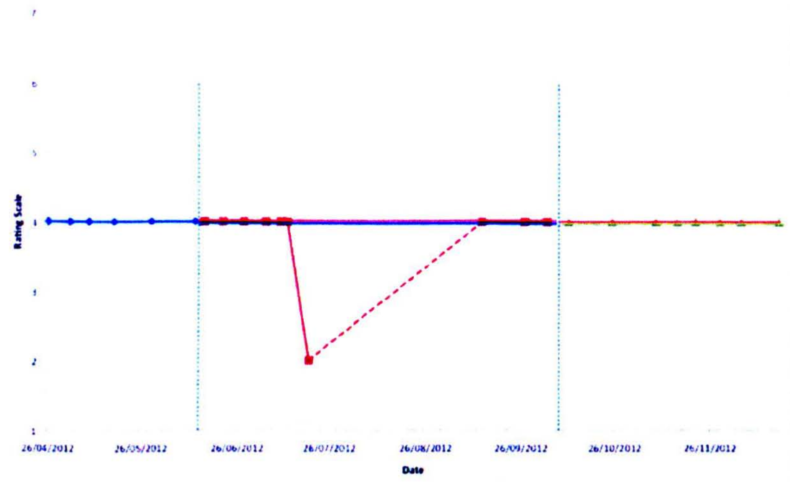
Graph 4.33 A line graph showing Child A's self-rating scores of his reading enjoyment and **immediacy of effect** between A-B phases.



Graph 4.34 A line graph showing Child A's self-rating scores of his reading enjoyment and **immediacy of effect** between A-B1-B2 phases.



Graph 4.35 A line graph showing Child A's self-rating scores of his reading enjoyment and **overlap of data** between A-B phases.



Graph 4.36 A line graph showing Child A's self-rating scores of his reading enjoyment and **overlap of data** between A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.27 shows a slight decrease in mean score between phase A (4) and phase B (3.89). This equates to a -0.11 shift in mean score. Graph 4.28 shows phase A (4) and phase B1 (4) to have the same mean score, and B1's (3.8) being slightly less. Phase A to phase B1 shows a -0.2 shift and from phase B1 to phase B2 a +0.2 shift in mean score.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.29 shows a horizontal trend line for phase A. Phase B has a slightly inclining trend line. Graph 4.30 shows phase B1 with a slight inclining trend line and both phase A and phase B1 with a horizontal trend line.
Variability (*The range of data about the best fitting line*)	Graph 4.31 shows no variability for phase A. Phase B has a larger variability. Graph 4.32 shows phase A and phase B2 with no variability and phase B1 with greater variability.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.33 and Graph 4.34 show no change in level between the last three data points of one phase and the first three data points of the next phase.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.35 shows the majority of data from phase B overlapping with phase A. Graph 4.36 also shows that the majority of data from phase B1 overlapping with phase A, and phase B2 data overlapping with phase B1.

Table 4.4 A table providing information regarding visual analysis of Child A's self-rating regarding reading enjoyment graphs.

4.2.4.1.1 Inter-Observed Agreement (IOA)

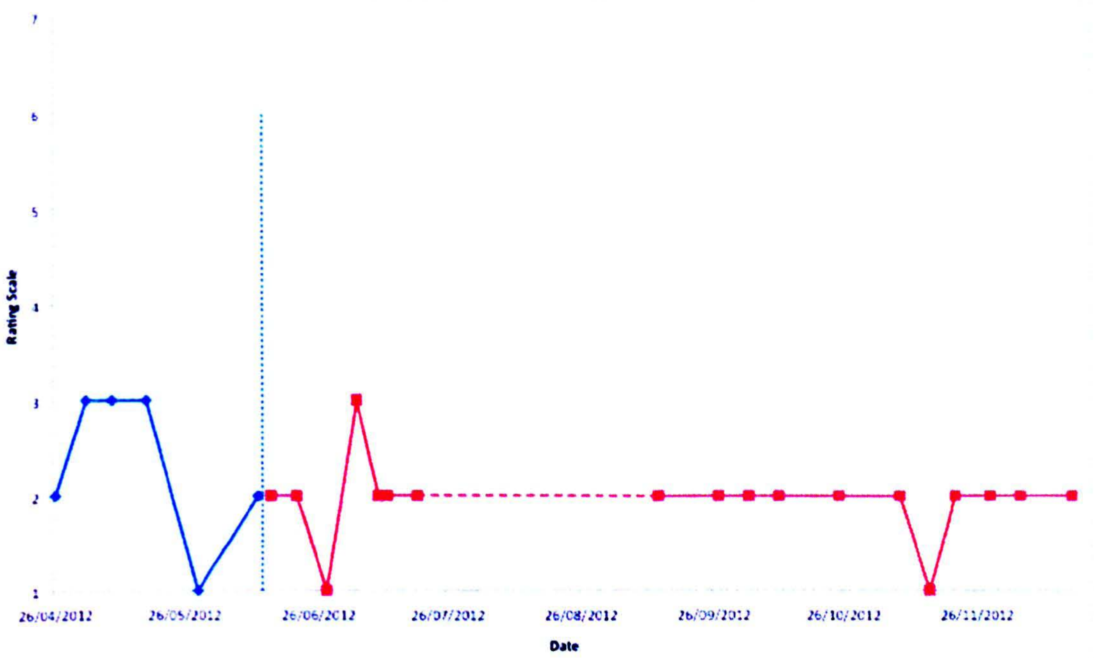
'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 100%

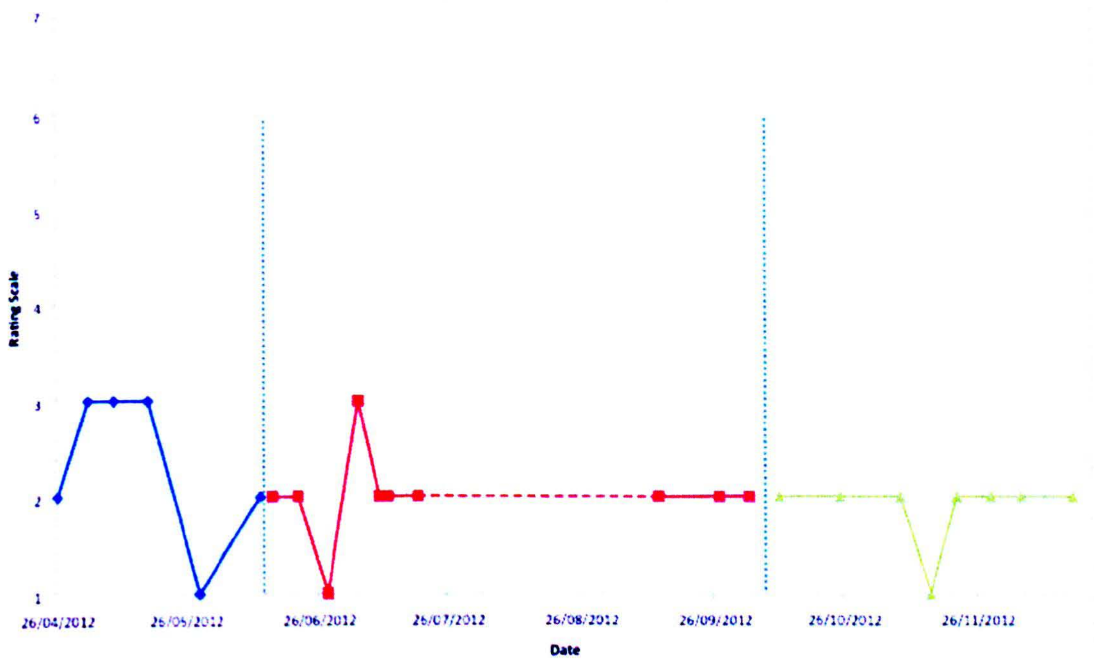
4.2.4.1.2 Summary (Child A)

The visual analysis of reading enjoyment shows a fairly consistent pattern across all phases introduced, indicating that the intervention has not had an effect on Child A's reading enjoyment. Phase B and B1 show one data point that varies from the other data points, indicating greater enjoyment of learning but in isolation it is not possible to suggest it is an effect of the intervention.

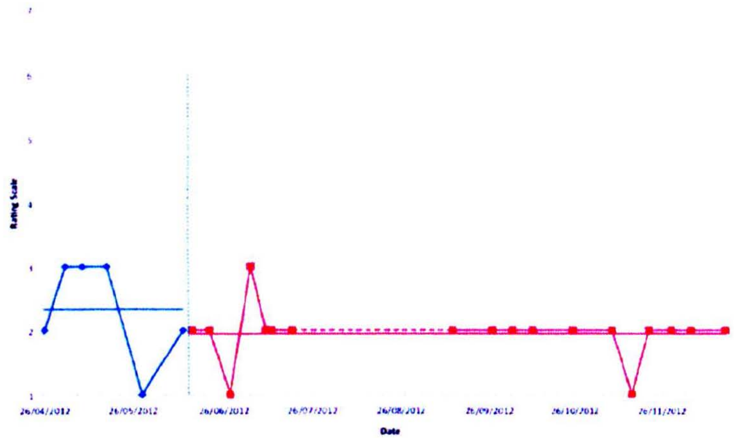
4.2.4.2 Child A's Self-Rating Regarding Reading Ability



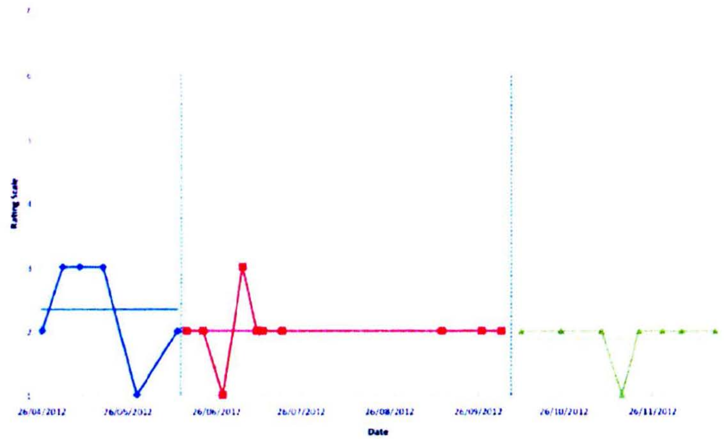
Graph 4.37 A line graph showing Child A's self-rating scores regarding his reading ability across phase A and B.



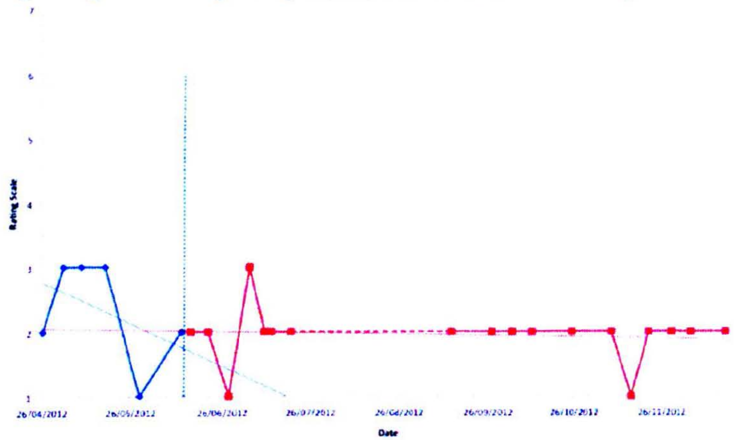
Graph 4.38 A line graph showing Child A's self-rating scores regarding his reading ability across phase A, B1 and B2.



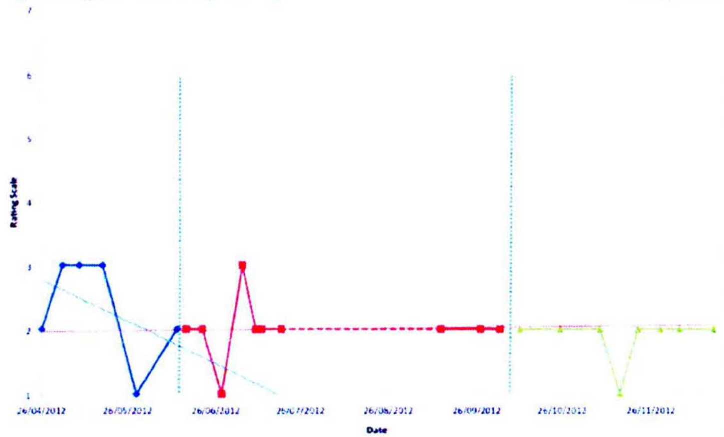
Graph 4.39 A line graph showing Child A's self-rating scores regarding his reading ability and **mean scores** across A-B phases.



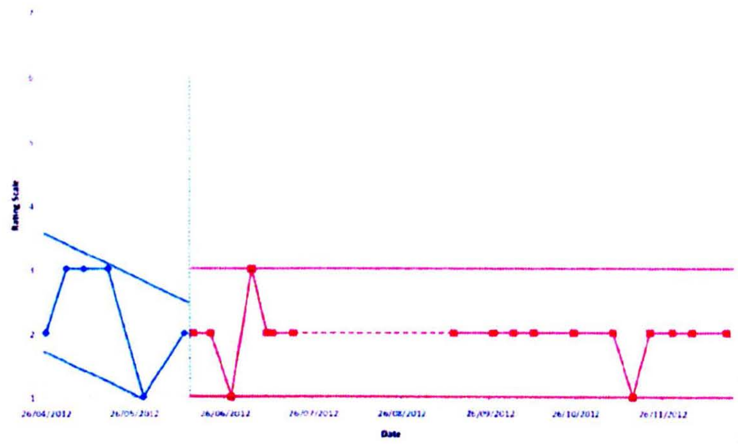
Graph 4.40 A line graph showing Child A's self-rating scores regarding his reading ability and **mean scores** across A-B1-B2 phases.



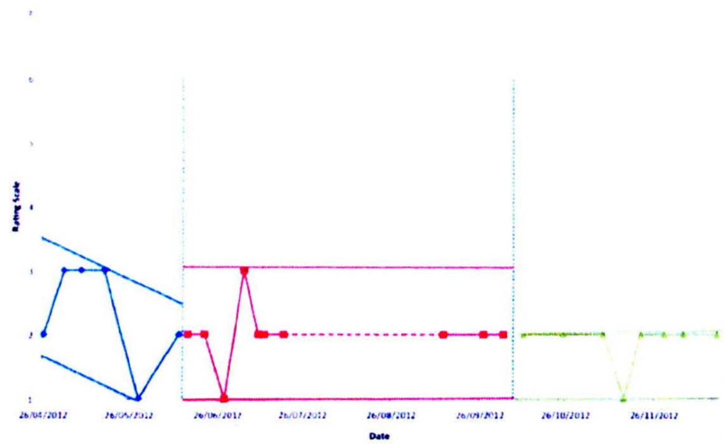
Graph 4.41 A line graph showing Child B's self-rating scores regarding reading ability with **trend lines** across A-B phases.



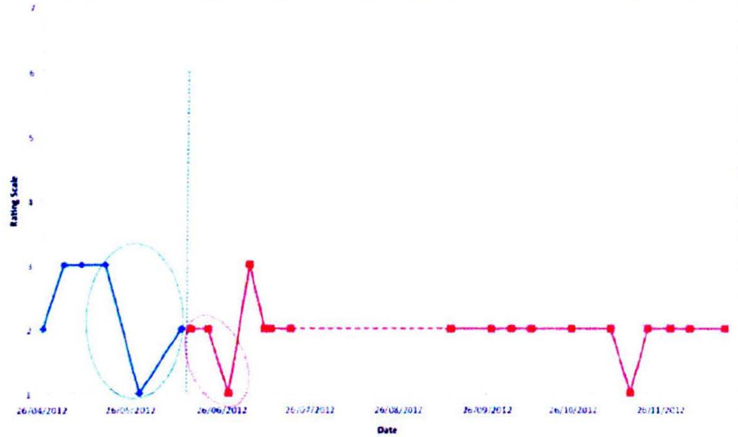
Graph 4.42 A line graph showing Child B's self-rating scores regarding his reading ability with **trend lines** across A-B1-B2 phases.



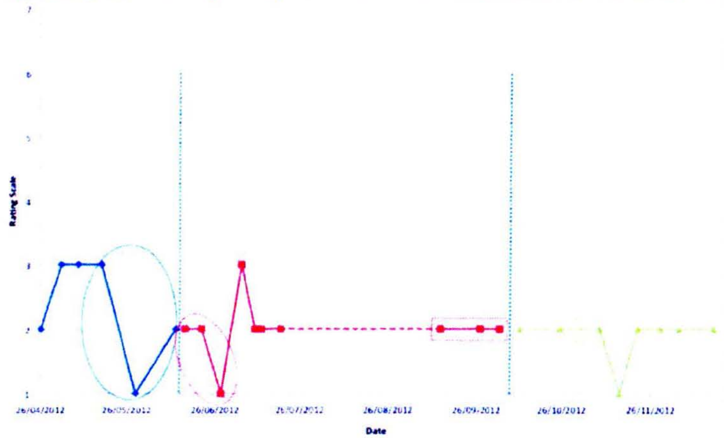
Graph 4.43 A line graph showing Child A's self-rating scores regarding his reading ability with **variance lines** across A-B phases.



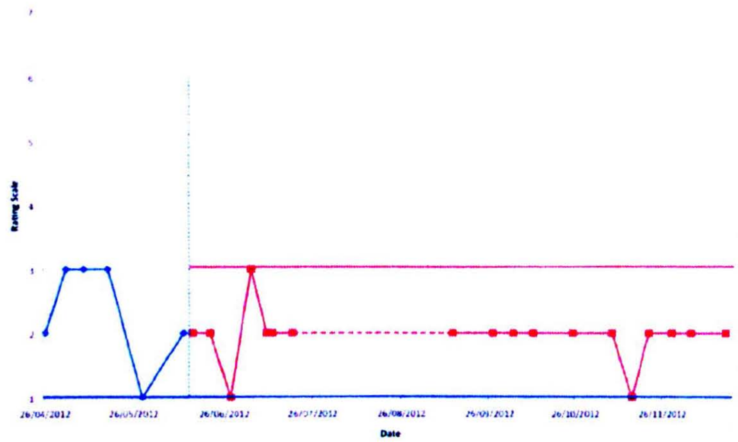
Graph 4.44 A line graph showing Child A's self-rating scores regarding his reading ability with **variance lines** across A-B1-B2 phases.



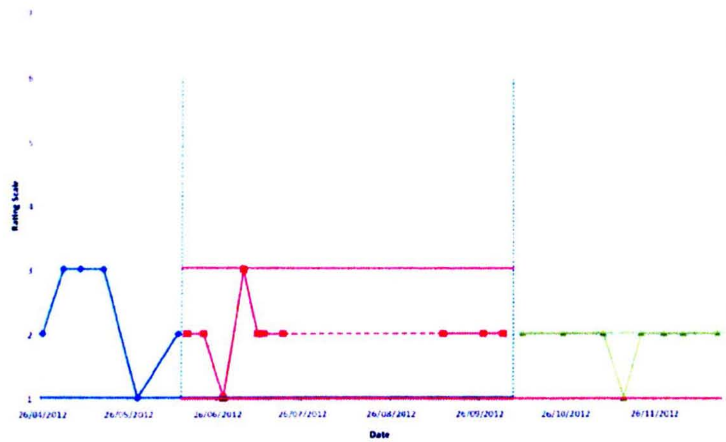
Graph 4.45 A line graph showing Child A's self-rating scores regarding his reading ability and **immediacy of effect** across A-B phases.



Graph 4.46 A line graph showing Child A's self-rating scores regarding his reading ability and **immediacy of effect** across A-B1-B2 phases.



Graph 4.47 A line graph showing Child A's self-rating scores regarding his reading ability and **overlap of data** across A-B phases.



Graph 4.48 A line graph showing Child A's self-rating scores regarding his reading ability and **overlap of data** across A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.39 shows a decrease in mean score across phase A (2.33) and phase B (1.94), equating to a -0.39 shift. Graph 4.40 shows a decreasing mean score across phase A (2.33), phase B1 (2) and phase B2 (1.88). This equates to a -0.33 shift from phase phase A to phase B1, and a -0.12 shift from phase B1 to phase B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.41 shows a fairly steep decline in trend line for phase A and phase B with a relatively horizontal trend line. Graph 4.42 shows phase B1 and phase B2 to have fairly horizontal trend lines.
Variability (*The range of data about the best fitting line*)	Graph 4.43 shows phase A and phase B to have similar variability. Graph 4.44 shows phase A and phase B1 to have a similar level of variability and phase B2 to have a smaller range and level of variability to phase A and phase B1.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.45 shows phase B to indicate a slight change in effect between the two phases. Graph 4.46 shows no change between phase B1 and phase B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.47 shows all of the data from phase B to overlap with phase A. Graph 4.48 shows all of the data from phase B2 to overlap with date from phase B1.

Table 4.5 A table providing information regarding visual analysis of Child A's self-rating regarding reading ability graphs.

4.2.4.2.1 Inter-Observed Agreement (IOA)

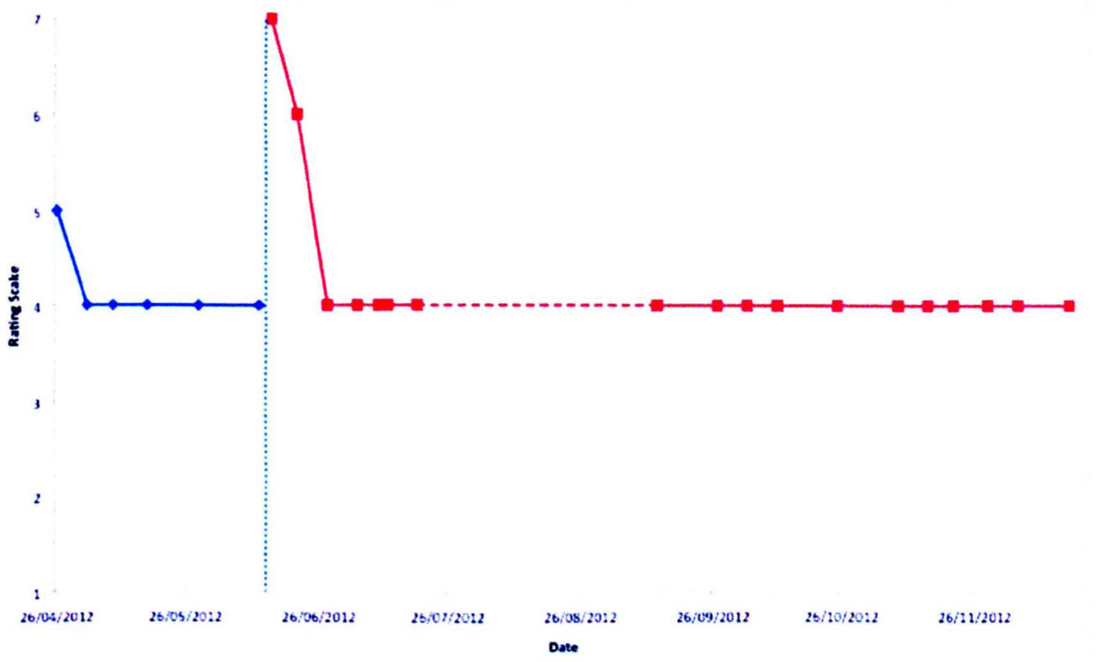
'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 66%

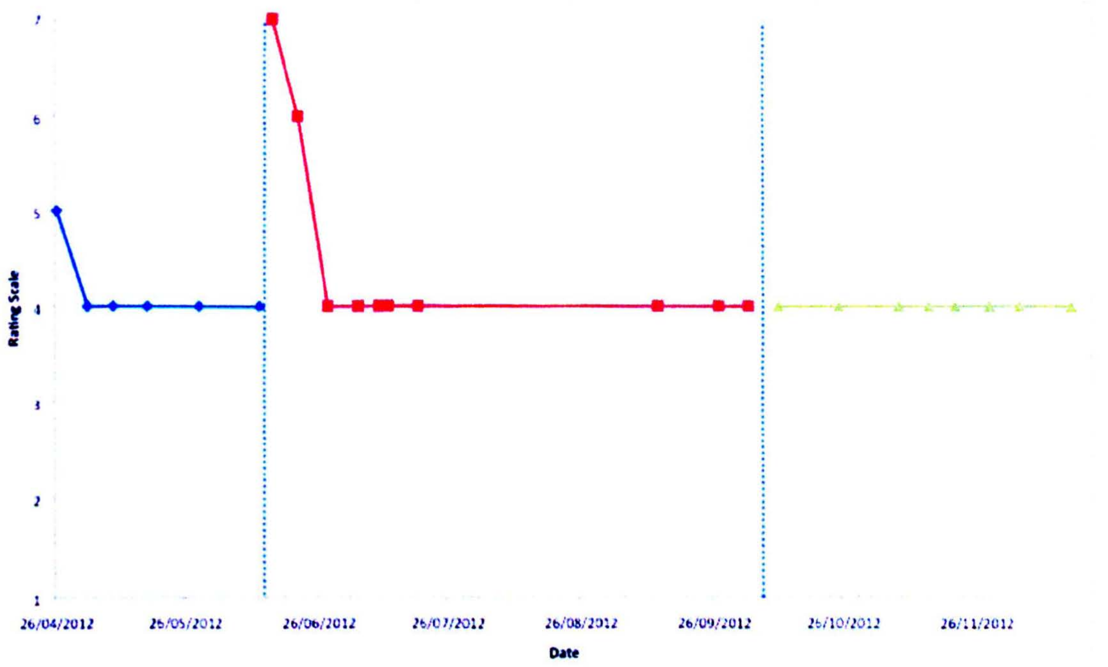
4.2.4.2.2 Summary (Child A)

The visual analysis of Child A's reading ability self-concept suggests a potential increase following the introduction of the intervention. Across phase A and B there are similar amounts of variation in data. The trend line for phase A shows a declining line in contrast to phase B. However, the mean for phase B is lower than phase A indicating a higher self-concept regarding reading ability. The immediacy of effect from phase A to phase B also indicates a difference in level between the two phases. When phase B2 is compared with the previous phases there appears to be a more consistent pattern of responding indicating an effect of the intervention. However, it is difficult to draw firm conclusions due to analyses such as overlap of data points and trend lines suggesting a less clear picture of an intervention effect.

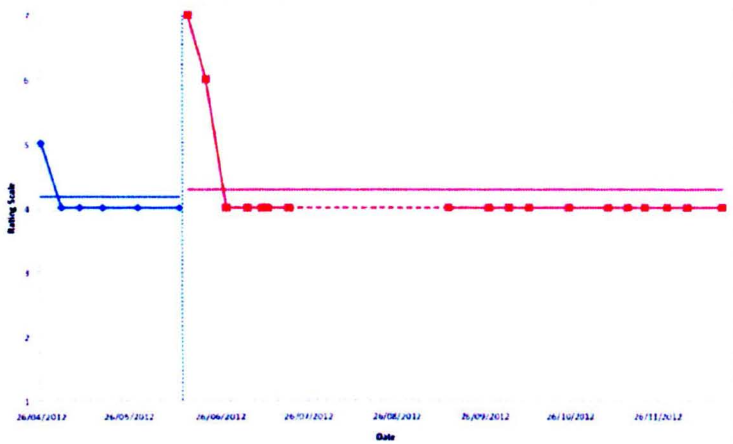
4.2.4.3 Child A's Self-Rating Regarding Enjoyment at Learning New Things



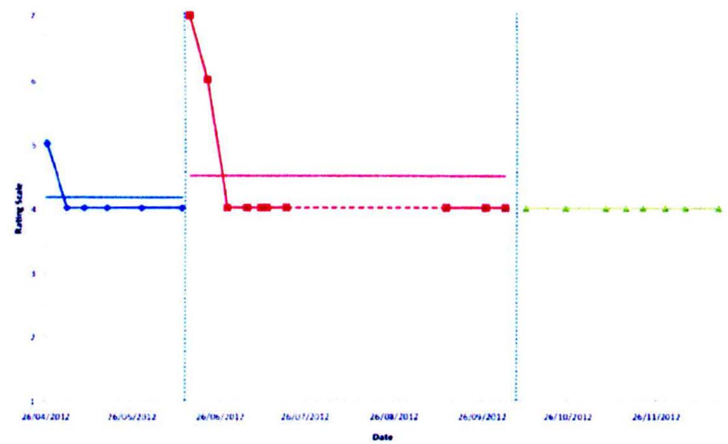
Graph 4.49 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things across phase A and B.



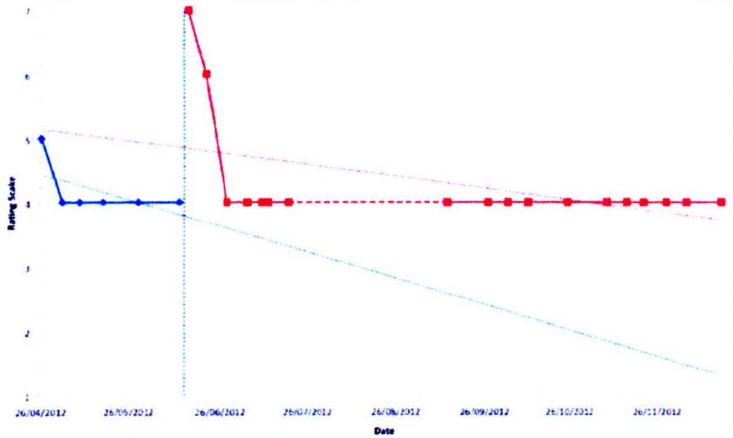
Graph 4.50 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things across phase A, B1 and B2.



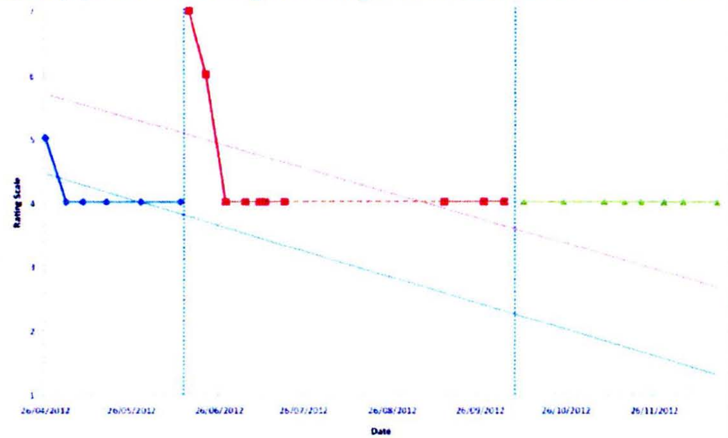
Graph 4.51 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things and **mean scores** across A-B phases.



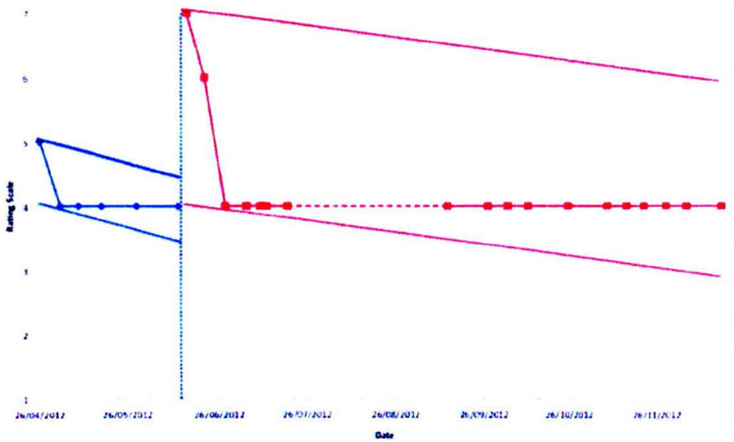
Graph 4.52 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things and **mean scores** across A-B1-B2 phases.



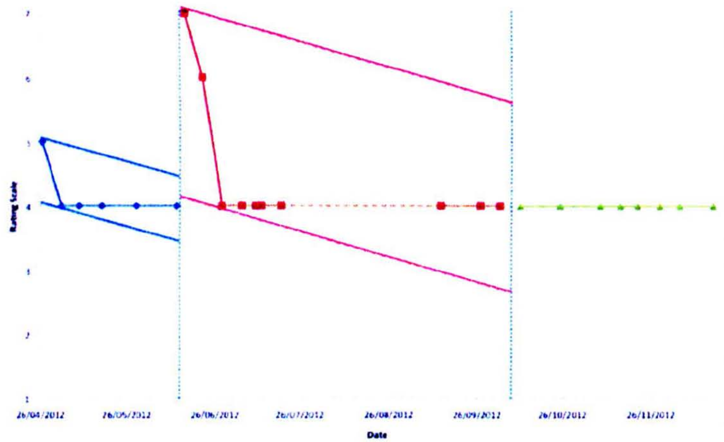
Graph 4.53 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things with **trend lines** across A-B phases.



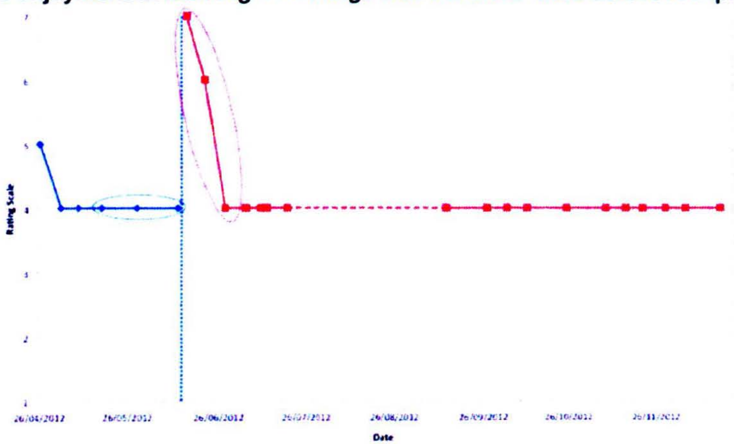
Graph 4.54 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things with **trend lines** across A-B1-B2 phases.



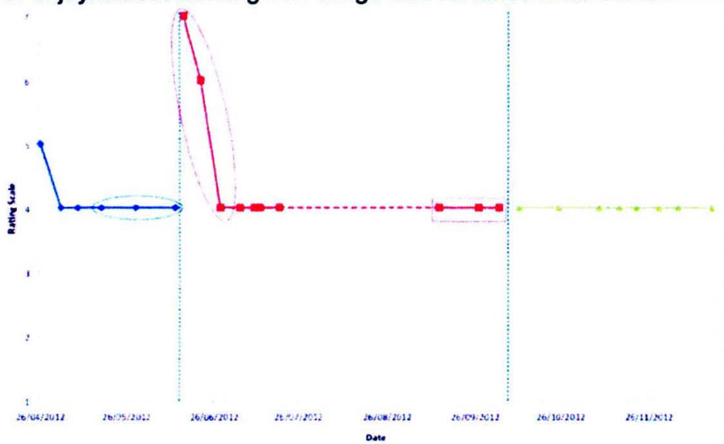
Graph 4.55 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things with **variance lines** across A-B phases.



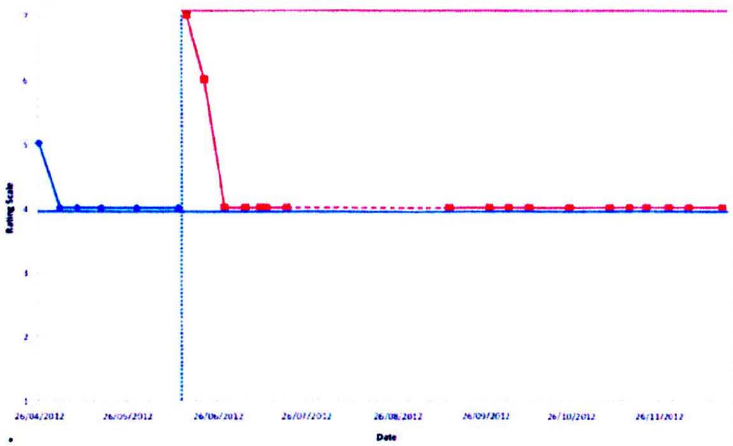
Graph 4.56 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things with **variance lines** across A-B1-B2 phases.



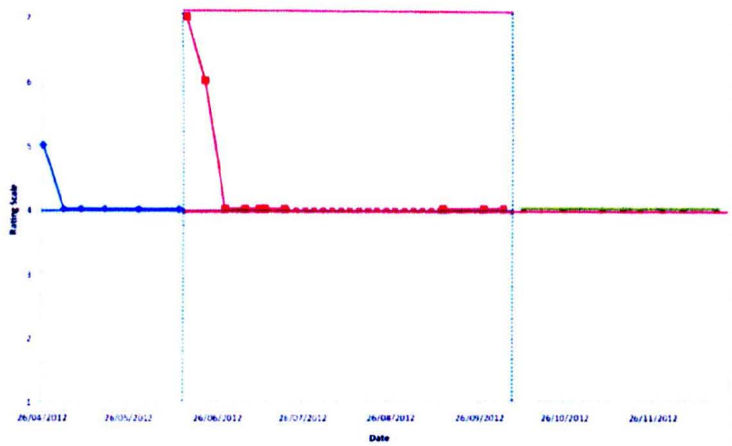
Graph 4.57 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things and **immediacy of effect** across A-B phases.



Graph 4.58 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things and **immediacy of effect** across A-B1-B2 phases.



Graph 4.59 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things and **overlap of data** across A-B phases.



Graph 4.60 A line graph showing Child A's self-rating scores regarding his enjoyment at learning new things and **overlap of data** across A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.51 shows a slight increase in mean score across phase A (4.17) and phase B (4.28), equating to a +0.11 shift. Graph 4.52 shows an increase in mean score from phase A (4.17) to phase B1 (4.5), and a decrease from phase B1 (4.5) to phase B2 (4). This equates to a +0.33 shift from phase A to phase B1, a -0.5 shift from phase B1 to phase B2, and -0.17 shift from phase A to phase B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.53 shows both phase A and phase B with declining trend lines. Phase A with the slightly steeper declining line. Graph 4.54 shows phase A and phase B1 with declining trend lines with similar levels of gradient, and phase B2 trend line is horizontal.
Variability (*The range of data about the best fitting line*)	Graph 4.55 shows phase B to have a larger variability than phase A. Graph 4.56 shows phase B1 to have a larger variability than phase A. Phase B2 does not have any variation in data.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.57 indicates an effect through change in level between phase A and phase B. Graph 4.58 indicates no effect from phase B1 to B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.59 shows all of the data from phase B to overlap with phase A. Graph 4.60 shows all of the data from phase B2 overlapping with phase B1.

Table 4.6 A table providing information regarding visual analysis of Child A's self-rating regarding enjoyment at learning new things graphs.

4.2.4.3.1 Inter-Observed Agreement (IOA)

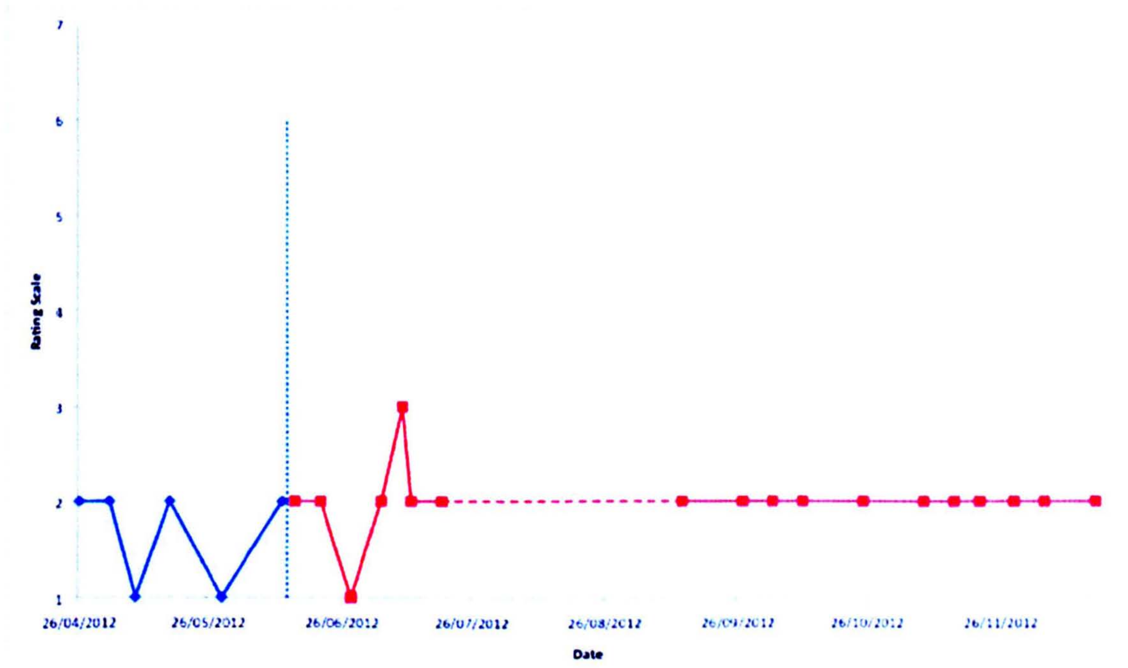
'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 50%

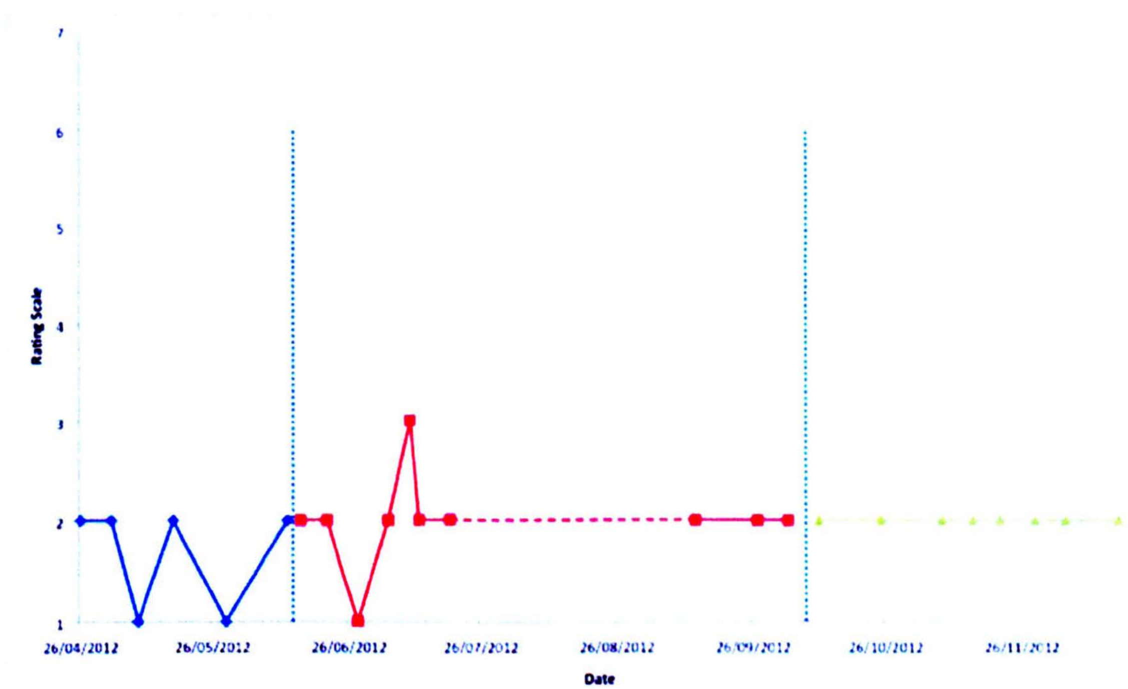
4.2.4.3.2 Summary (Child A)

Visual analysis of the graph regarding Child A's enjoyment at learning new things indicates a potential effect at the onset of the intervention which is not maintained. Across phase A and B there is a clear effect at the onset of intervention in which Child A's responses regarding his enjoyment of learning new things appears to decline. However, the effect is not maintained and is not shown when the intervention is undertaken with greater consistency, making it difficult to draw any firm conclusions.

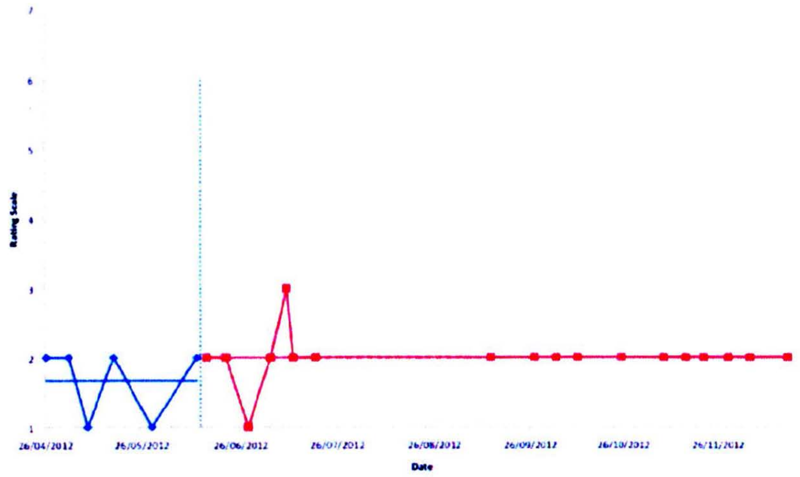
4.2.4.4 Child A's Self-Rating Regarding Ability to Learn New Information



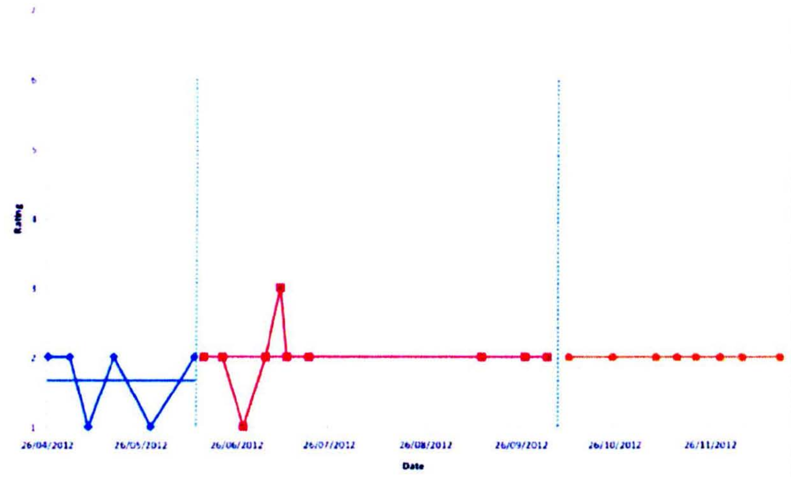
Graph 4.61 A line graph showing Child A's self-rating regarding his ability for learning new information across phase A and B.



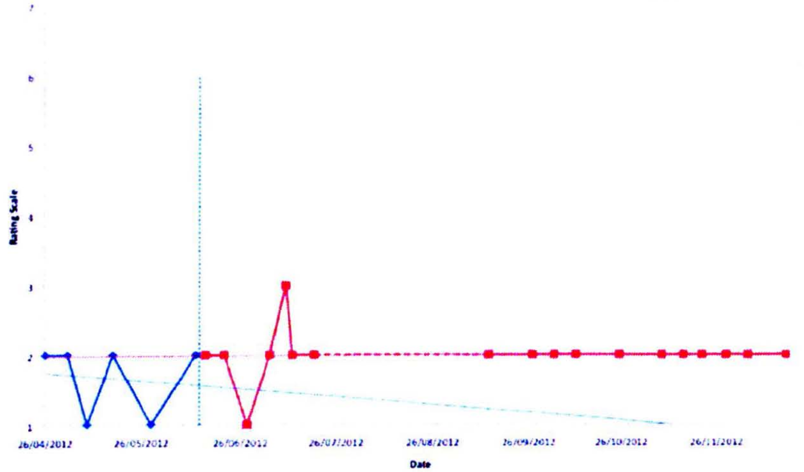
Graph 4.62 A line graph showing Child A's self-rating scores regarding his ability for learning new information across phase A, B1 and B2.



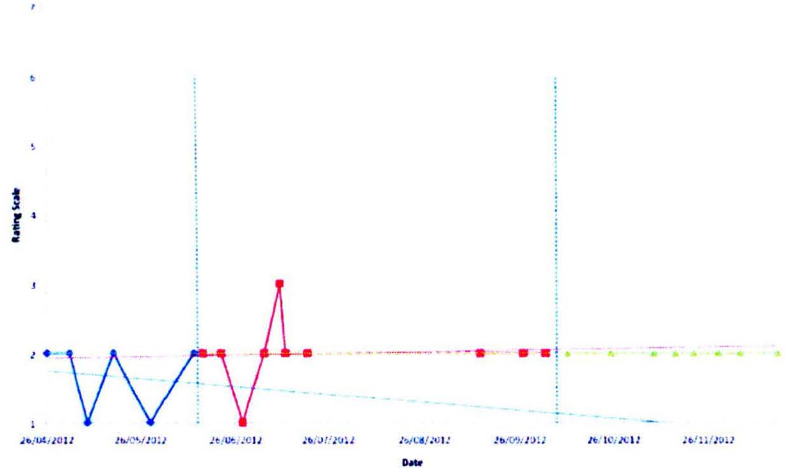
Graph 4.63 A line graph showing Child A's self-rating scores regarding his ability for learning new information with **mean scores** across A-B phases.



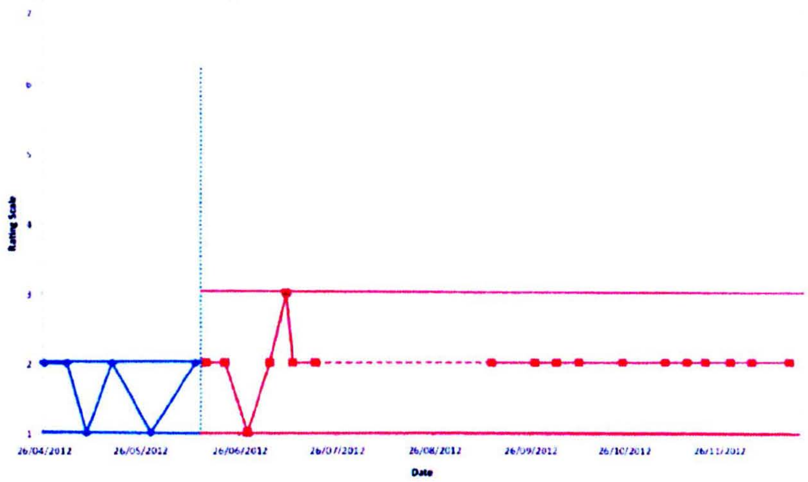
Graph 4.64 A line graph showing Child A's self-rating scores regarding his ability for learning new information with **mean scores** across A-B1-B2 phases.



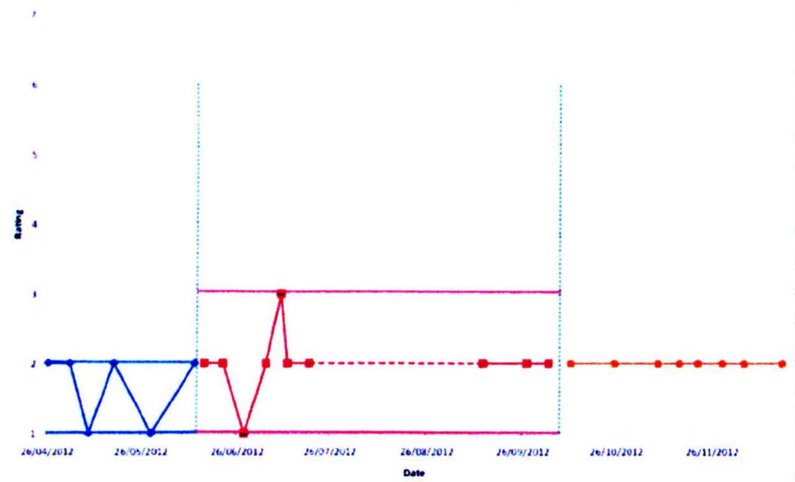
Graph 4.65 A line graph showing Child A's self-rating score regarding his ability for learning new information with **trend lines** across A-B phases.



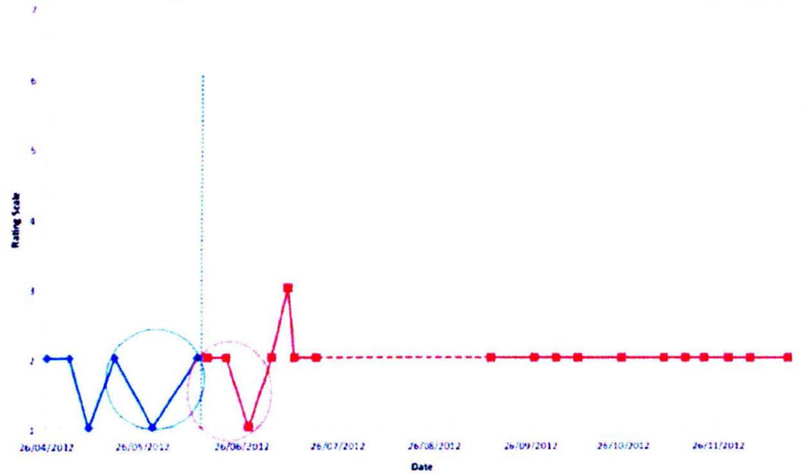
Graph 4.66 A line graph showing Child A's self-rating score regarding his ability for learning new information with **trend lines** across A-B1-B2 phases.



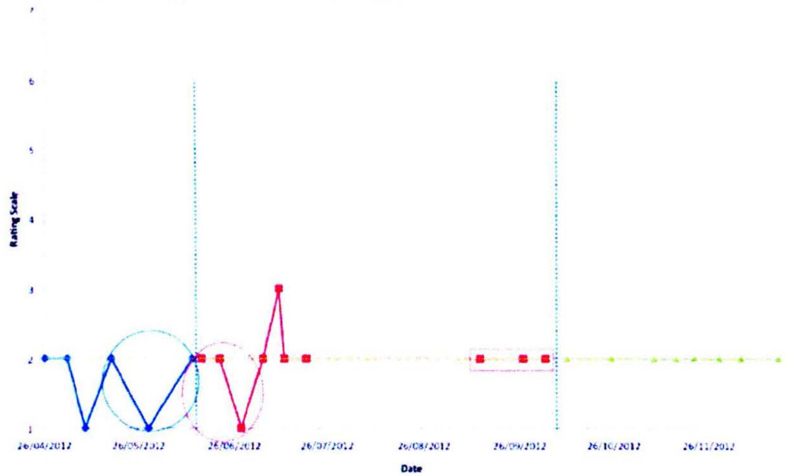
Graph 4.67 A line graph showing Child A's self-rating scores regarding his ability for learning new information with **variance lines** across A-B phases.



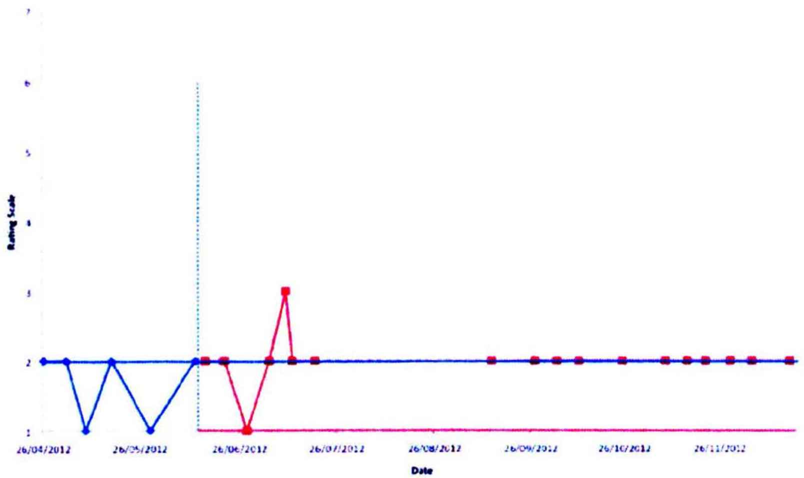
Graph 4.68 A line graph showing Child A's self-rating score regarding his ability for learning new information with **variance lines** across A-B1-B2 phases.



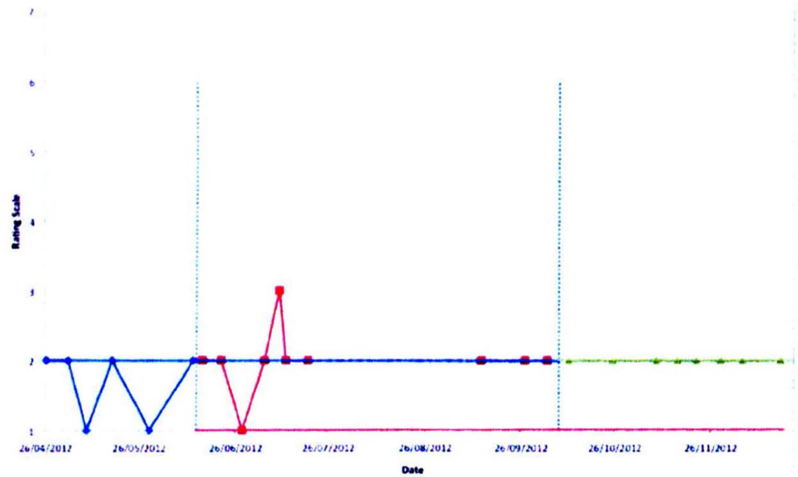
Graph 4.69 A line graph showing Child A's self-rating score regarding his ability for learning new information and **immediacy of effect** across A-B phases.



Graph 4.70 A line graph showing Child A's self-rating score regarding his ability for learning new information and **immediacy of effect** across A-B1-B2 phases.



Graph 4.71 A line graph showing Child A's self-rating score regarding his ability for learning new information and **overlap of data** across A-B phases.



Graph 4.72 A line graph showing Child A's self-rating score regarding his ability for learning new information and **overlap of data** across A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.63 shows phase A (1.67) as having a lower mean level than phase B (2). This shows an increase +0.33 shift mean self-rating score. Graph 4.64 shows B1 (2) and B2 (2) having the same mean level.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.65 shows phase A having a declining trend line and phase B's trend line is horizontal. Graph 4.66 shows B1 having a slight inclining trend line and B2 having a horizontal trend line.
Variability (*The range of data about the best fitting line*)	Graph 4.67 shows phase A to have some variability of data. Phase B shows a greater range of data points and variability. Graph 4.68 shows phase B1 with the same variability as phase A, and phase B2 without any variability.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.69 and Graph 4.70 shows no change in level between the last three data points of one phase and the first three data points of the next phase.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.71 shows the majority of data from phase B overlapping with phase A. Graph 4.72 also shows that the majority of data from phase B1 overlapping with phase A, and B2 data overlapping with phase B1.

Table 4.7 A table providing information regarding visual analysis of Child A's self-concept regarding ability to learn new information graphs.

4.2.4.4.1 Inter-Observed Agreement (IOA)

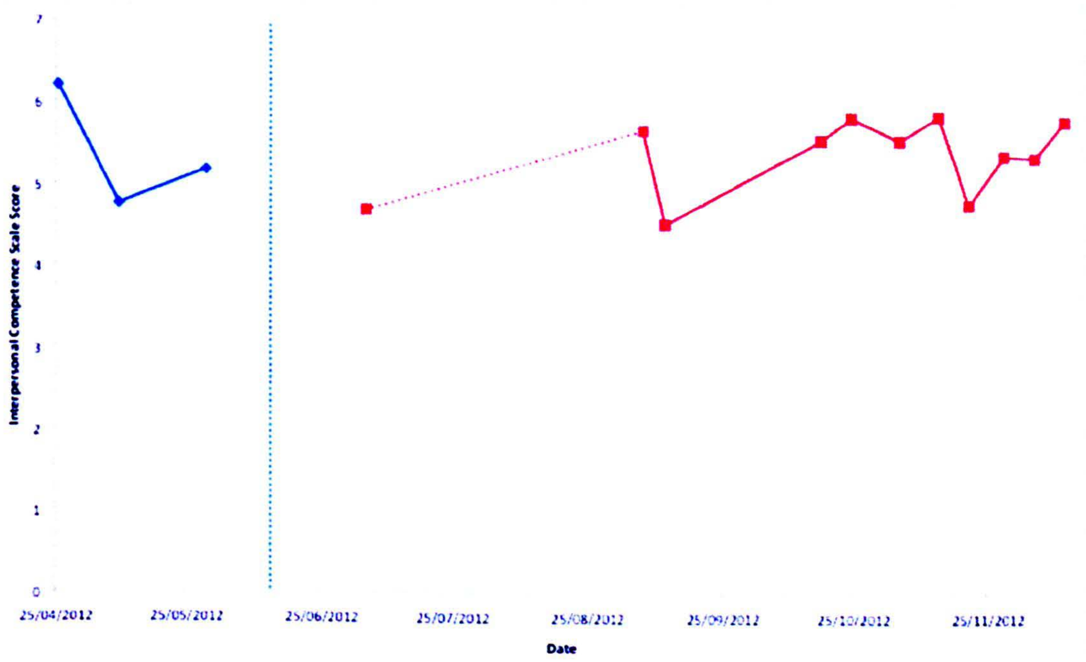
'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 40%

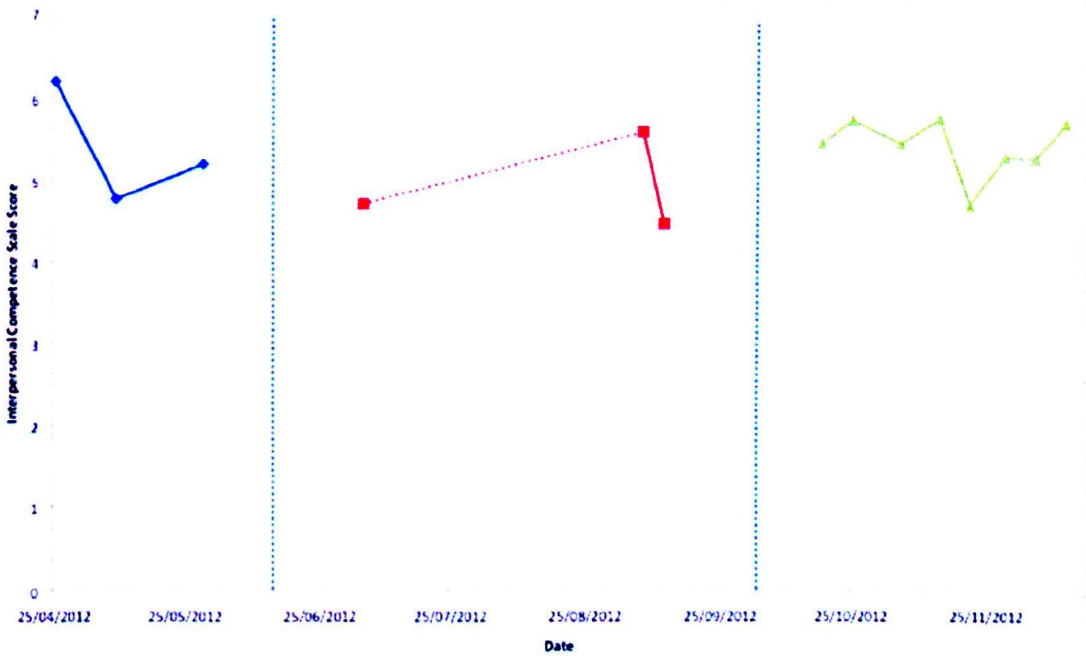
4.2.4.4.2 Summary (Child A)

The visual analysis of the line graphs regarding Child A's self-concept of their ability to learn new information does not show a clear effect when the intervention is introduced. There was minimal change between phase A and B in the majority of features analysed. When comparing across phase A, B1 and B2 there was less variance in phase B1 in comparison to the other phases. There is an indication that phase B2, with the intervention implemented consistently, has aided in Child A's stability regarding this concept.

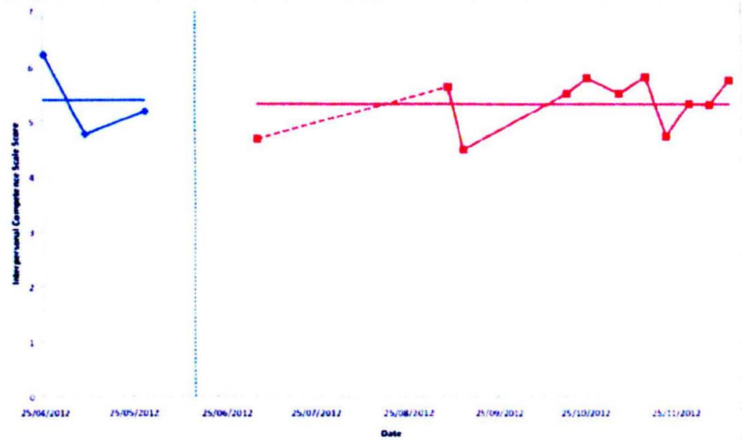
4.2.5 Single Case Experimental Design – Behaviour (Child A)

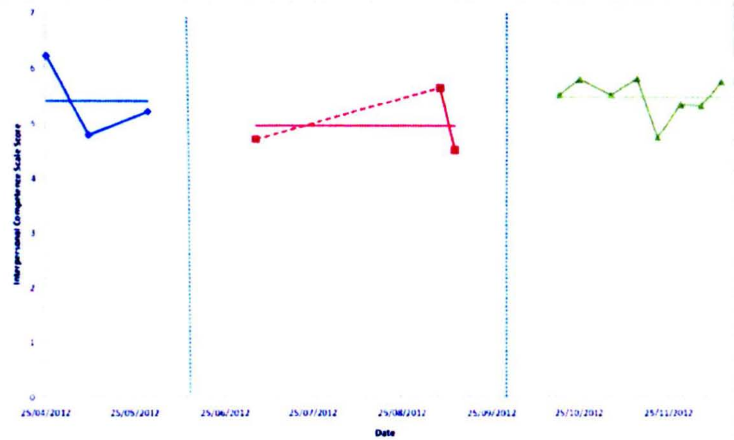


Graph 4.73 A line graph showing Child A's behaviour scores across phase A and B.



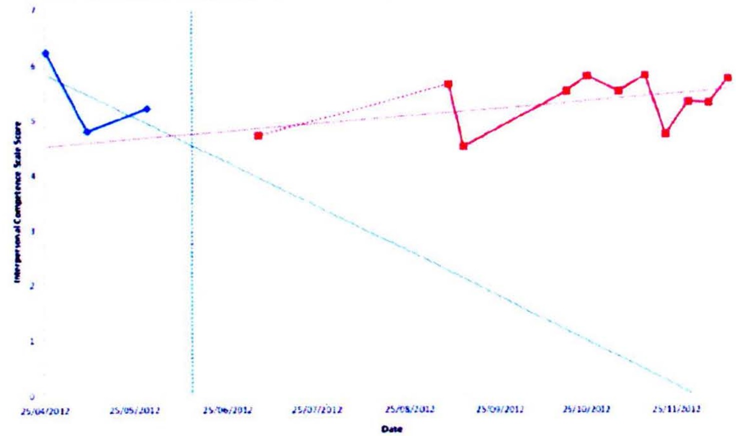
Graph 4.74 A line graph showing Child A's behaviour scores across phase A, B1 and B2.

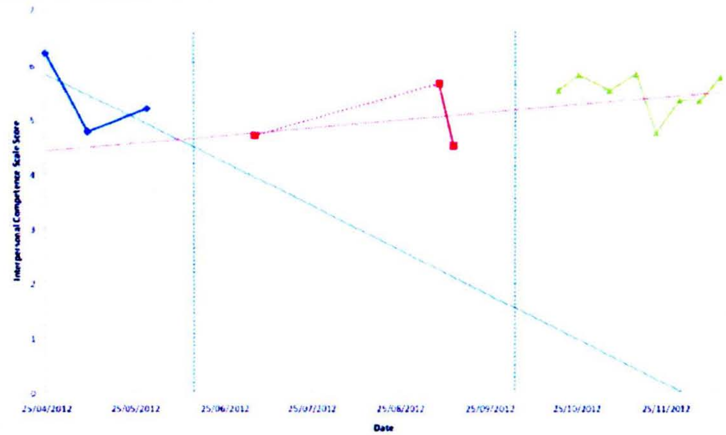




Graph 4.75 A line graph showing Child A's behaviour scores and **mean scores** across A-B phases.

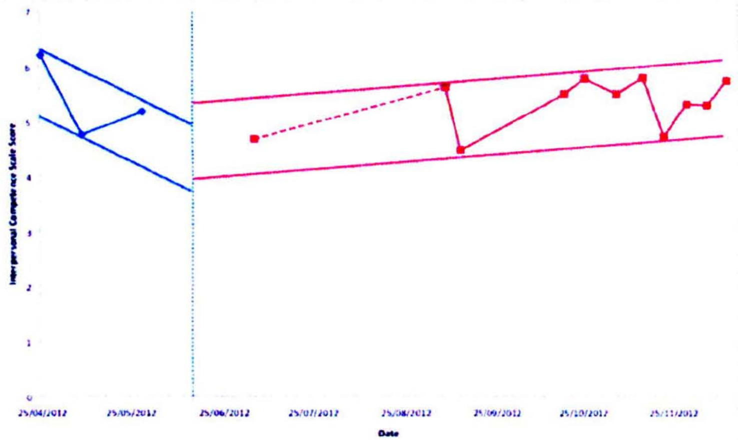
Graph 4. 76 A line graph showing Child A's behaviour scores and **mean scores** across A-B1-B2 phases.



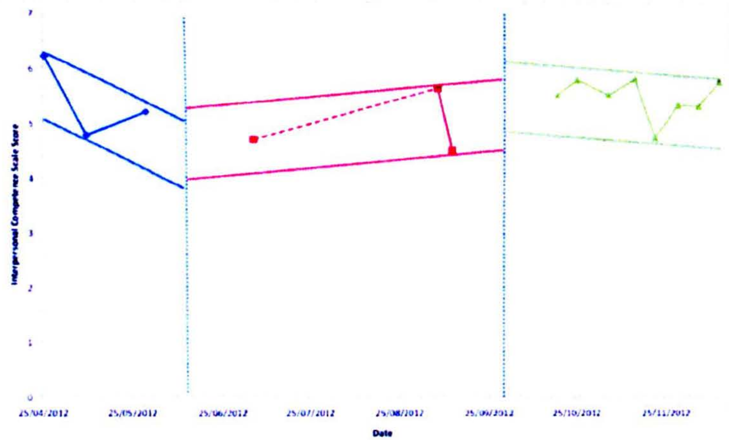


Graph 4.77 A line graph showing Child A's behaviour scores with **trend lines** across A-B phases.

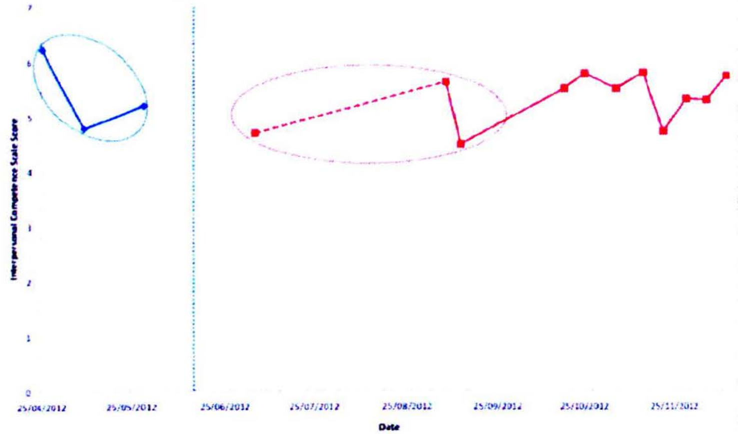
Graph 4.78 A line graph showing Child A's behaviour scores with **trend lines** across A-B1-B2 phases.



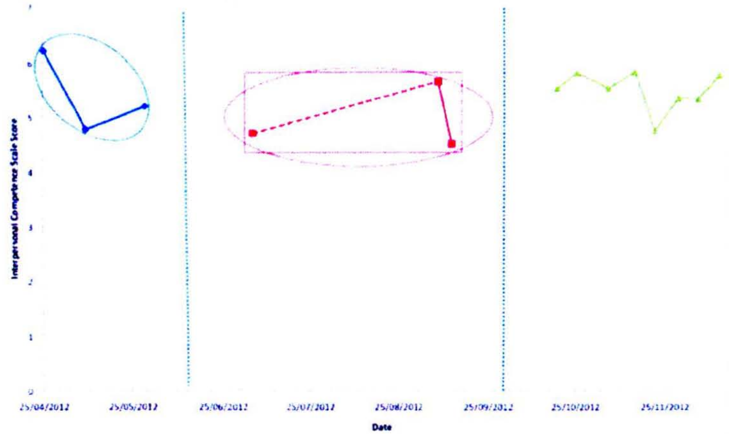
Graph 4.79 A line graph showing Child A's behaviour scores with **variance lines** across A-B phases.



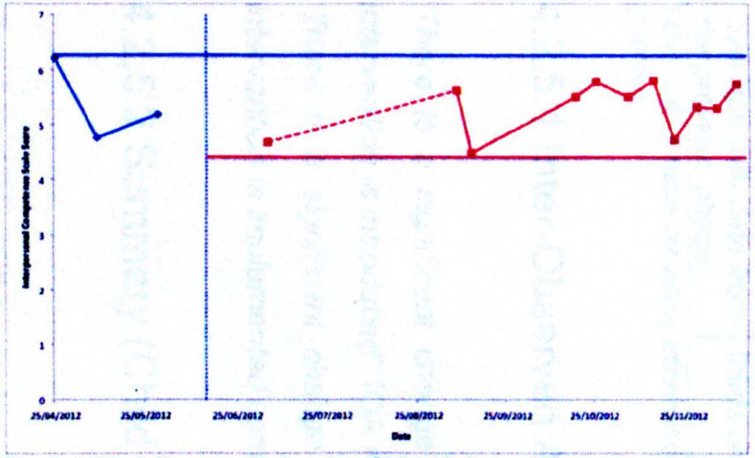
Graph 4.80 A line graph showing Child A's behaviour scores with **variance lines** across A-B1-B2 phases.



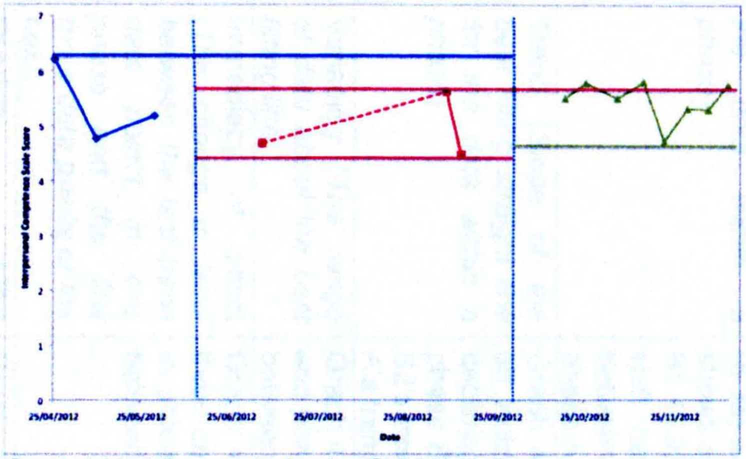
Graph 4. 81 A line graph showing Child A's behaviour scores and **immediacy of effect** across A-B phases.



Graph 4.82 A line graph showing Child A's behaviour scores and **immediacy of effect** across A-B1-B2 phases.



Graph 4.83 A line graph showing Child A's behaviour scores and overlap of data across A-B phases.



Graph 4.84 A line graph showing Child A's behaviour scores and overlap of data across A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.75 shows a similar mean level between phase A (5.38) and phase B (5.31), a slight -0.07 shift. Graph 4.76 shows similar mean levels between phase A (5.38), phase B1 (4.93) and phase B2 (5.46). This equates to a -0.45 shift between phase A and phase B1, a +0.53 shift between phase B1 and phase B2, and a +0.08 shift from phase A to phase B1.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.77 shows a declining trend line for phase A and an inclining trend line for phase B. Graph 4.78 shows a declining trend line for phase A, an inclining trend line for phase B1, and a declining trend line for phase B2. Phase B2's trend line has a slightly shallower decline than phase A's trend line.
Variability (*The range of data about the best fitting line*)	Graph 4.79 shows a similar variability between phase A and phase B. Graph 4.80 shows a similar level of variability between phase A, B1 and B2.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.81 shows little change in level between the last three data points in phase A and the first three data points in phase B. Graph 4.82 shows a slight increase in level between phase B1 and phase B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.83 shows all the data from phase B overlapping with phase A data. Graph 4.84 shows all of the data from phase B1 overlapping with phase A. Approximately two thirds of data in phase B2 overlaps with phase B1.

Table 4.8 A table providing information regarding visual analysis of Child A's behaviour scores graphs.

4.2.5.1 Inter-Observed Agreement (IOA)

'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 100%

4.2.5.2 Summary (Child A)

Visual analysis of the graphs across the various phases does not indicate an effect of the intervention on Child A's behaviour. There is limited change in the various features examined, with no clear indication of the intervention having an effect on Child A's behaviour.

4.2.6 Thematic Analysis of Staff Focus Group (Child A)

The thematic analysis of the staff focus group discussion regarding 'Child A and the precision teaching intervention' identified three *Main Themes* that emerged from the data.

- Self-Concept as a Learner
- Relationships
- Academic Attainment

4.2.6.1 Main Theme 1: Self-Concept as a Learner

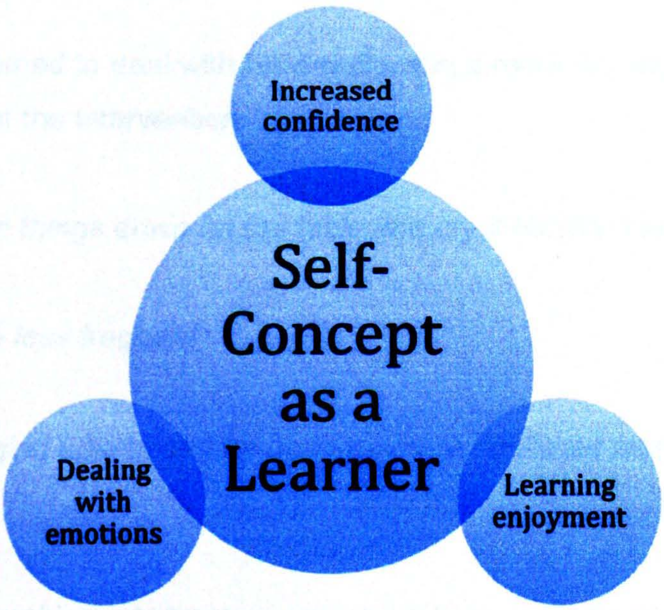


Figure 4. 1. Thematic map for *Self-Concept as a Learner* theme.

The focus group discussed how Child A's approach to learning had improved after the onset of the precision teaching intervention. This *Main Theme* related to Child A's approach to learning and general classroom behaviour that appear to improve due to his self-concept as a learning being developed. The *Main*

Theme consisted of *Sub-Themes* regarding the impact of the precision teaching and how it developed Child A's self-concept as a learner.

4.2.6.1.1 Sub-Theme 1: Increased Confidence

The discussion drew out a number of issues around Child A's confidence and approach to learning. It was felt that precision teaching helped to develop Child A's confidence in approaching tasks and undertaking activities that he may not have been secure in.

'It is ok not to know something'

'He takes on key roles in school plays'

4.2.6.1.2 Sub-Theme 2: Dealing with Emotions

Child A was deemed to deal with his emotions in a more appropriate manner after the onset of the intervention.

'He used to slam things down on the table and cry if he didn't know the answer'

'Melt-down's are less frequent'

'Better at managing upsets and he appears more confident that solutions can be found'

The precision teaching intervention appeared to support Child A's self-concept as a learner which meant that he felt less threatened by certain tasks and activities. There was a general sense from the discussion that Child A had a greater emotional stability, possibly as his self-esteem was less threatened by more testing circumstances.

4.2.6.1.3 Sub-Theme 3: Learning Enjoyment

Child A appeared to show greater enjoyment with learning in precision teaching sessions and other learning activities. He was more likely to engage in learning activities.

'Comes straight over for precision teaching sessions'

'Happier to read out in front of class'

Child A's learning enjoyment appeared to be entwined with his self-concept as a learner. He was keen to engage in the precision teaching sessions and he also showed greater enthusiasm in participating in other learning activities.

4.2.6.2 Main Theme 2: Relationships

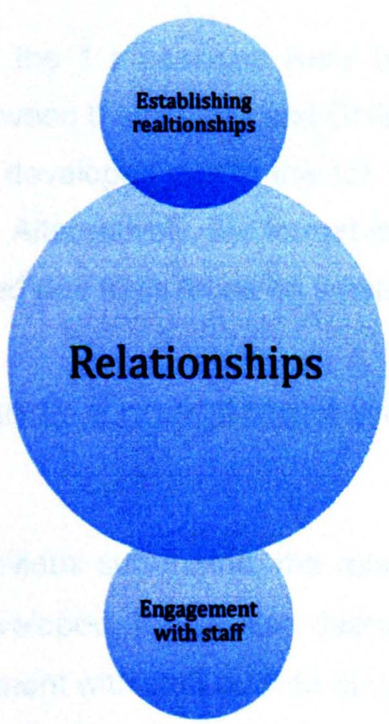


Figure 4.2 Thematic map for *Relationships* theme.

Relationships emerged as a main theme from the focus group discussion as sessions were perceived to allow a relationship to be built between staff and Child A that was not apparent prior to the intervention. The relationship may have developed positively due to the precision teaching intervention recognising small steps of progress made and ensuring that the child will succeed through careful monitoring of the intervention. The recognition of success may have helped foster a positive relationship to emerge. Two sub-themes were identified that contributed to the overall theme of relationships.

4.2.6.2.1 Sub-Theme 1: Establishing Relationships

As discussed previously, the relationship between Child A and staff was deemed to positively improve due to the intervention sessions.

'It *fostered better relationships through 1:1 work with staff'*

'The sessions established trust with staff'

The focus group felt that the 1:1 sessions were the primary reason for the relationship to improve between themselves and Child A. It could be argued that the relationship may have developed due to the 1:1 session, irrespective of the precision teaching format. Alternatively, the format may have allowed a positive relationship to be developed due to its focus on small steps and success.

4.2.6.2.2 Sub-Theme 2: Engagement with Staff

As discussed with the previous sub-theme, the relationship between staff and Child A had positively developed. It was also deemed that this also positively affected Child A's engagement with staff outside of the sessions.

'He was more chatty and jokey'

'Willingness to listen and take on board advice'

The positive relationship that had developed between Child A and staff appeared to have had an effect on their general engagement in the classroom. Child A was reported to be more willing to engage the staff in task related talk and general discussion. The intervention may have allowed trust to develop between Child A and staff, and possibly developed Child A's sense of self-worth.

4.2.6.3 Main Theme 3: Learning

Figure 4.3 Thematic map for *Learning* theme.

Child A was deemed to have made improvements in learning after the onset of the precision teaching intervention. *Learning* was defined in this instance as the improvements in curriculum activities. This was broken down into two sub-themes that contributed to the overarching *learning* theme.

4.2.6.3.1 Sub-Theme 1: Generalisation of Learning

The intervention appeared to support Child A's learning in other areas of the curriculum. Child A was found to engage better in tasks that were the same and different to the specific focus of the intervention.

'Boost with spellings, previously writing random words'

'Improvements with literacy and numeracy'

The intervention appeared to have had an impact on Child A's ability to undertake other curriculum related activities, possibly due to the generalisation of the skills learnt in the precision teaching sessions.

4.2.6.3.2 Sub-Theme 2: Accelerated Learning

The focus group identified an impact on the learning of basic skills. It was felt that as well as generalising to other areas of the curriculum the intervention had an accelerating effect on Child A's learning.

'Gone on an upward trend with learning'

'Accelerated learning'

4.2.6.4 Thematic Analysis Interrater Reliability (Child A)

An interrater reliability of 71% was obtained when a reliability check of the themes was undertaken. This is slightly below the 75% recommended by Joffe (2011) for a reliable coding frame. However, the researcher asserts that the secondary observer did not have the full context of the data extracts, and was not privy to the thematic analysis process, therefore accounting for some of the variance seen.

4.2.6.5 Summary of Thematic Analysis Information (Child A)

The three themes identified from the focus group are intertwined but demonstrate important factors that staff felt were related to the intervention. The common thread that runs throughout the themes is the positive impact that the precision teaching intervention was perceived to have had on Child A. It appeared to lead to positive outcomes in terms of learning and development through the establishment of the child's self-concept as a learner and their relationships with staff.

4.2.7 Summary of Child A's Findings

The single case experimental design measures showed improvements in the individual word reading when the intervention was implemented consistently. An effect was also present in the passage word reading measure when the precision teaching was implemented consistently. The affect measures showed no clear effect of the intervention. The self-rating scale that explored being good at reading showed a more consistent pattern of responding when the intervention was consistently implemented suggesting a more stable self-concept in this area. Child A's enjoyment at learning new things declined at the onset of the intervention but subsequently returned to the baseline level. The behaviour measure did not indicate any intervention effect.

The thematic analysis suggests that there had been a positive impact on the child based on staff's perceptions. In particular, their self-concept as learner was perceived to improve and Child A showed a more positive approach to learning. Child A's relationships with staff developed positively and this impacted on their relationship not only in the intervention session but also in general classroom interactions. The final theme that emerged indicated that Child A's learning had improved in the area focused on in the intervention and also generalised into other areas of the curriculum.

4.3 Case Study 2

4.3.1 Child B Profile

Sex: Male Age: 10.1 years (at onset of research project)

Child B has a diagnosis of autism. Child B has particular difficulties with social skills and interaction with others. He is reported by school staff to sometimes display behavioural issues such as refusing to take part in activities, and reportedly can sometimes exhibit 'silly' and disruptive behaviour. Also, it is reported that Child B can experience high anxiety levels, and low confidence and self-esteem. He also lacks certain skills in regards to independent and self-help skills, requiring support with toileting and dressing. Child B had previous Speech and Language Therapy service involvement as there were difficulties with his receptive and expressive language, although he has now been discharged from this service. Child B displays particular difficulties with basic skills such as literacy and numeracy and currently attends a primary special school that caters for pupils with a wide range of learning difficulties.

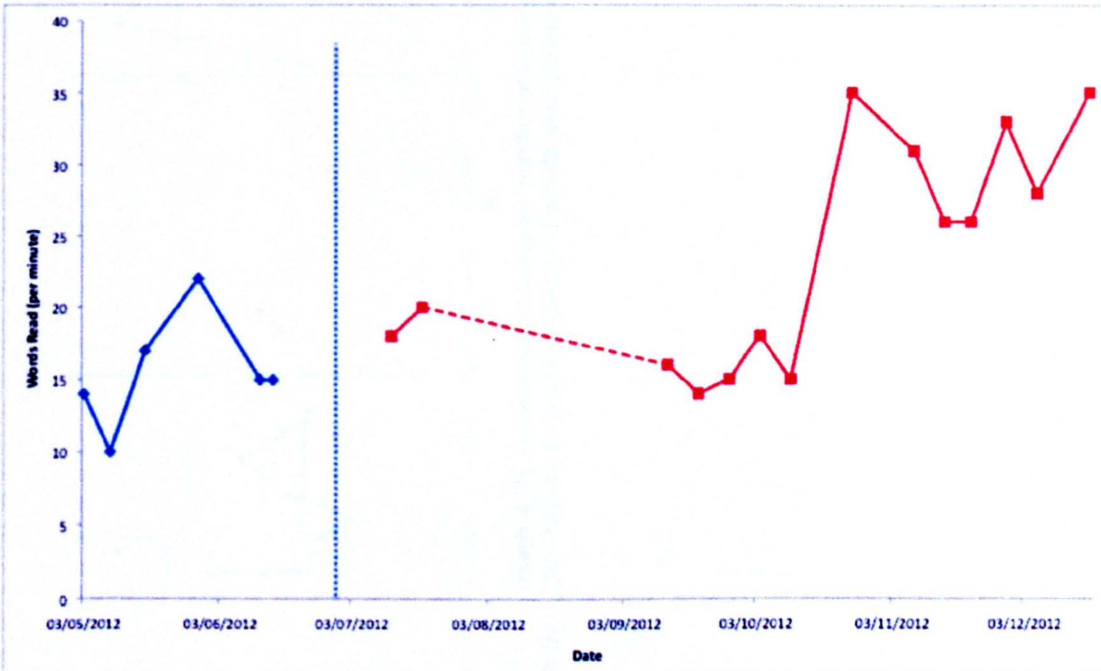
4.3.2 Assessment of a 'Structured Approach' to Learning

Structured Teaching		
Structured Environment	Routines	Activities in class are kept as consistent as possible. There are routines for transitioning between activities and within activities.
	Physical structure	Child B has a particular seat that he sits on when in class. He sits on a table with other pupils for the majority of the activities that he undertakes. The classroom is arranged to ensure clear physical and visual boundaries.
	Visual schedules and timetables	There is a class visual timetable that is referred to at the start of the day and throughout the day. Child B does not have an individual timetable as it is deemed by class staff that he is able to follow the class timetable.
	Work systems	Child B does not have an individual work system to complete class work. Child B is able to undertake class work in a small group setting without the need for additional supports such as work systems.
	Visual structure	Key concepts are presented visually by the class teacher. Child B has some tasks presented visually but also has tasks presented orally. Instructions are presented with visual clarity, e.g. left to right. The classroom has visual symbol labels for classroom objects. Class rules are also presented visually, along with reward and sanction systems.
Curriculum	Differentiated	Class work is differentiated to meet the learning needs of the child. Pupils undertake structured assessments to ensure appropriate differentiation.
Behaviour Approaches	There are a number of systems in place to manage behaviour. There is a visual points system for good work and following rules. There is a tick board for good behaviour. Also, there is a separate behaviour chart presented visually in a hierarchical fashion for undesirable behaviour. Pupils are also able to express their feelings and place their names on a visual feelings thermometer. Staff try to maintain a calm environment, and behaviour difficulties are dealt with by a calm but assertive approach. Pupils are also able to access a time-out space when they have become distressed. Child B can display anxious behaviour, the above strategies and structured approaches are used to manage his behaviour.	

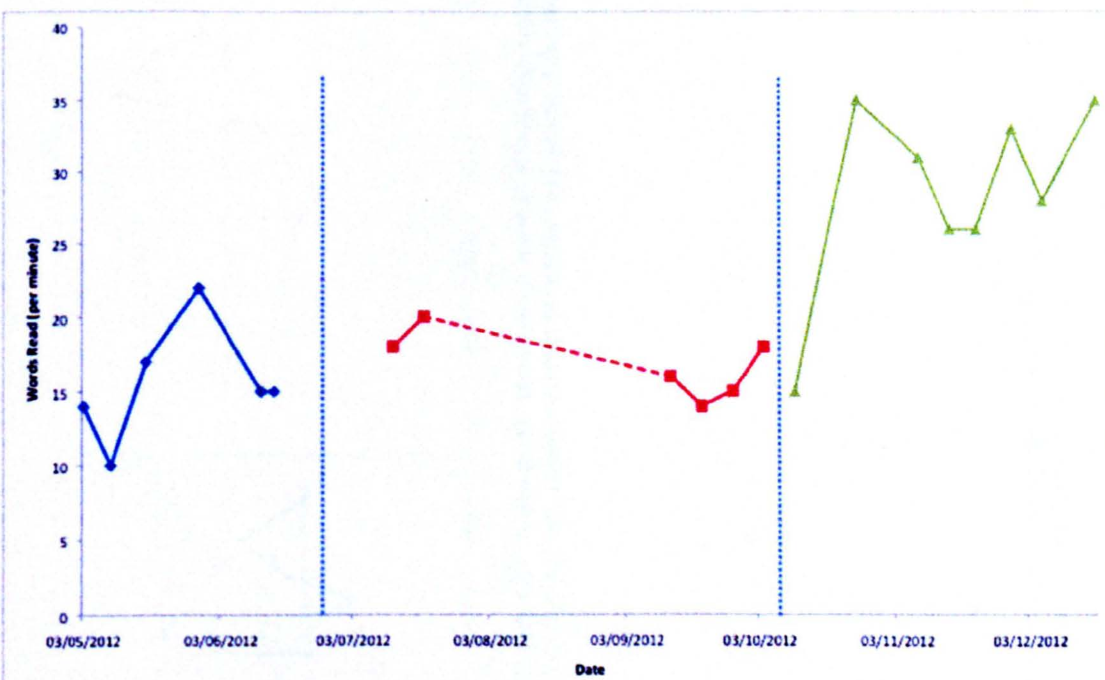
Table 4.9 A table showing the features of a 'structured approach' for Child B.

4.3.3 Single Case Experimental Design – Learning

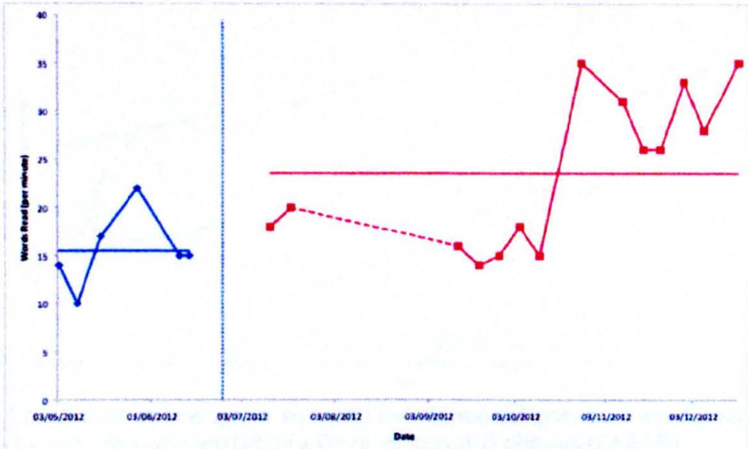
4.3.3.1 Number of Individual Words Read (per minute) (Child B)



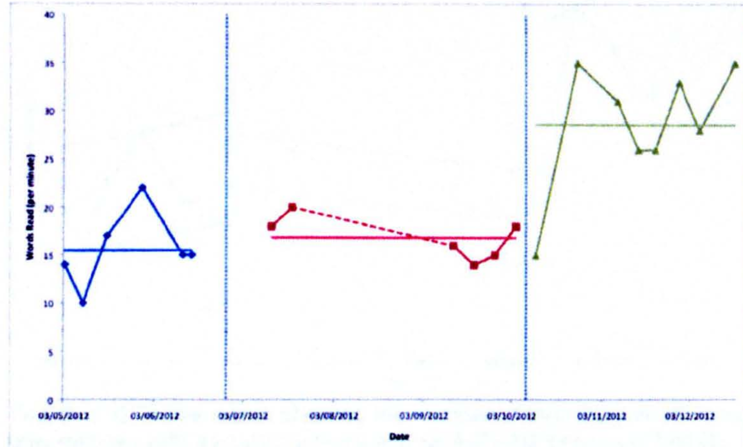
Graph 4.85 A line graph showing the number of individual words read (per minute) across A and B phases (Child B).



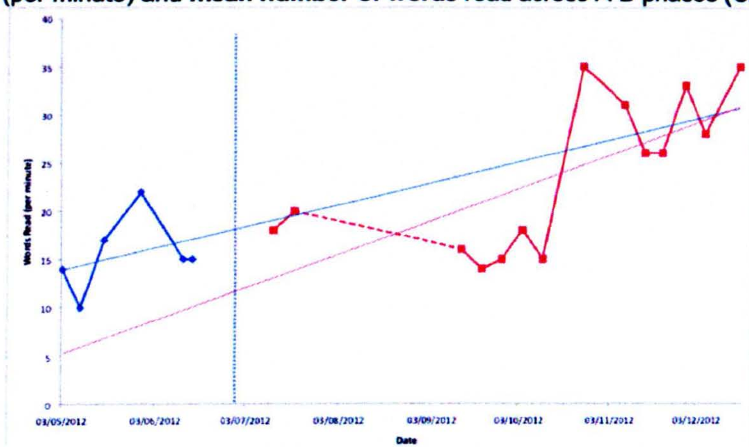
Graph 4.86 A line graph showing the number of individual words read (per minute) across A, B1, and B2 phases (Child B).



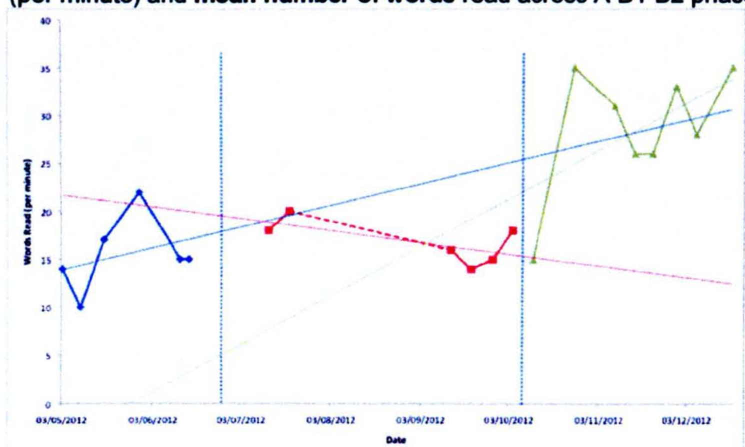
Graph 4.87 A line graph showing the number of individual words read (per minute) and **mean number of words** read across A-B phases (Child B).



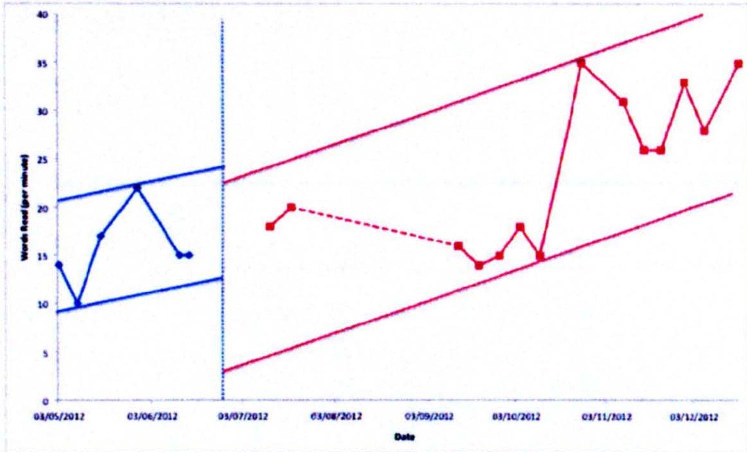
Graph 4.88 A line graph showing the number of individual words read (per minute) and **mean number of words** read across A-B1-B2 phases (Child B)



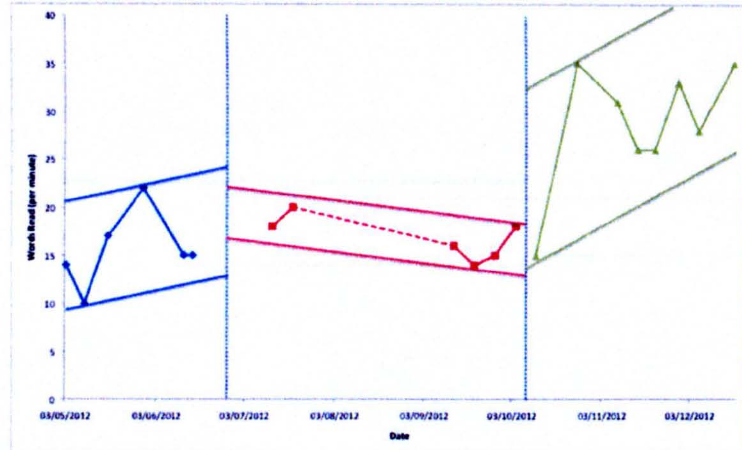
Graph 4.89 A line graph showing the number of individual words read (per minute) with **trend lines** across A-B phases (Child B).



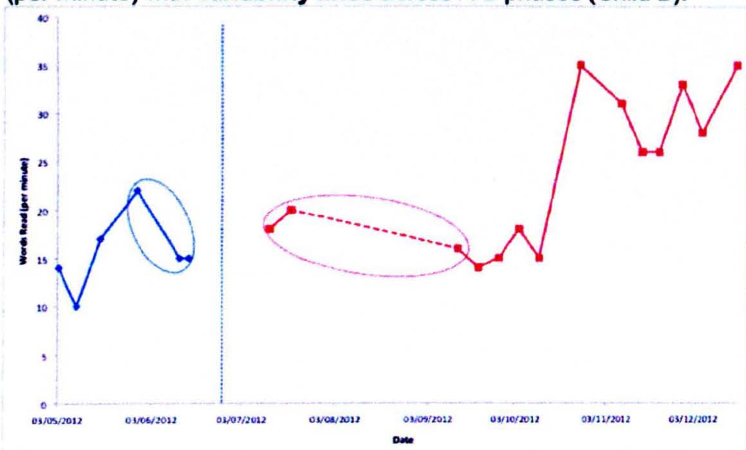
Graph 4.90 A line graph showing the number of individual words read (per minute) with **trend lines** across A-B1-B2 phases (Child B).



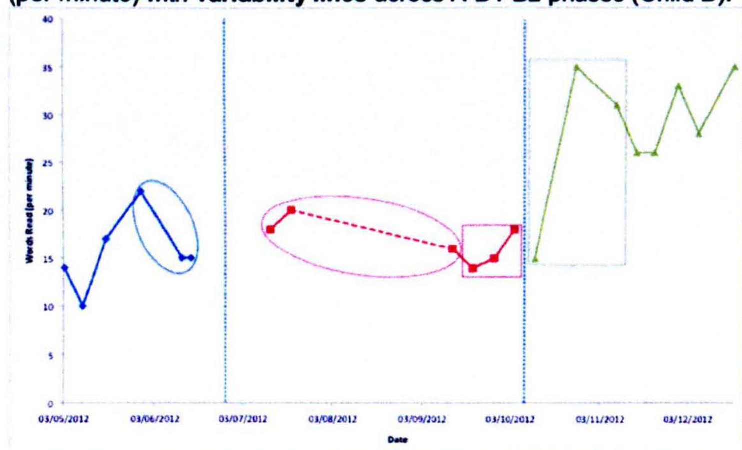
Graph 4.91 A line graph showing the number of individual words read (per minute) with **variability lines** across A-B phases (Child B).



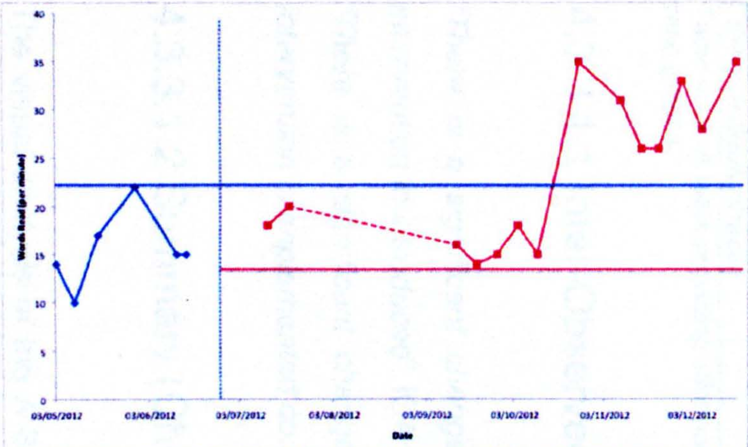
Graph 4.92 A line graph showing the number of individual words read (per minute) with **variability lines** across A-B1-B2 phases (Child B).



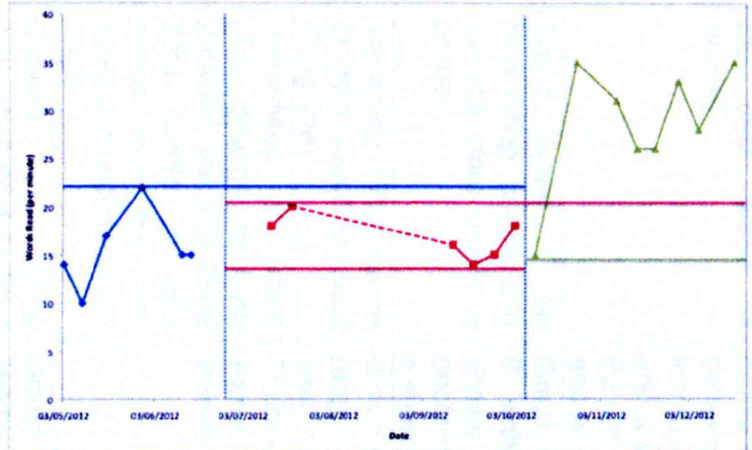
Graph 4.93 A line graph showing the number of individual words read (per minute) and **immediacy of effect** across A-B phases (Child B).



Graph 4.94 A line graph showing the number of individual words read (per minute) and **immediacy of effect** across A-B1-B2 phases (Child B).



Graph 4.95 A line graph showing the number of individual words read (per minute) and **overlap between data points** of phase A and B (Child B).



Graph 4.96 A line graph showing the number of individual words read (per minute) and **overlap between data points** of phase A, B1 and B2 (Child B)

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.87 shows a large increase in mean between phase A (15.5) and B (23.57). This equates to a +8.07 shift between phase A and B. Graph 4.88 shows a small increase in mean between phase A (15.5) and B1 (16.83), and a substantial increase between phase B1 (16.83) and B2 (28.63). This equates to a +1.33 shift between phase A and B1, and a +11.8 shift between phase B1 and B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.89 shows an inclining trend line for phase A and B, with both lines meeting at similar points. Graph 4.90 shows inclining trend lines for phase A and B2, and a declining trend line for phase B1. Phase B2's trend line has a steeper incline.
Variability (*The range of data about the best fitting line*)	Graph 4.91 shows phase A and phase B with a fairly large range of data. Graph 4.92 shows phase B1 to have a fairly small variability and phase B2 with a large variability.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	There is limited change in level between phase A and B as shown in graph 4.93. Graph 4.94 shows a definite change in level between phase B1 and B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.95 shows 50% of the data points in phase B overlapping with phase A. Graph 4.96 shows all of the data from phase B1 overlapping with phase A. Phase B2 has only one data point overlapping with phase B1.

Table 4.10 A table providing information regarding visual analysis of Child B's individual words read graphs.

4.3.3.1.1 Inter-Observed Agreement (IOA)

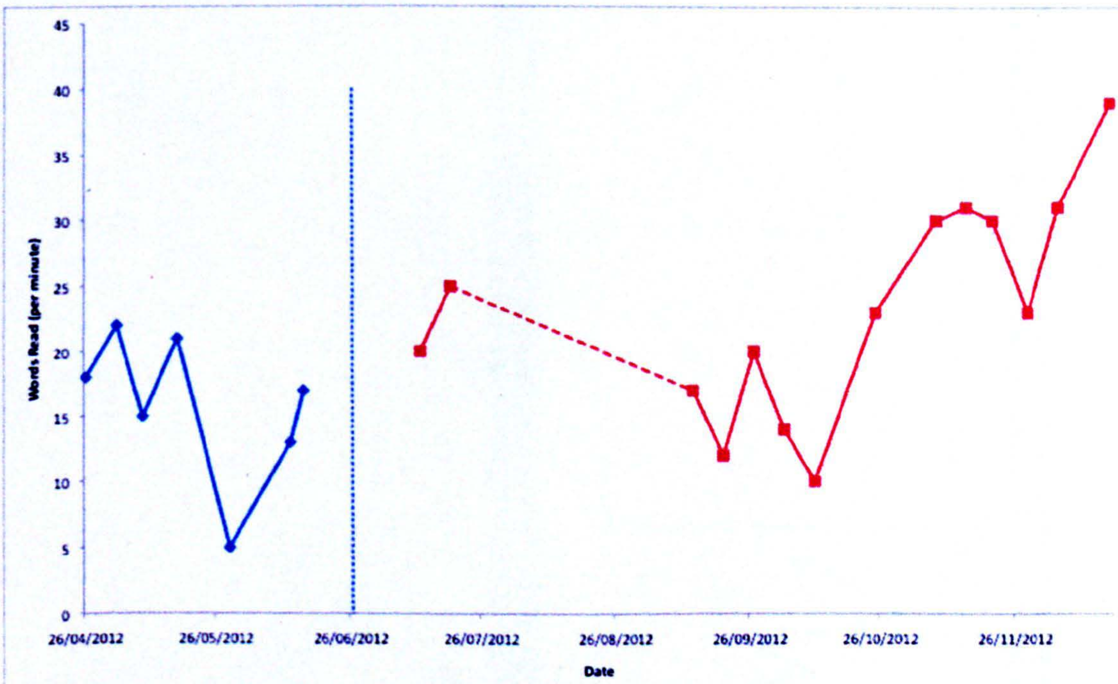
'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 88%

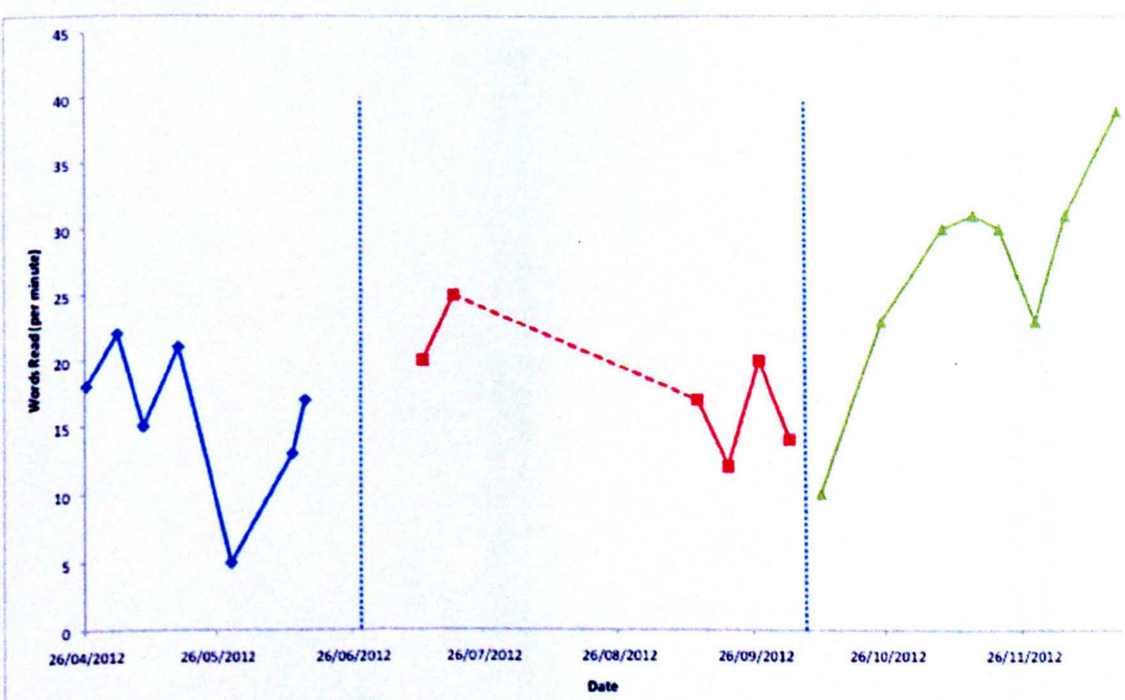
4.3.3.1.2 Summary (Child B)

The visual analysis of the A-B design regarding individual word reading does not indicate an intervention effect. The mean level does increase substantially from phase A to phase B but the trend lines, immediacy of effect and overlap of data does not suggest a definite effect. When explored as an A-B1-B2 design there is more compelling evidence to suggest an effect when the intervention was implemented consistently. There is only a small positive change in mean between phase A and B1. However, there is a large change in mean between phase B1 and B2. The trend line for phase B2 indicates an increasing trend, and there is a significant change in level between phase B1 and B2, with the majority of data points in phase B2 not overlapping with the previous phase. The graphs indicate an intervention effect when the intervention is implemented consistently.

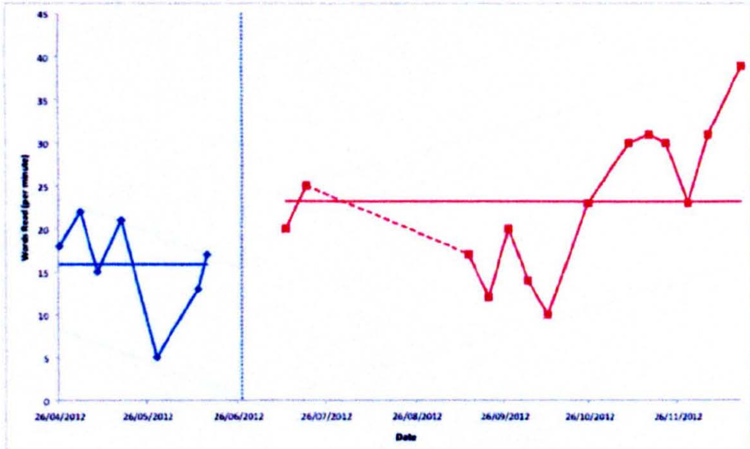
4.3.3.2 Number of Passage Words Read (per minute) (Child B)



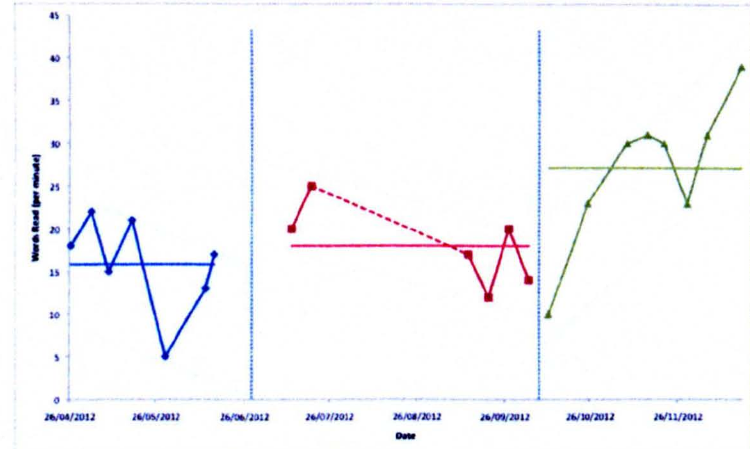
Graph 4.97 A line graph showing the number of words read in a passage (per minute) across phase A and B.



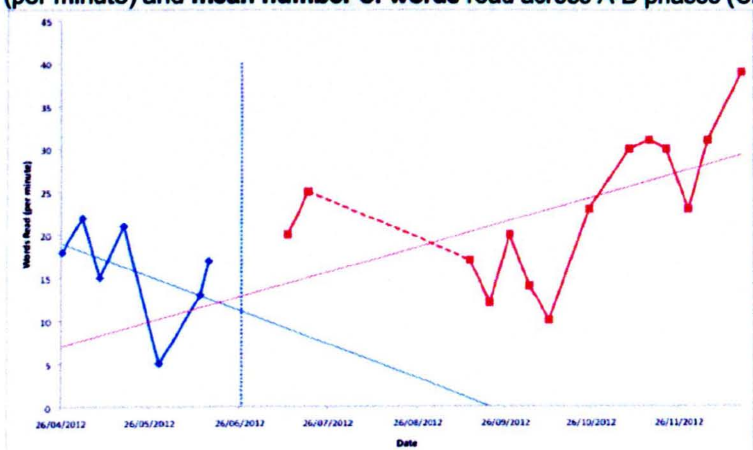
Graph 4.98 A line graph showing the number of words read in a passage (per minute) across phase A, B1, and B2.



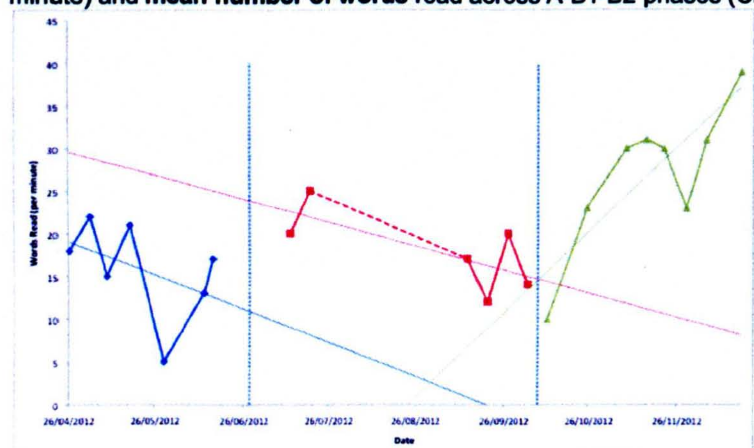
Graph 4.99 A line graph showing the number of words read in a passage (per minute) and **mean number of words** read across A-B phases (Child B).



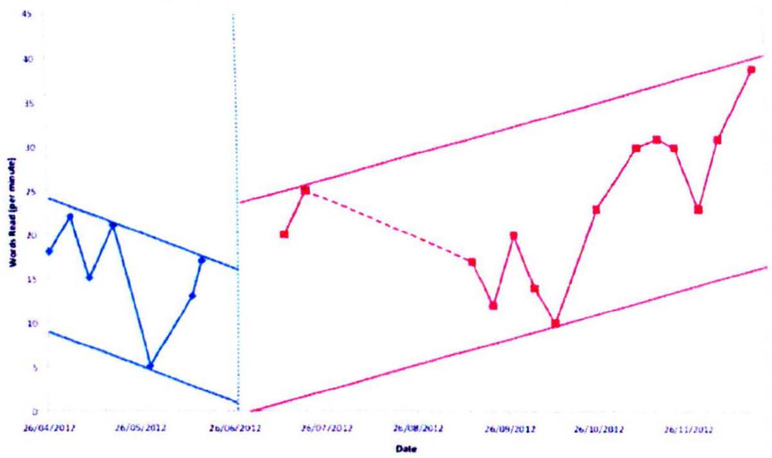
Graph 4.100. A line graph showing the number of words read in a passage (per minute) and **mean number of words** read across A-B1-B2 phases (Child B).



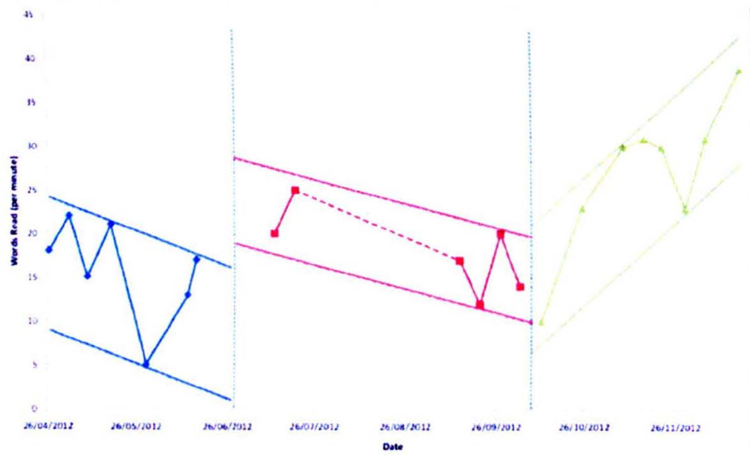
Graph 4.101 A line graph showing Child A's self-rating score regarding his ability for learning new information with **trend lines** across A-B phases.



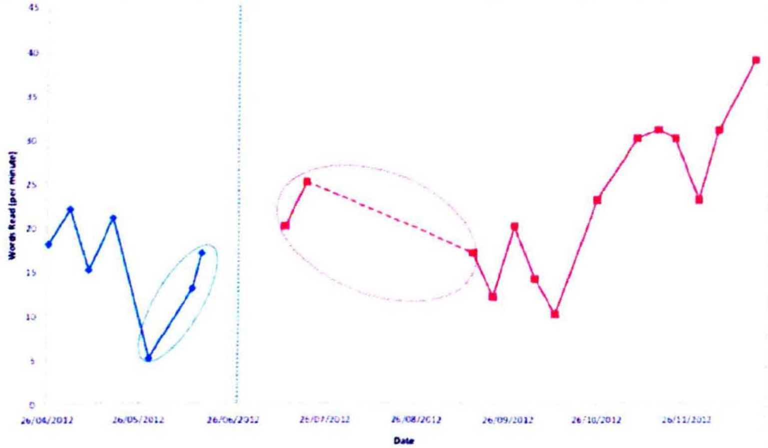
Graph 4.102 A line graph showing Child A's self-rating score regarding his ability for learning new information with **trend lines** across A-B1-B2 phases.



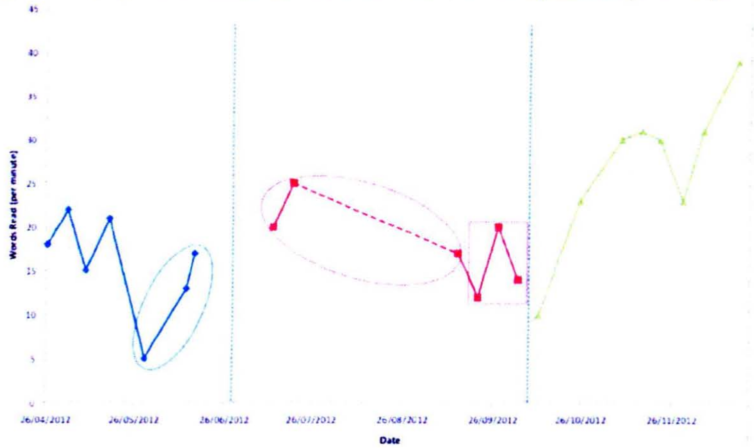
Graph 4.103 A line graph showing the number of words read in a passage (per minute) with **variance lines** across A-B phases (Child B).



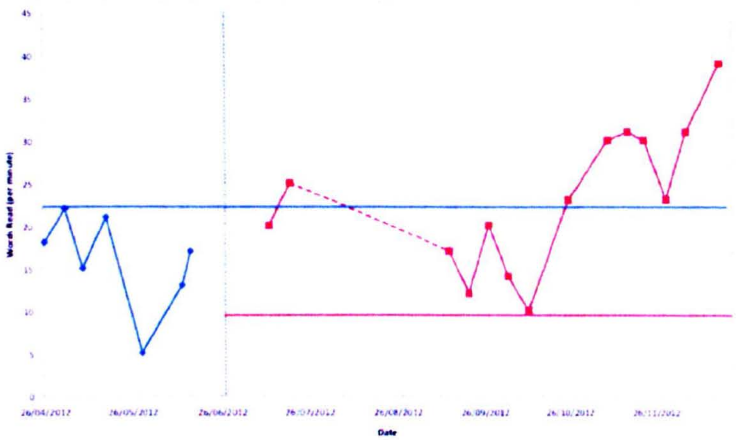
Graph 4.104 A line graph showing the number of words read in a passage (per minute) with **variance lines** across A-B1-B2 phases (Child B).



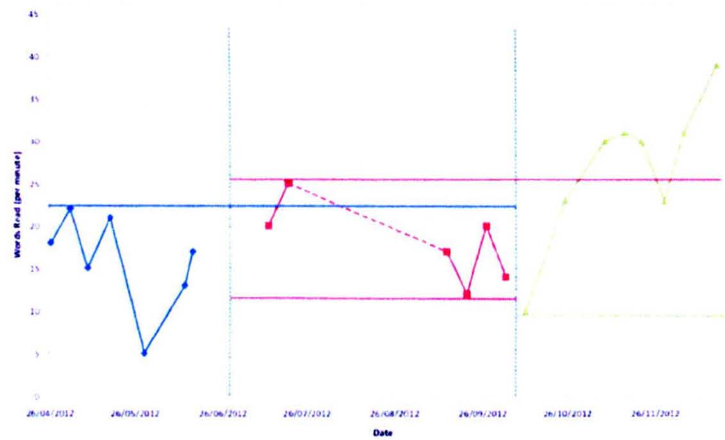
Graph 4.105 A line graph showing the number of words read in a passage (per minute) and **immediacy of effect** across A-B phases (Child B).



Graph 4.106 A line graph showing the number of words read in a passage (per minute) and **immediacy of effect** across A-B1-B2 phases (Child B).



Graph 4.107 A line graph showing the number of words read in a passage (per minute) and **overlap between data points** of phase A and B (Child B).



Graph 4.108 A line graph showing the number of words read in a passage (per minute) and **overlap between data points** of phase A, B1 and B2 (Child B).

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.99 shows a fairly large change in mean between phase A (15.86) and phase B (23.21). This equates to a +7.35 shift in mean between phases. Graph 4.100 shows a small change in mean between phase A (15.87) and phase B1 (18), and a larger change between phase B1 (18) and phase B2 (27.13). This equates to a +2.13 shift between phase A and phase B1, and a +9.13 shift between phase B1 and phase B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.101 shows a downward trend for phase A and an upward trend for phase B. Graph 4.102 shows a downwards trend for phase A and phase B1, and an upwards trend for phase B2.
Variability (*The range of data about the best fitting line*)	Graph 4.103 shows a fairly large range of data for phase A and a larger range for phase B. Graph 4.104 shows a smaller range of data for phase B1 and B2 than phase A.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.105 shows an immediate impact of the intervention from phase A to B. However, the last three data points in phase A were going in an upward trend. Graph 4.106 shows a slight change in level between phase B1 and B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Approximately 50% of data is overlapped between phase A and B (Graph 4.107). Graph 4.108 shows the majority of data from phase B1 overlapping with phase A. Phase B2 has approximately a third of data overlapping with phase B1.

Table 4.11 A table providing information regarding visual analysis of Child B's words read in a passage graphs.

4.3.3.2.1 Inter-Observed Agreement (IOA)

'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

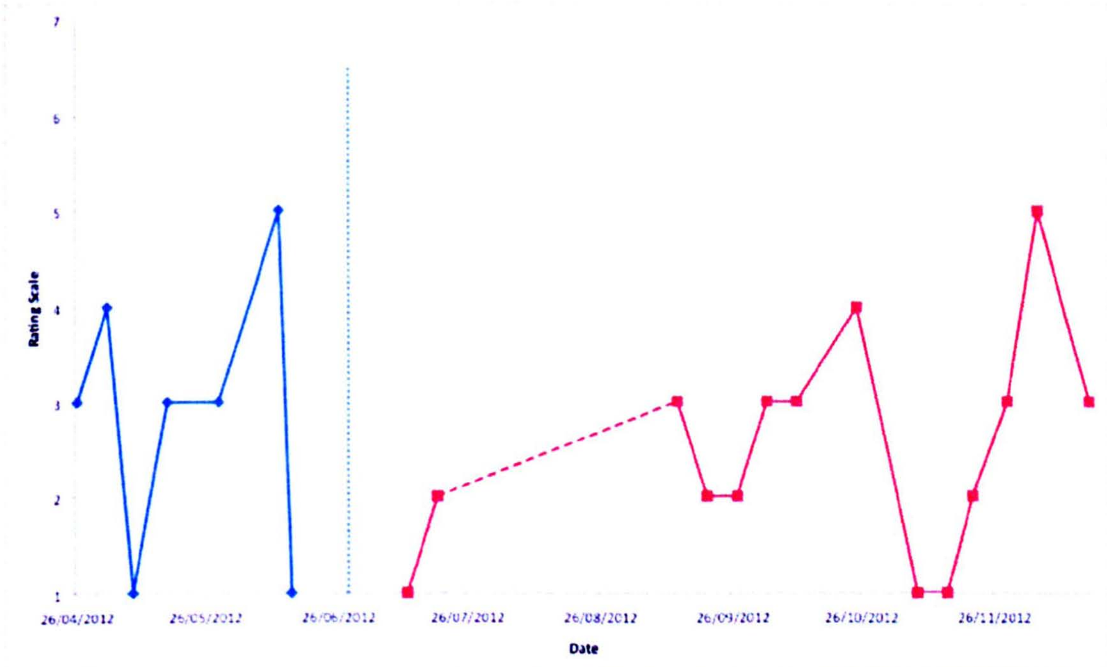
'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 88%

4.3.3.2.2 Summary (Child B)

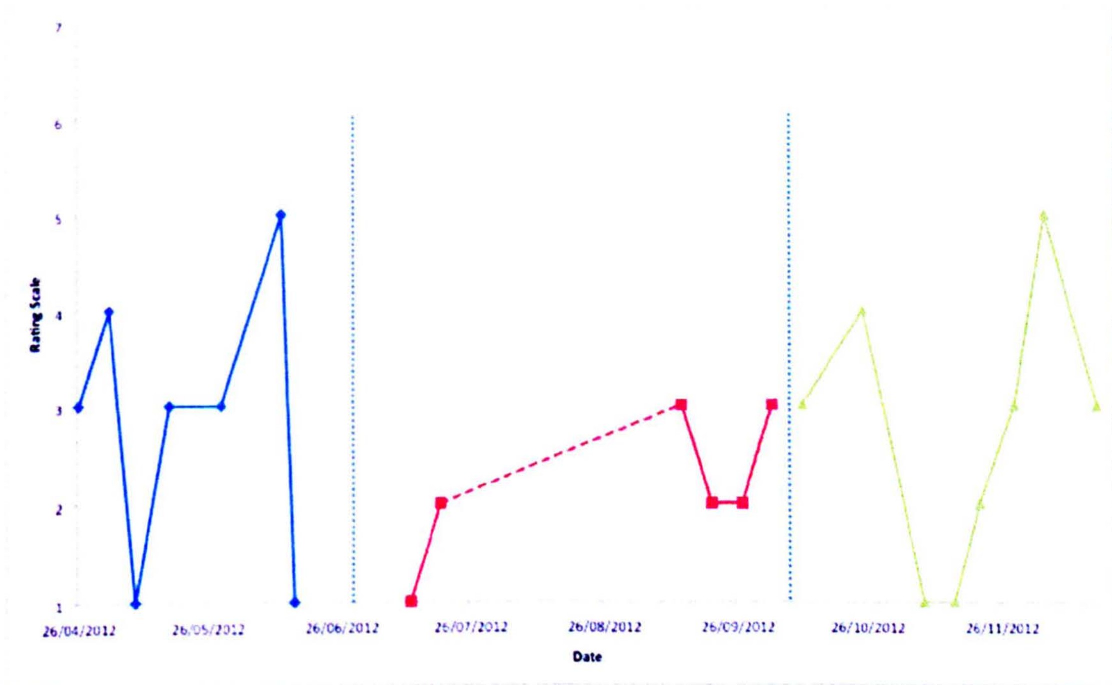
Visual analysis of Child B's passage word reading across baseline and intervention phases suggests an effect. This effect is less apparent when examined as an A-B design as the features that indicate an effect are enhanced by the data at the end of the phase when the intervention was implemented more consistently. Examined as an A-B1-B2 design, phase B2's mean is substantially larger than phase B1, there is an upwards trend for phase B2 in contrast to the downwards trend of phase A and B1, and the variability of phase B2 is relatively small. Phase B2 also appears to show an effect at the start of the phase, and has a limited amount of overlap with the previous phase. The visual analysis indicates an intervention effect when precision teaching is implemented consistently.

4.3.4 Single Case Experimental Design – Affect

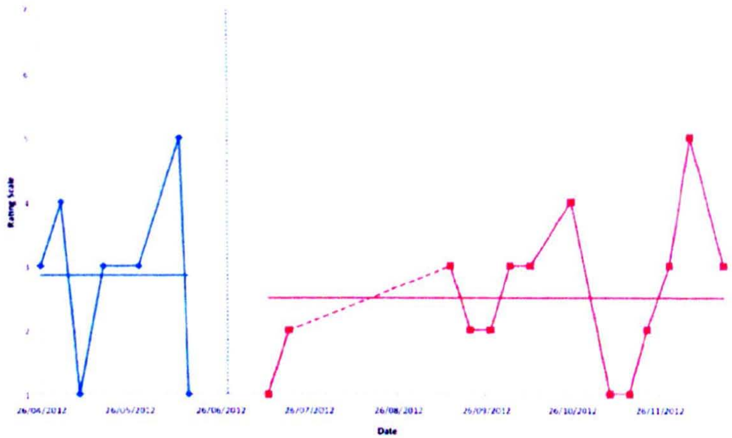
4.3.4.1 Child B's Self-Rating Regarding Reading Enjoyment



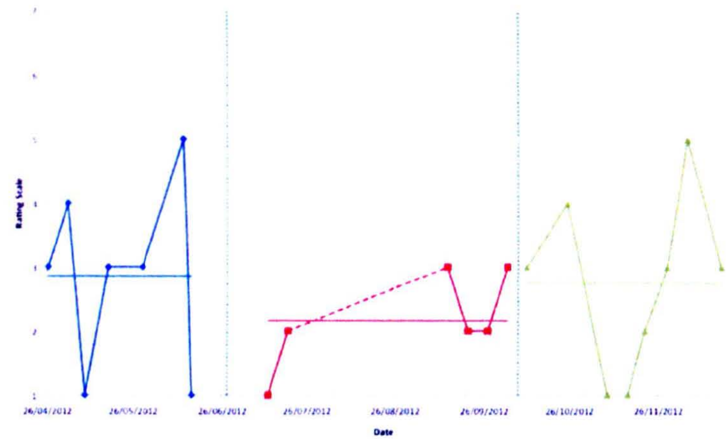
Graph 4.109 A line graph showing Child B's self-rating scores of his reading enjoyment across phase A and B.



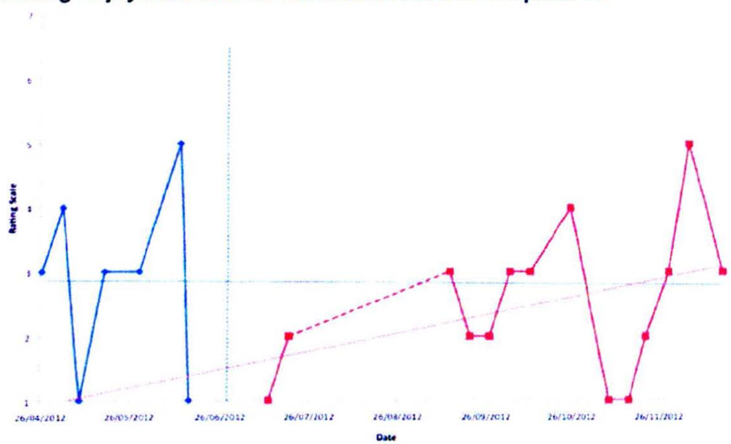
Graph 4.110 A line graph showing Child B's self-rating scores of his reading enjoyment across phase A, B1, and B2.



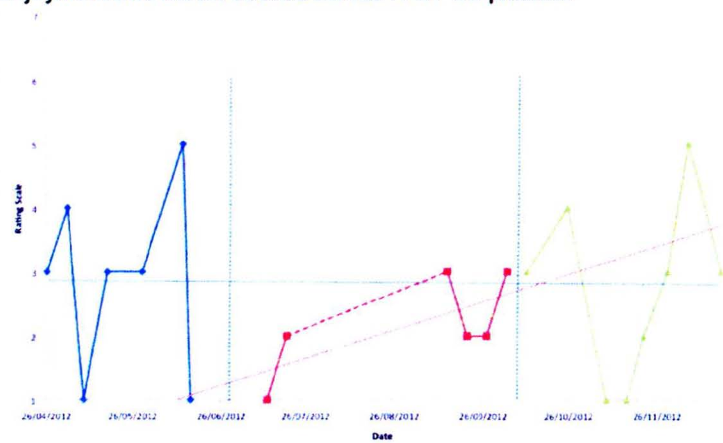
Graph 4.111 A line graph showing Child B's self-rating scores of his reading enjoyment and **mean scores** across A-B phases.



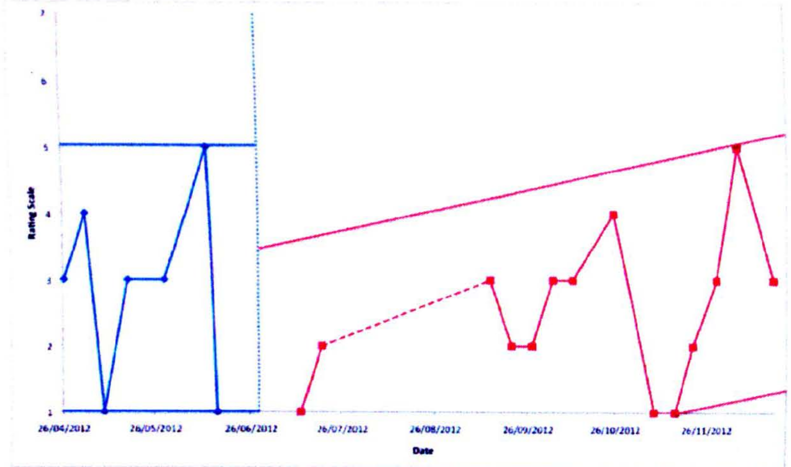
Graph 4.112 A line graph showing Child B's self-rating scores of his reading enjoyment and **mean scores** across A-B1-B2 phases.



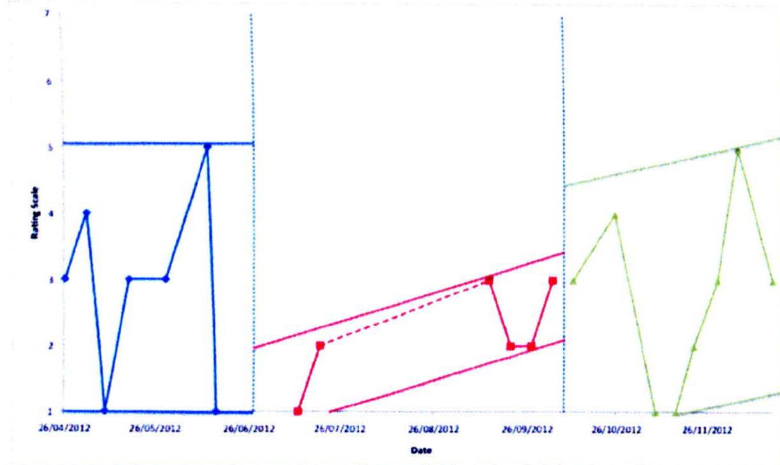
Graph 4.113 A line graph showing Child B's self-rating scores of his reading enjoyment and **trend lines** across A-B phases.



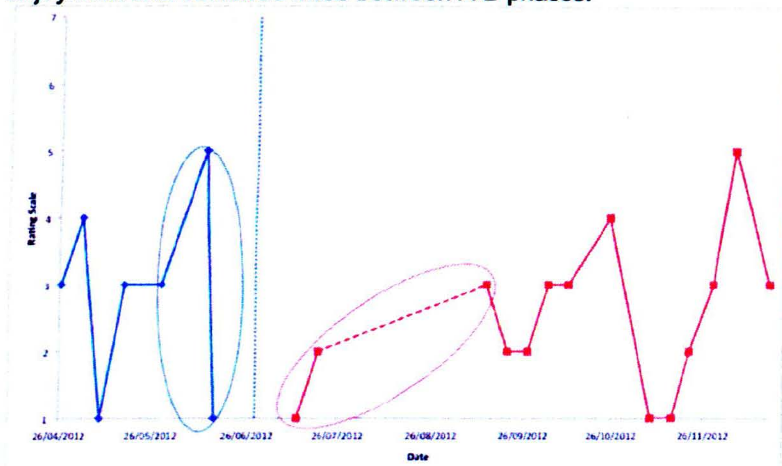
Graph 4.114 A line graph showing Child B's self-rating scores of his reading enjoyment and **trend lines** across A-B1-B2 phases.



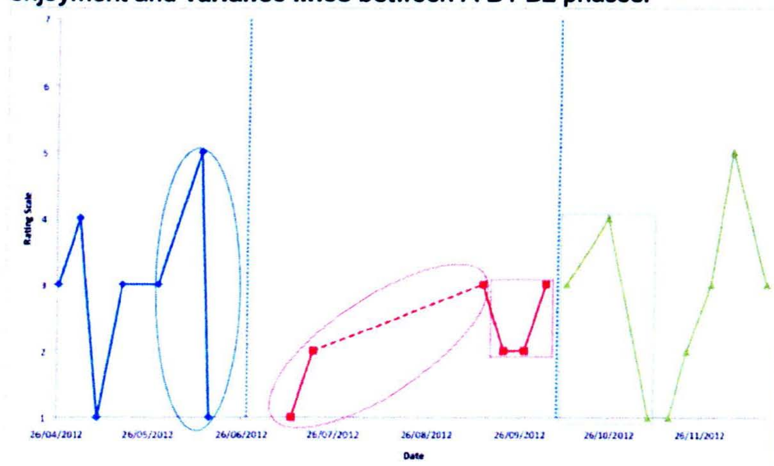
Graph 4.115 A line graph showing Child B's self-rating scores of his reading enjoyment and **variance lines** between A-B phases.



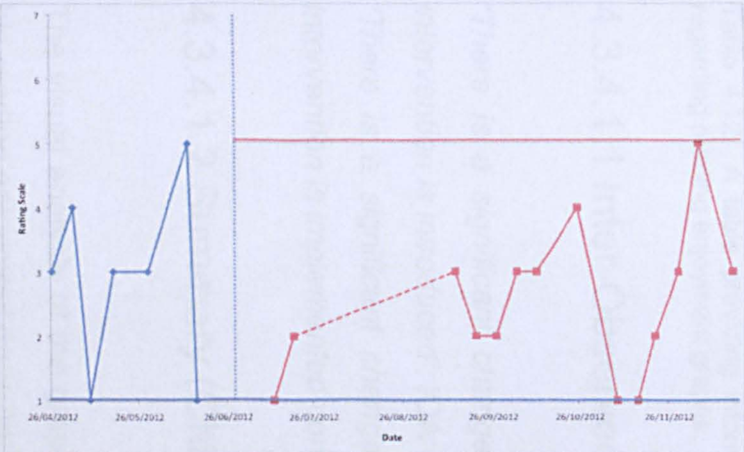
Graph 4.116 A line graph showing Child B's self-rating scores of his reading enjoyment and **variance lines** between A-B1-B2 phases.



Graph 4.117 A line graph showing Child B's self-rating scores of his reading enjoyment and **immediacy of effect** between A-B phases.



Graph 4.118 A line graph showing Child B's self-rating scores of his reading enjoyment and **immediacy of effect** between A-B1-B2 phases.



Graph 4.119 A line graph showing Child B's self-rating scores of his reading enjoyment and **overlap of data** between A-B phases.

Graph 4.120 A line graph showing Child B's self-rating scores of his reading enjoyment and **overlap of data** between A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.111 shows the mean decreasing from phase A (2.86) to B (2.5). This equates to a -0.36 shift between phase A and B. Graph 4.112 shows a decrease in mean between phase A (2.86) and B1 (2.17), and an increase in mean between phase B1 (2.17) and B2 (2.75). This equates to a -0.69 shift between phase A and B1, and a +0.58 shift between phase B1 and B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.113 shows a fairly horizontal trend line for phase A and an increasing trend line for phase B. Graph 4.114 shows phase B1 and B2 with an increasing trend line.
Variability (*The range of data about the best fitting line*)	Graph 4.115 shows phase A and B with a large variability. Graph 4.116 shows phase A and B2 with a large variability and phase B1 with a smaller range of data.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.117 shows a slight decrease in level between phase A and phase B. Graph 4.118 shows a similar level between phase B1 and B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.119 and graph 4.120 shows all the data overlapping between each phase.

Table 4.12 A table providing information regarding visual analysis of Child B's self-rating regarding reading enjoyment graphs.

4.3.4.1.1 Inter-Observed Agreement (IOA)

'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 80%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 60%

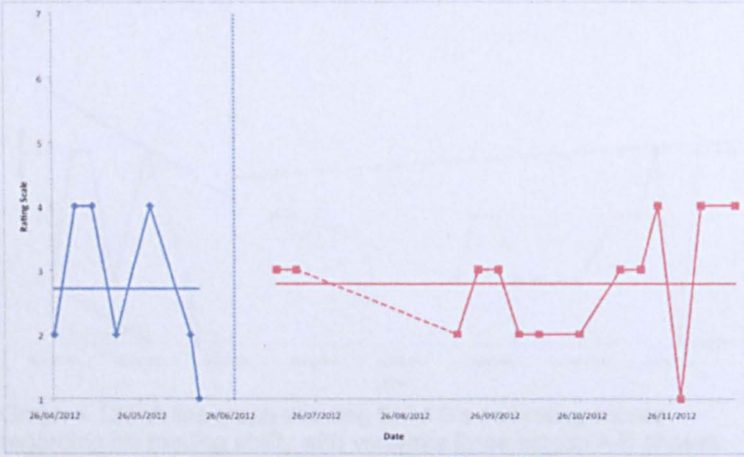
4.3.4.1.2 Summary (Child B)

The visual analysis of the graphs exploring the self-rating of Child B regarding his reading enjoyment does not indicate a clear effect of the intervention. The A-B design graphs do show a decline in mean which indicates a greater enjoyment of reading but the variability within and between phases is quite large making inferences difficult. The trend line for phase B suggests a declining trend, indicating a reduction in reading enjoyment but there is some evidence of immediacy of effect between phase A and phase B. The exploration of the A-B1-B2 design does not show any clear effects of the intervention being implemented more consistently.

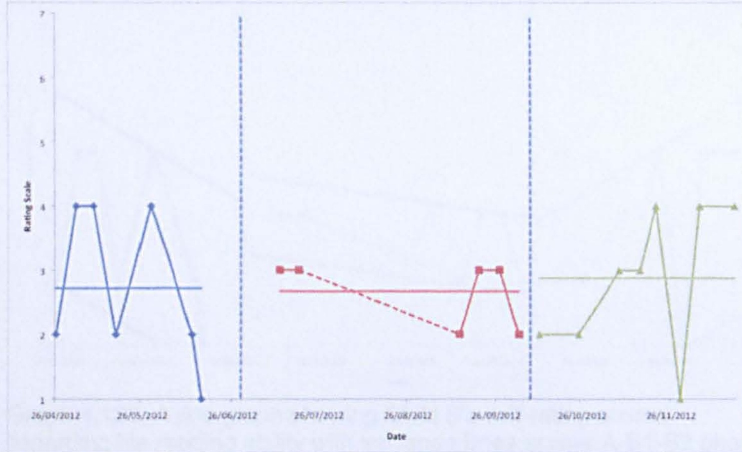
4.3.4.2 Child B's Self-Rating Regarding Reading Ability

Graph 4.121 A line graph showing Child B's self-rating scores regarding his reading ability across phase A and B.

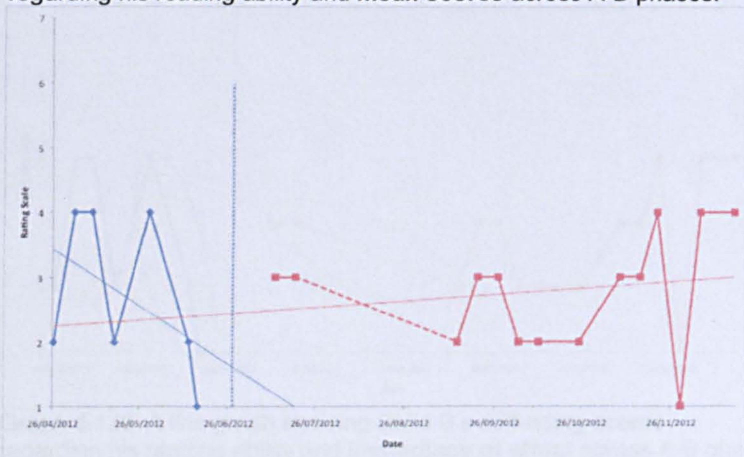
Graph 4.122 A line graph showing Child B's self-rating scores regarding his reading ability across phase A, B1, and B2.



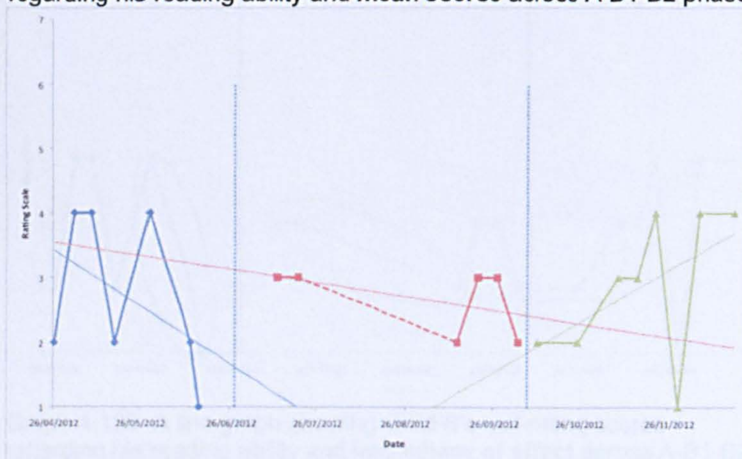
Graph 4.123 A line graph showing Child B's self-rating scores regarding his reading ability and **mean scores** across A-B phases.



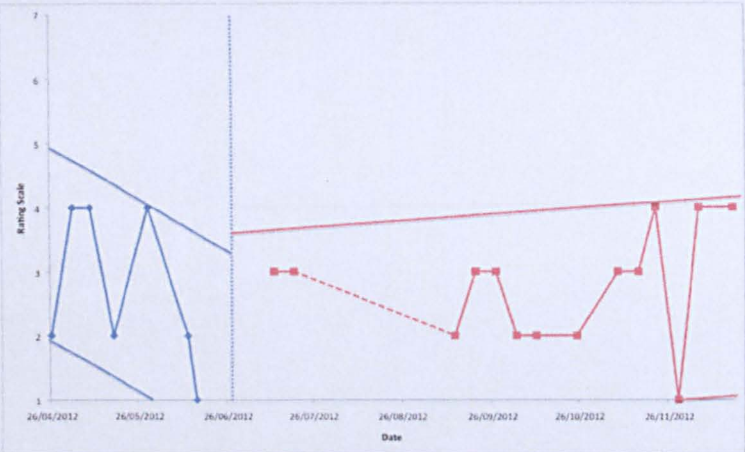
Graph 4.124 A line graph showing Child B's self-rating scores regarding his reading ability and **mean scores** across A-B1-B2 phases.



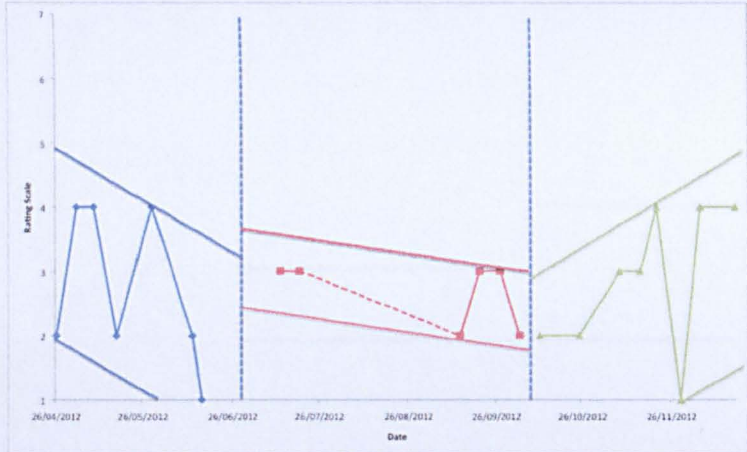
Graph 4.125 A line graph showing Child B's self-rating scores regarding his reading ability with **trend lines** across A-B phases.



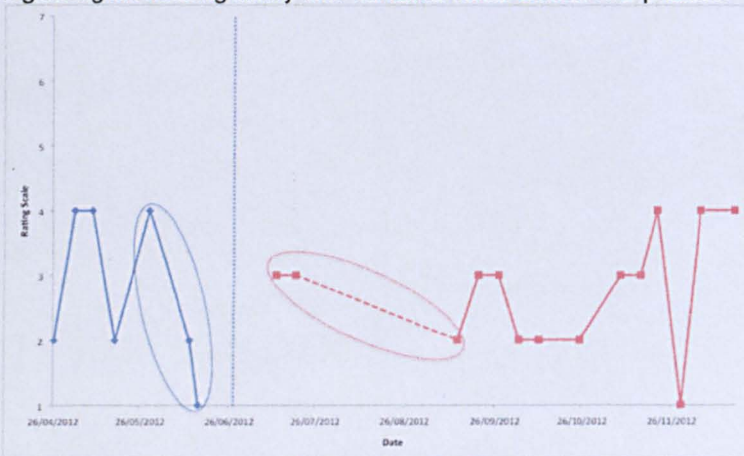
Graph 4.126 A line graph showing Child B's self-rating scores regarding his reading ability with **trend lines** across A-B1-B2 phases.



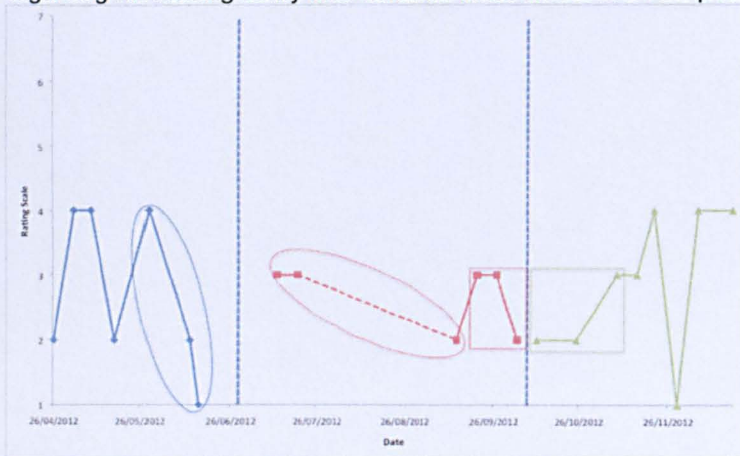
Graph 4.127 A line graph showing Child B's self-rating scores regarding his reading ability with **variance lines** across A-B phases.



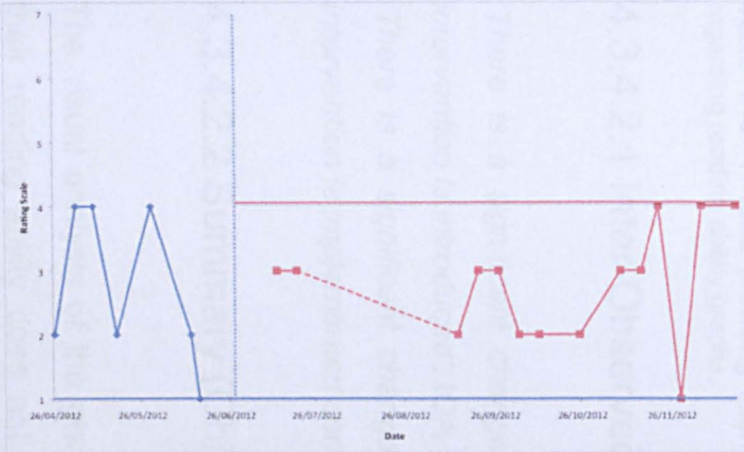
Graph 4.128 A line graph showing Child B's self-rating scores regarding his reading ability with **variance lines** across A-B1-B2 phases.



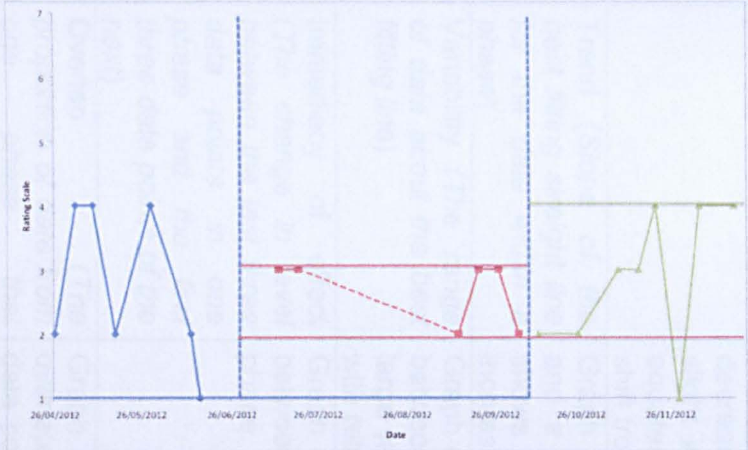
Graph 4.129 A line graph showing Child B's self-rating scores regarding his reading ability and **immediacy of effect** across A-B phases.



Graph 4.130 A line graph showing Child B's self-rating scores regarding his reading ability and **immediacy of effect** across A-B1-B2 phases.



Graph 4.131 A line graph showing Child B's self-rating scores regarding his reading ability and **overlap of data** across A-B phases.



Graph 4.132 A line graph showing Child B's self-rating scores regarding his reading ability and **overlap of data** across A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.123 shows a slight increase in mean between phase A (2.71) and B (2.79). This equates to a +0.08 shift between phase A and B. Graph 4.124 shows a slight decrease from phase A (2.71) to B1 (2.67), and then a slight increase from phase B1 (2.67) to B2 (2.89). This equates to a -0.04 shift from phase A to B1, and a +0.12 shift from phase B1 to B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.125 shows a decreasing trend line for phase A and a increasing trend line for phase B. Graph 4.126 shows a decreasing trend line for phase B1 and an increasing trend line for phase B2.
Variability (*The range of data about the best fitting line*)	Graph 4.127 shows a similar level of large variability between phase A and B. Graph 4.128 shows comparably large variability between phase A and B2, and phase B1 with relatively small variability.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.129 and graph 4.130 show little change in level between the end of one phase and the start of another phase.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.131 shows all of the data points in phase B overlapping with phase A. Graph 4.132 shows all of the data points from phase B1 overlapping with phase A, and the majority of data points in phase B2 overlapping with phase B1.

Table 4.13 A table providing information regarding visual analysis of Child B's self-rating regarding reading ability graphs.

4.3.4.2.1 Inter-Observed Agreement (IOA)

'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 40%

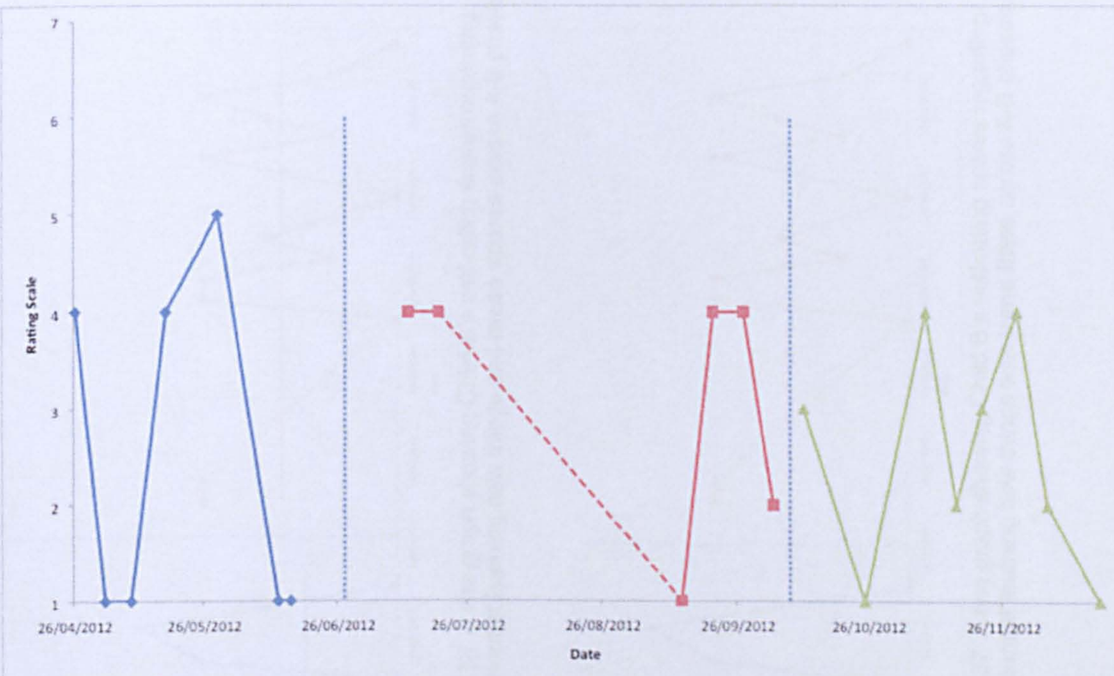
'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 33%

4.3.4.2.2 Summary (Child B)

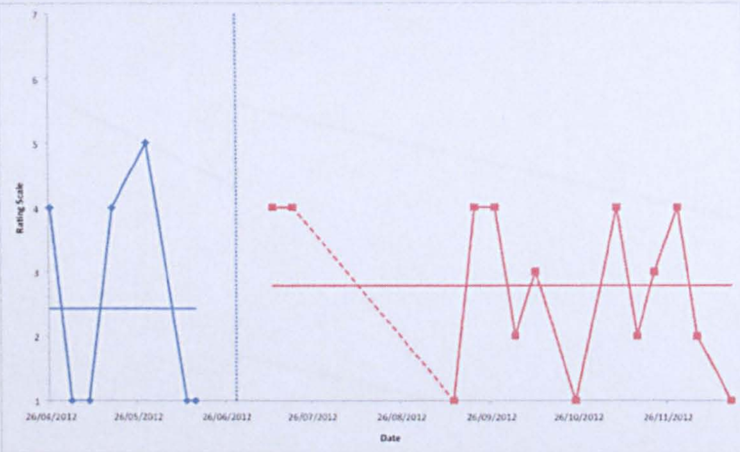
The visual analysis of the graphs exploring Child B's self-concept regarding their reading ability does not appear to show a significant effect from the intervention. The A-B design graphs shows a small increase in mean that suggests a slight decrease in Child B's self-concept regarding his reading ability. There is also an increasing trend line for phase B in contrast to a decreasing trend line for phase A. The immediacy of effect does not show a substantial change in level between phase A and phase B. When exploring the data across three phases, phase B1 has less variability and shows a fairly consistent pattern of responding. Phase A and phase B2 have a larger variability making it difficult to infer any effect of the intervention. The visual analysis of the graphs does not show a clear change in relation to the implementation of the intervention.

4.3.4.3 Child B's Self-Rating Regarding Enjoyment at Learning New Things

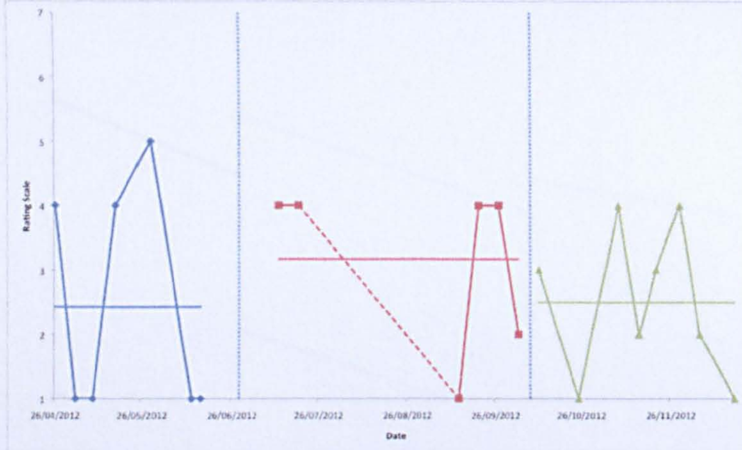
Graph 4.133 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things across phase A and B.



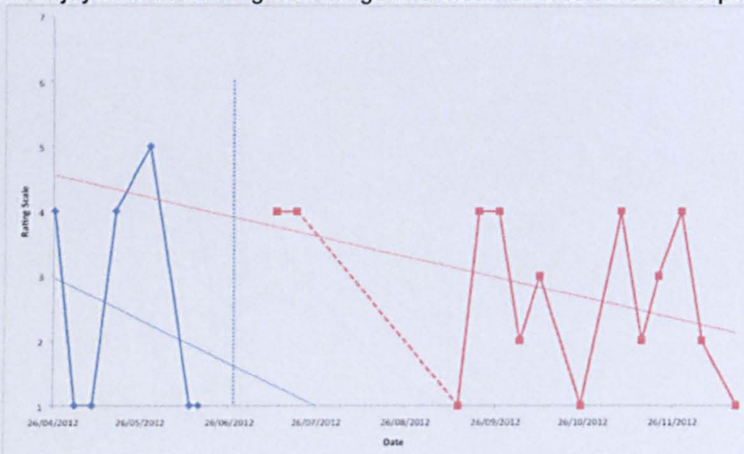
Graph 4.134 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things across phase A, B1 and B2.



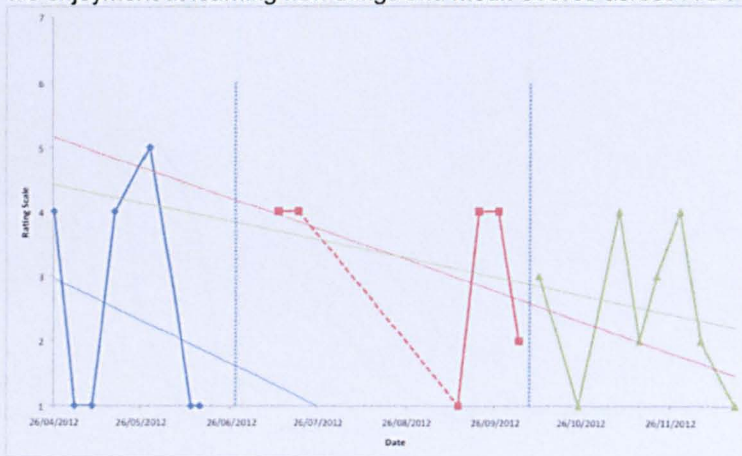
Graph 4.135 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things and **mean scores** across A-B phases.



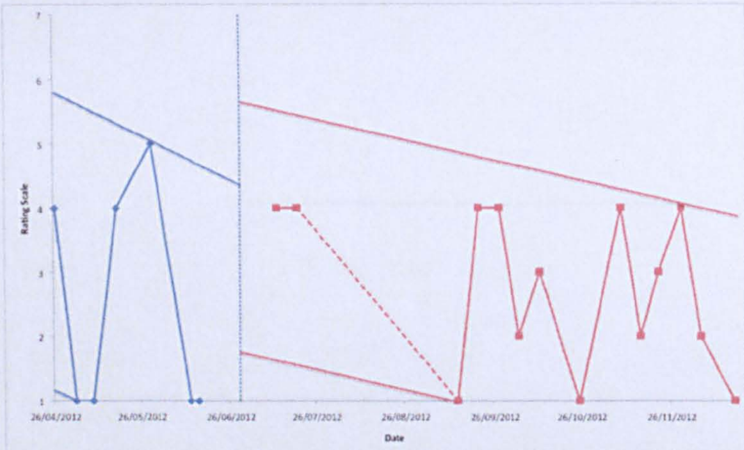
Graph 4.136 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things and **mean scores** across A-B1-B2 phases.



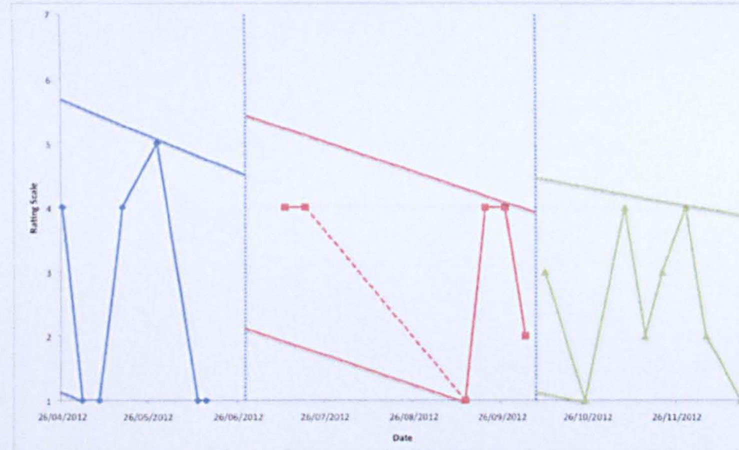
Graph 4.137 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things with **trend lines** across A-B phases.



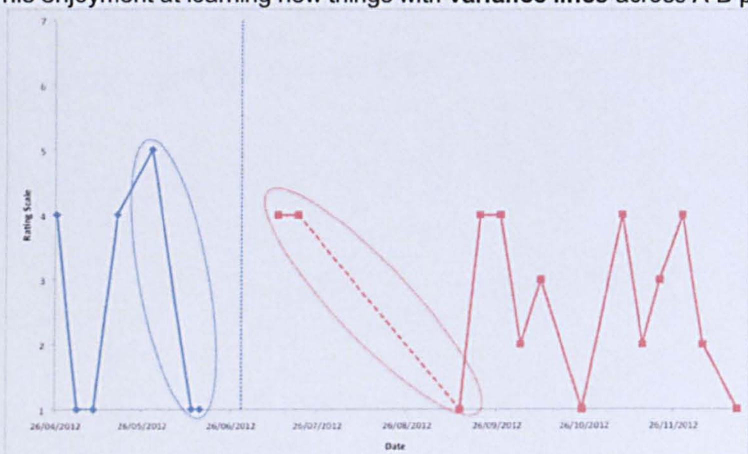
Graph 4.138 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things with **trend lines** across A-B1-B2 phases.



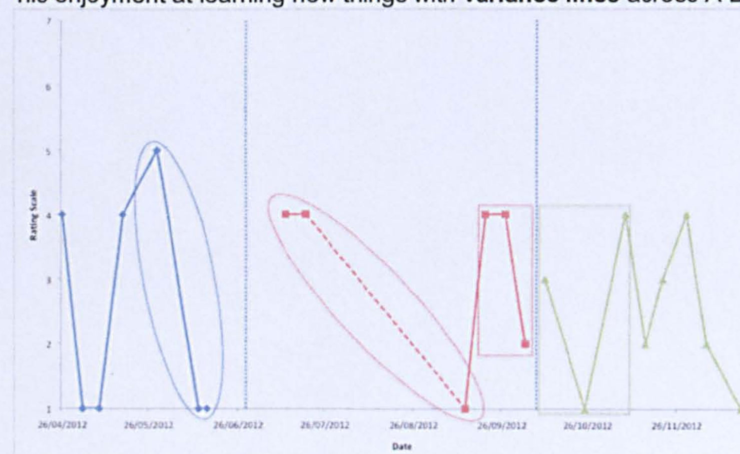
Graph 4.139 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things with **variance lines** across A-B phases.



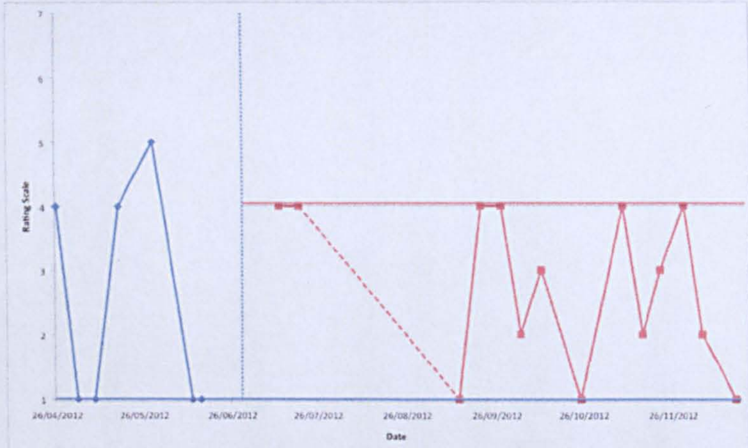
Graph 4.140 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things with **variance lines** across A-B1-B2 phases.



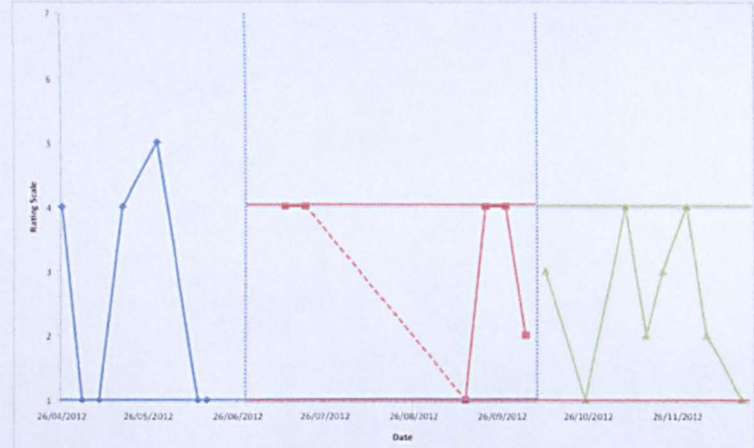
Graph 4.141 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things and **immediacy of effect** across A-B phases.



Graph 4.142 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things and **immediacy of effect** across A-B1-B2 phases.



Graph 4.143 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things and **overlap of data** across A-B phases.



Graph 4.144 A line graph showing Child B's self-rating scores regarding his enjoyment at learning new things and **overlap of data** across A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.135 shows a small increase in mean between phase A (2.43) and B (2.79). This equates to a +0.36 shift between phase A and B. Graph 4.136 shows a fairly large increase from phase A (2.43) to B1 (3.17), and then a decrease from phase B1 (3.17) to B2 (2.5). This equates to a +0.74 shift from phase A to B1, and a -0.67 shift from phase B1 to B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.137 shows phase A and B with a decreasing trend line. Graph 4.138 shows phase A, B1, and B2 with decreasing trend lines. Phase B2's trend line is slightly flatter than phase A and B.
Variability (*The range of data about the best fitting line*)	Graph 4.139 and graph 4.140 shows a fairly large variability across each phase displayed.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.141 does not show a substantial change in level between phase A and B. Graph 4.142 shows a similar level between phase B1 and B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.143 shows all of the data points in phase B to overlap with phase A. Graph 4.144 shows all of the data points in phase B1 to overlap with phase A, and all of the data points in phase B2 to overlap with phase B1.

Table 4.14 A table providing information regarding visual analysis of Child B's self-rating regarding enjoyment at learning new things graphs.

4.3.4.3.1 Inter-Observed Agreement (IOA)

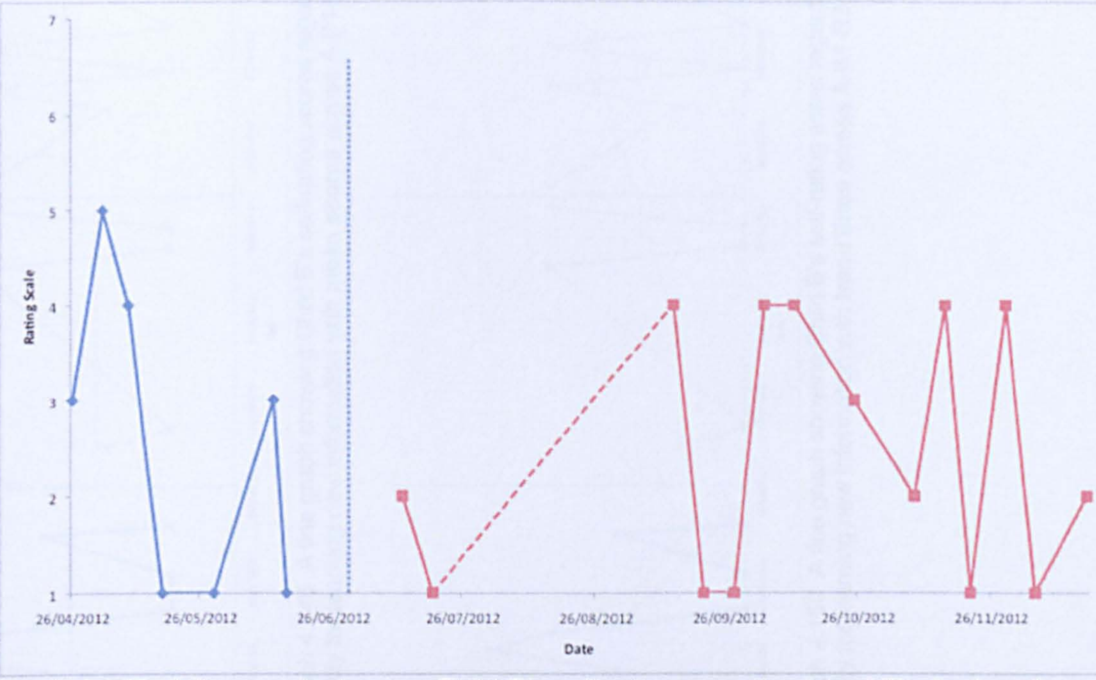
'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 50%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 40%

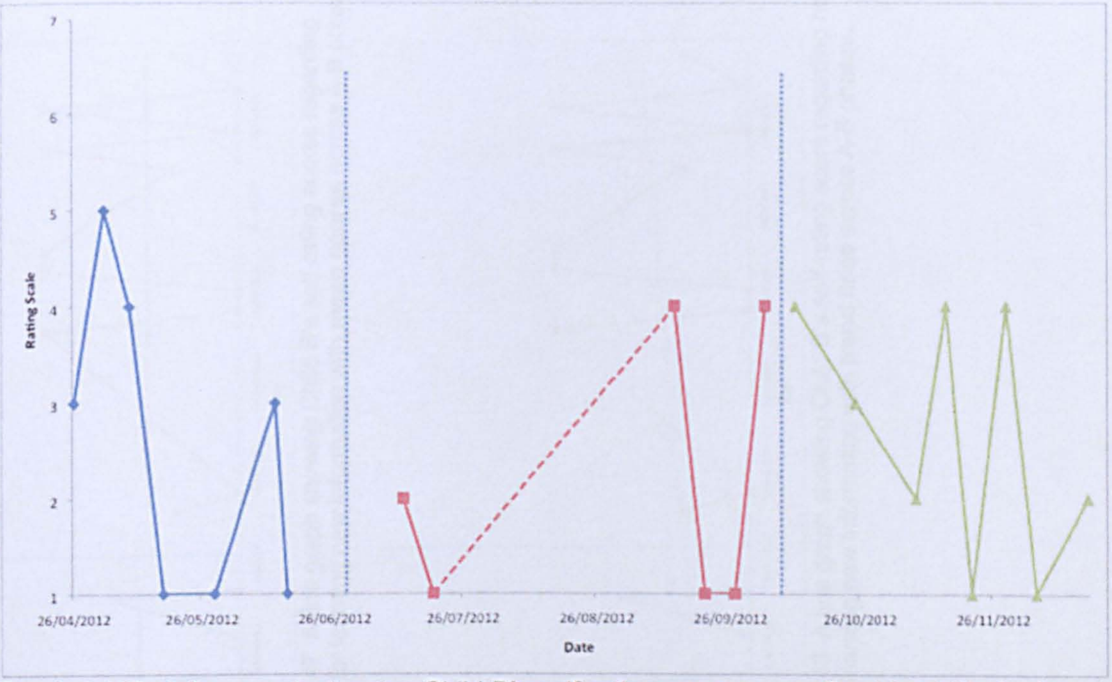
4.3.4.3.2 Summary (Child B)

The visual analysis of Child B's self-rating regarding their enjoyment for learning new things does not indicate a clear effect as a result of the intervention being implemented. The A-B design graphs show a slight increase in mean between phase A and B suggesting a decrease in the Child B's enjoyment for learning new things. However, there is a decreasing trend for both A and B phases. The variability in phase A and B is also quite large making inferences regarding direction of change difficult. The graphs that show A-B1-B2 design do not indicate a clear effect from the intervention.

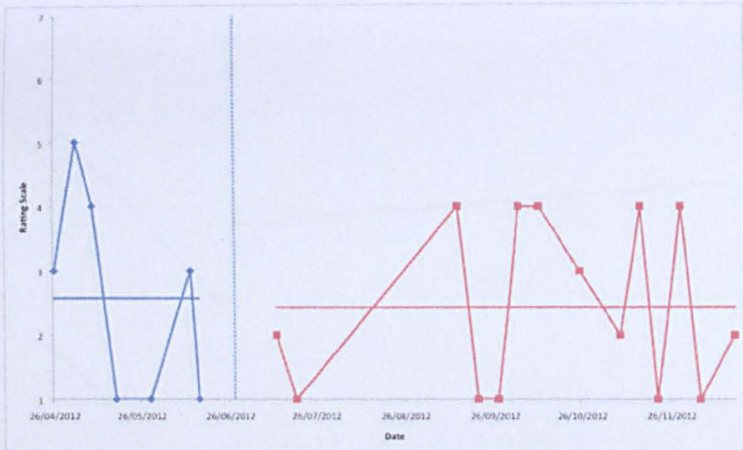
4.3.4.4 Child B's Self-Rating Regarding Ability to Learn New Information



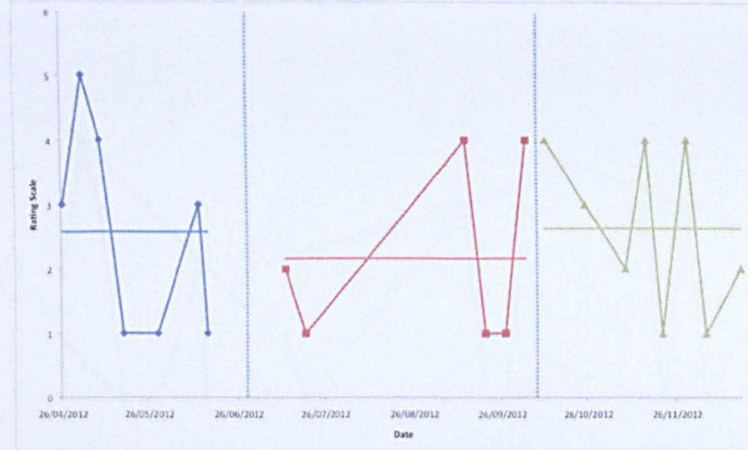
Graph 4.145 A line graph showing Child B's self-rating regarding his ability for learning new information across phase A and B.



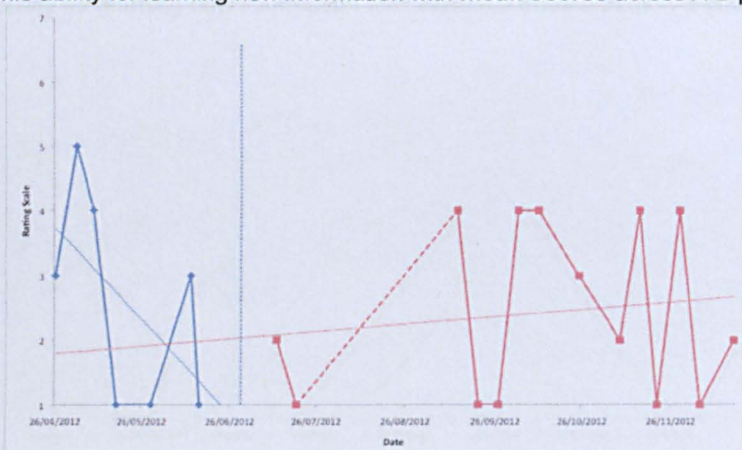
Graph 4.146 A line graph showing Child B's self-rating scores regarding his ability for learning new information across phase A, B1 and B2.



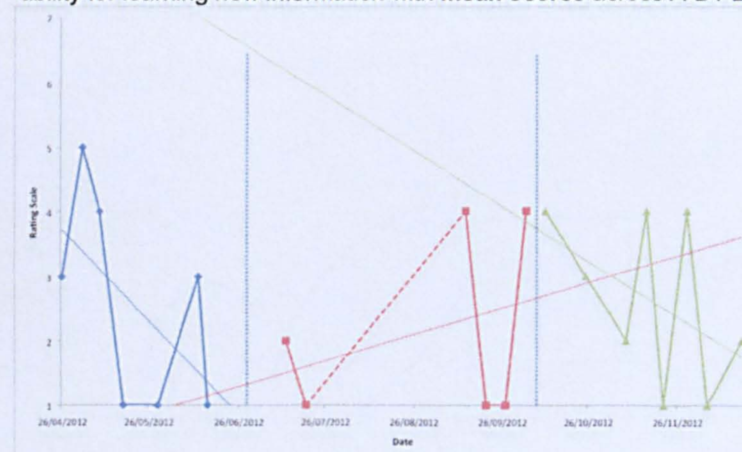
Graph 4.147 A line graph showing Child B's self-rating scores regarding his ability for learning new information with **mean scores** across A-B phases.



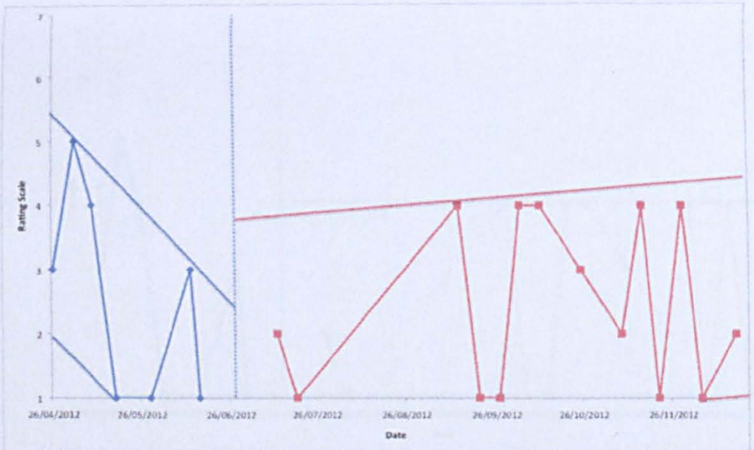
Graph 4.148 A line graph showing Child B's self-rating scores regarding his ability for learning new information with **mean scores** across A-B1-B2 phases.



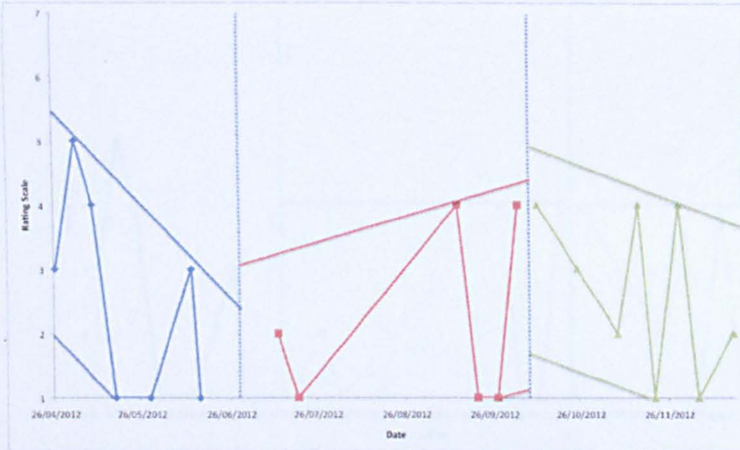
Graph 4.149 A line graph showing Child B's self-rating score regarding his ability for learning new information with **trend lines** across A-B phases.



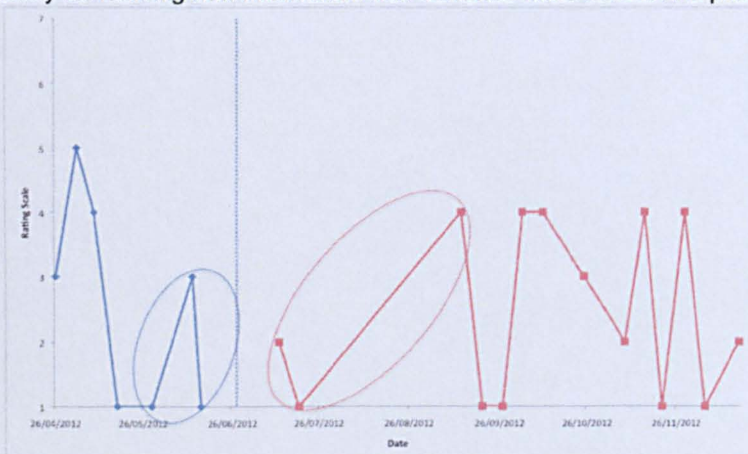
Graph 4.150 A line graph showing Child B's self-rating score regarding his ability for learning new information with **trend lines** across A-B1-B2 phases.



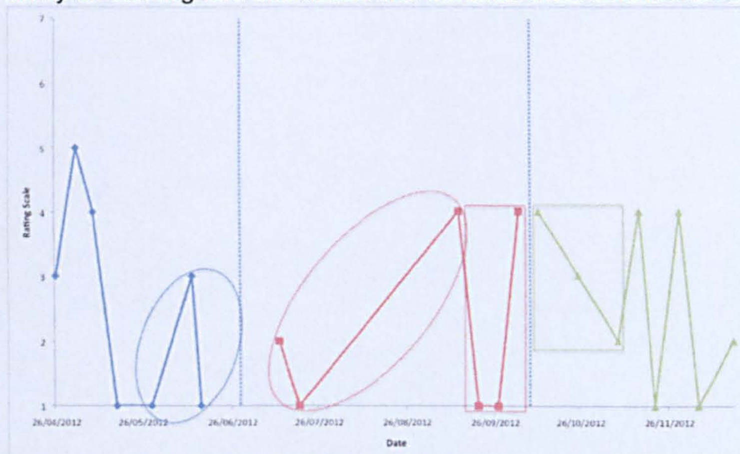
Graph 4.151 A line graph showing Child B's self-rating scores regarding his ability for learning new information with **variance lines** across A-B phases.



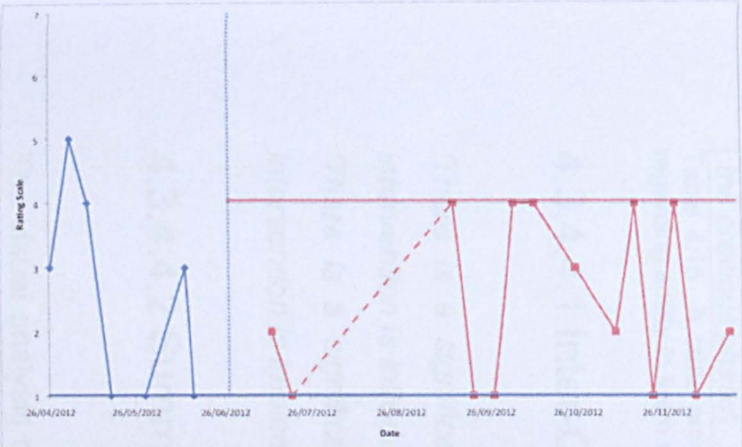
Graph 4.152 A line graph showing Child B's self-rating score regarding his ability for learning new information with **variance lines** across A-B1-B2 phases.



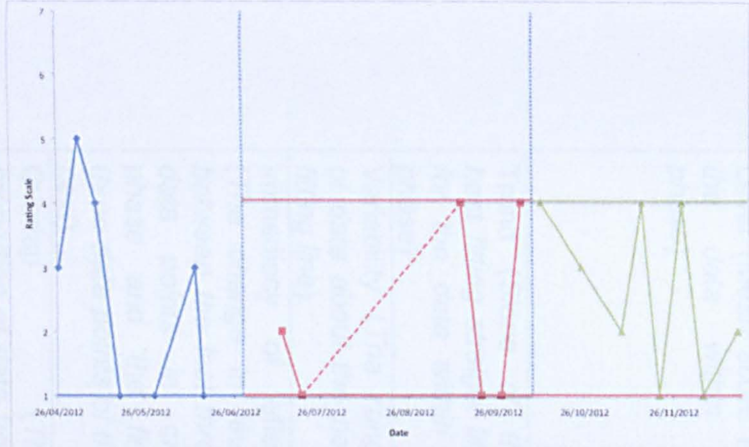
Graph 4.153 A line graph showing Child B's self-rating score regarding his ability for learning new information and **immediacy of effect** across A-B phases.



Graph 4.154 A line graph showing Child B's self-rating score regarding his ability for learning new information and **immediacy of effect** across A-B1-B2 phases.



Graph 4.155 A line graph showing Child B's self-rating score regarding his ability for learning new information and **overlap of data** across A-B phases.



Graph 4.156 A line graph showing Child B's self-rating score regarding his ability for learning new information and **overlap of data** across A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.147 shows a slight decrease in mean between phase A (2.57) and B (2.43). This equates to a -0.14 shift between phase A and B. Graph 4.148 shows a decrease in mean between phase A (2.57) and B1 (2.17), and an increase in mean between phase B1 (2.17) and B2 (2.63). This equates to a -0.4 shift from phase A to B1, and a +0.46 shift from phase B1 to B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.149 shows a decreasing trend line for phase A and a increasing trend line for phase B. Graph 4.150 shows an increasing trend line for phase B1 and a decreasing trend line for phase B2.
Variability (*The range of data about the best fitting line*)	Graph 4.151 and graph 4.152 show a large variability across all of the phases.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.153 shows a slight increase in level between phase A and B. Graph 4.154 shows an increase in level between phase B1 and B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.155 and graph 4.156 show an overlap of all the data between the phases.

Table 4.15 A table providing information regarding visual analysis of Child B's self-concept regarding ability to learn new information graphs.

4.3.4.4.1 Inter-Observed Agreement (IOA)

'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 66%

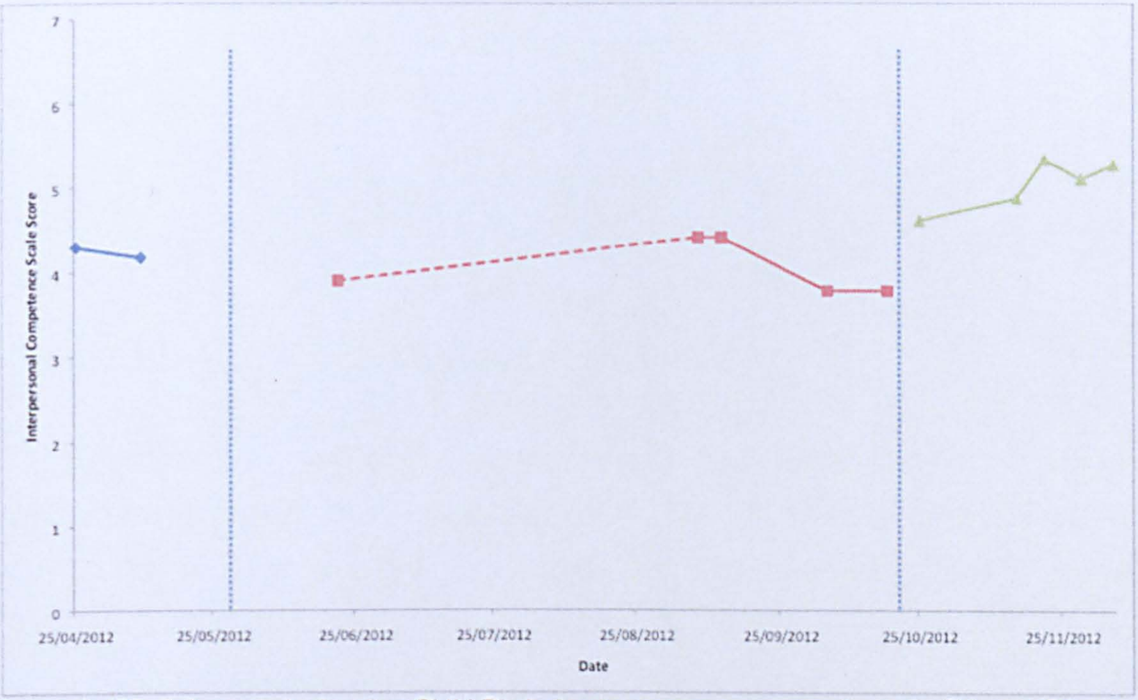
'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 66%

4.3.4.4.2 Summary (Child B)

The visual analysis of the graphs showing Child B's self-concept regarding his ability to learn new information does not suggest an intervention effect. The various phases do not show a consistent pattern of responding with the large variability making inferences difficult. The change in mean is quite minimal between the phases, as is the immediacy of effect. There is overlap of all of the data with the subsequent phase.

4.3.5 Single Case Experimental Design – Behaviour (Child B)

Graph 4.157 A line graph showing Child B's behaviour scores across phase A and B.



Graph 4.158 A line graph showing Child B's behaviour scores across phase A , B1, and B2.

Child B's data regarding his behaviour obtained two data points for the baseline phase. Therefore, the ability to infer any type of conclusions from this data is severely impeded and prone to limitations. Two data points in the baseline phase does not allow a predictable baseline pattern to emerge for which to compare the subsequent phase. A full visual analysis of the graphs was not completed due to the inadequacies of the data obtained. A superficial examination of Graph 4.157 does indicate a potential improvement of behaviour in phase B. This becomes more apparent when examined as an A-B1-B2 design in Graph 4.158, with phase B2 showing an upwards trend and higher levels of data. A highly cautious inference of this data is that when the precision teaching was consistently implemented, Child B's behaviour improved.

4.3.6 Thematic Analysis of Staff Focus Group (Child B)

The thematic analysis of the focus group discussing Child B's response to the precision teaching intervention identified two *Main Themes*.

- Intervention Process
- Self-concept as a learner

4.3.6.1 Main Theme 1: Intervention Process

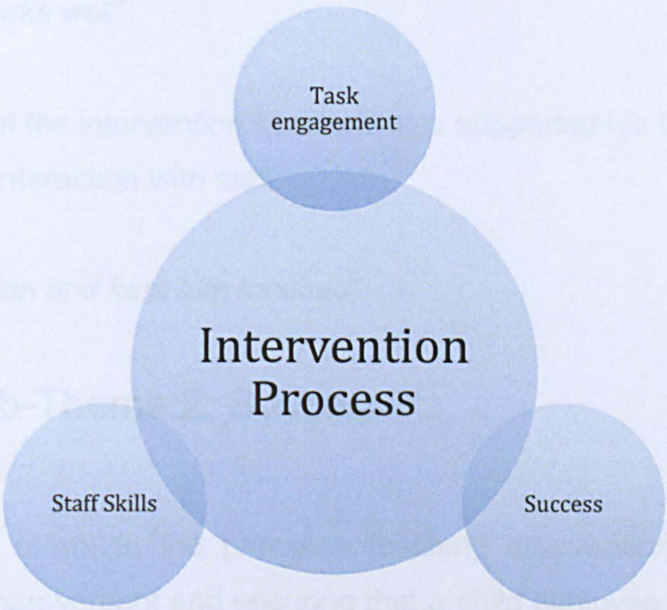


Figure 4.4 Thematic map for *Intervention Process* theme (Child B).

The focus group discussion highlighted a number of features of the precision teaching intervention that supported Child B. An overarching theme of *intervention process* emerged in relation to the undertaking of the precision teaching intervention. Sub-themes were identified that contributed to the overarching *intervention process* theme.

4.3.6.1.1 Sub-Theme 1: Task Engagement

This sub-theme relates to Child B's engagement with the precision teaching intervention. The precision teaching task process of repetition and consolidation of skills learnt, was perceived to aid Child B's learning and support his acquisition and understanding of key skills.

'Keep going and going'

'Repetition works well'

'Overlearning works well'

Staff also felt that the intervention sessions also supported his task engagement through the 1:1 interaction with staff.

'Liked the attention and kept him focused'

4.3.6.1.2 Sub-Theme 2: Success

This sub-theme refers to the precision teaching intervention acknowledging small steps of improvement and ensuring that a child achieves success through the careful monitoring of data and adjustment of tasks. This sub-theme also has links with the overarching theme of *self-concept as a learner*.

'*Having success and realising he can do things for himself'*

4.3.6.1.3 Sub-Theme 3: Staff Skills

The intervention supported class staff in recognising ways to support Child B in the classroom that could be used in situations other than the intervention sessions.

'Precision teaching facilitated strategies to support learning in all areas'

4.3.6.2 Main Theme 2: Self-Concept as a Learner

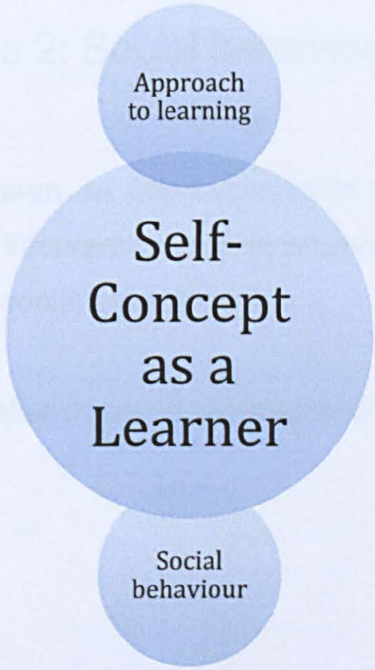


Figure 4.5 Thematic map for *Self-concept as a Learner* theme (Child B).

The theme of *self-concept as a learner* refers to Child B's approach to learning and general classroom behaviour appearing to improve due to his self-concept as a learner being developed. This theme consisted of two sub-themes that combined to form the overarching theme.

4.3.6.2.1 Sub-Theme 1: Approach to learning

Child B showed improvements in his approach to learning in the precision teaching sessions and other curriculum related tasks. The focus group stated that he was;

'More engaged in tasks'

'Thinking for himself'

'General improvements across the curriculum'

They identified that there had been a positive shift in his approach to tasks, being more engaged and needing less adult support.

4.3.6.2.2 Sub-Theme 2: Social behaviour

Staff felt that there had been an improvement in Child B's self-esteem that linked specifically with the intervention and its processes. There were particular improvements in Child B's social behaviour.

'Behaviour considerably better because learning and self-esteem improving'

'Better socially'

'Matured'

'Improvements in behaviour at home'

4.3.6.3 Thematic Analysis Interrater Reliability (Child B)

An interrater reliability of 61% was obtained when a reliability check of the themes was undertaken. This is below the 75% recommended by Joffe (2011) for a reliable coding frame. However, the researcher contends that the secondary observer did not have the full context of the data extracts, and was not privy to the thematic analysis process, therefore accounting for some of the variance seen.

4.3.6.4 Summary of the Thematic Analysis (Child B)

The two main themes identified showed that the process involved in the precision teaching intervention supported staff and pupil alike. The principles underlying the intervention of overlearning skills and developing fluency appeared to have supported Child B in acquiring the skills being taught. The recognition of small steps and ensuring that the targets were specific to the child also meant that Child B experienced success which in turn was associated with, and helped to develop the second overarching theme of *self-concept as a learner*. The intervention process not only supported Child B but also supported staff in recognising Child B's learning needs and helping to develop strategies to support learning in all areas.

The second theme that emerged focused specifically on Child B's self-concept as a learner. The focus group discussion felt that the precision teaching intervention had developed Child B's self-esteem and approach to learning. He appeared to have more belief in himself to undertake activities without needing staff support. These improvements were seen in areas other than the specific focus of the intervention. Child B's development of his learning self-concept also appeared to impact on his social behaviour, showing a greater maturity in the class and improvements in behaviour. These improvements were deemed by the researcher to come under this theme as it was hypothesised that Child B's previous reliance on staff to undertake tasks was lessening and he was recognising his own self-efficacy.

4.3.7 Summary of Child B's Findings

The findings from the measures taken in the single case experiment design for Child B show that he made improvements in his individual word reading ability when the intervention was implemented consistently. The passage word reading ability measure shows an effect at the start of the intervention that was particularly apparent when the intervention was implemented consistently. This suggests that Child B was able to generalise the skills learnt from the precision teaching intervention. The affect measures did not show an effect for any of the self-rating scales. The behaviour measure did not achieve a suitable baseline period for an appropriate comparison to be made with the intervention phase. A highly cautious exploration of the graph suggests a possible intervention effect, and increase in positive behaviour, when the intervention was implemented consistently.

The focus group thematic analysis supports some of the findings found in the single case experimental design. The process of the precision teaching was perceived to aid Child B in generalising his word reading ability and also helped staff to recognise and develop strategies to support Child B in other curriculum related tasks. The process of the precision teaching also supported in developing Child B's self-concept as a learner which was not captured on the single case experimental design measures. The focus group identified Child B as being more engaged in tasks and more willing to engage with tasks independently. Child B's social behaviour improved which was attributed to his developing sense of learning self-concept and reducing reliance on staff.

4.4 Case Study 3

4.4.1 Child C Profile

Sex: Male   Age: 10.2 years (at onset of research study)

Child C has a diagnosis of autism and global developmental delay. Child C is reported by school staff to experience difficulties with his communications skills, self-help skills, motor skills, and social skills. Child C can present as a cheerful child and enjoying humour, getting along well with other members of his class. Child C has strengths in reading and spelling but requires prompts to ensure comprehension. Child C dislikes writing and colouring and usually requires 1:1 supervision to complete this type of work. He has minimal verbal communication and can occasionally drop to the floor to avoid work. He responds well to structure such as 'now and next' boards, when he can choose an activity of his choice after completing work. Sometimes he can become distressed, although the reasons for this are not always apparent. Child C currently attends a primary special school that caters for pupils with a wide range of learning difficulties.

4.4.2 Assessment of a Structured Approach to Learning for Child C

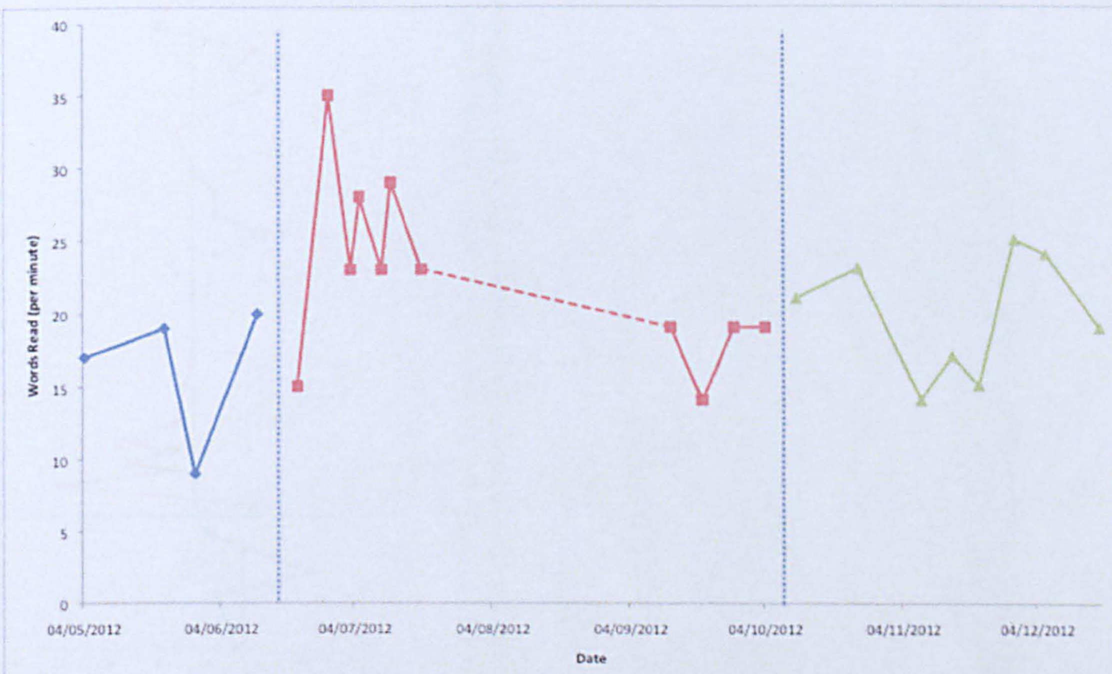
Structured Teaching		
Structured Environment	Routines	Activities in class are kept as consistent as possible. There are routines for transitioning between activities and within activities.
	Physical structure	Child C has a particular table that he sits at in class. This table is located in the corner of the classroom with minimal distractions for Child C. Child C undertakes the majority of his class work at this table, although there are occasions when he may work with a group of pupils. The classroom is arranged to ensure clear physical and visual boundaries.
	Visual schedules and timetables	There is a class visual timetable that is referred to at the start of the day and throughout the day. Child C has an individual timetable presented above his desk and a 'now and next' board is also used to facilitate understanding and motivation. The 'now and next' board is used to motivate as Child C may be allowed to undertake an activity of choice once he has completed class work.
	Work systems	Child C has an individual work system to complete class work. Child C uses a work station to complete individual work. The work station includes the use of work trays to support his independence and understanding of tasks.
	Visual structure	Key concepts are presented visually by the class teacher. Child C has the majority of his tasks presented visually. Instructions are presented with visual clarity, e.g. left to right. The classroom has visual labels for classroom objects. Class rules are also presented visually, along with reward and sanction systems.
Curriculum	Differentiated	Class work is differentiated to meet the learning needs of the child. Pupils undertake structured assessments to ensure appropriate differentiation.
Behaviour Approaches	There are a number of systems in place to manage behaviour. There is a visual points system for good work and following rules. There is a tick board for good behaviour. Also, there is a separate behaviour chart presented visually in a hierarchical fashion for undesirable behaviour. Pupils are also able to express their feelings and place their names on a visual feelings thermometer. Staff try to maintain a calm environment, and behaviour difficulties are dealt with by a calm but assertive approach. Pupils are also able to access a time-out space when they have become distressed. Child C can drop to the floor or show distress without any apparent reason. Class staff undertake the above approaches to manage this behaviour.	

Table 4.16 A table showing the features of a structured approach for Child C.

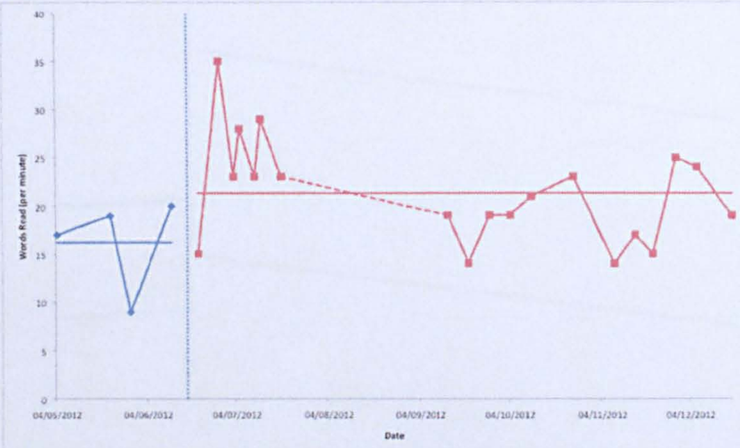
4.4.3 Single Case Experimental Design – Learning

4.4.3.1 Number of Individual Words Read (per minute) (Child C)

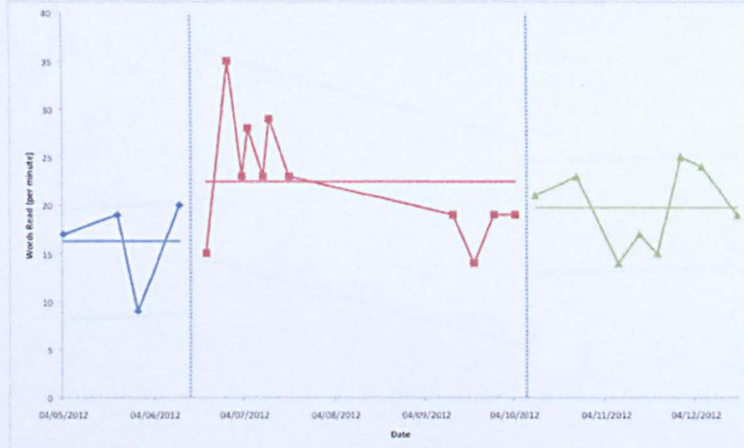
Graph 4.159 A line graph showing the number of individual words read (per minute) across phases A and B (Child C).



Graph 4.160 A line graph showing the number of individual words read (per minute) across phases A, B1 and B2 (Child C).

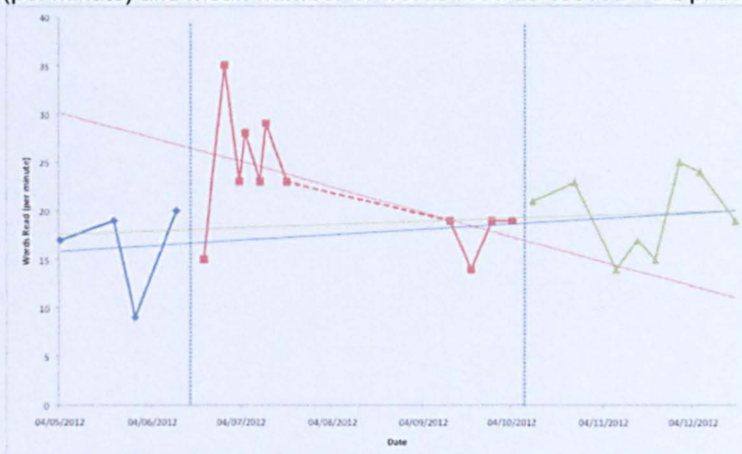


Graph 4.161 A line graph showing the number of individual words read (per minute) and **mean number of words** read across A-B phases (Child C).

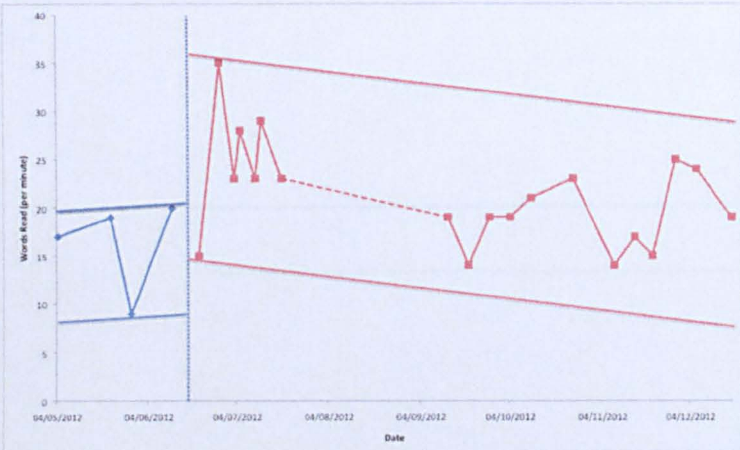


Graph 4.162 A line graph showing the number of individual words read (per minute) and **mean number of words read** across A-B1-B2 phases (Child C).

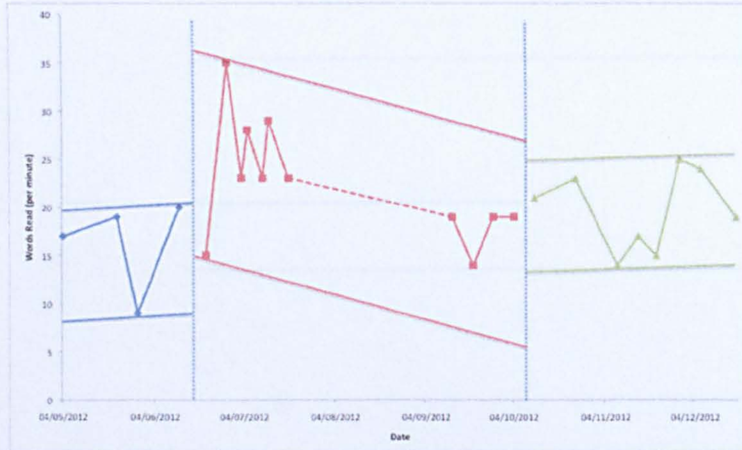
Graph 4.163 A line graph showing the number of individual words read (per minute) with **trend lines** across A-B phases (Child C).



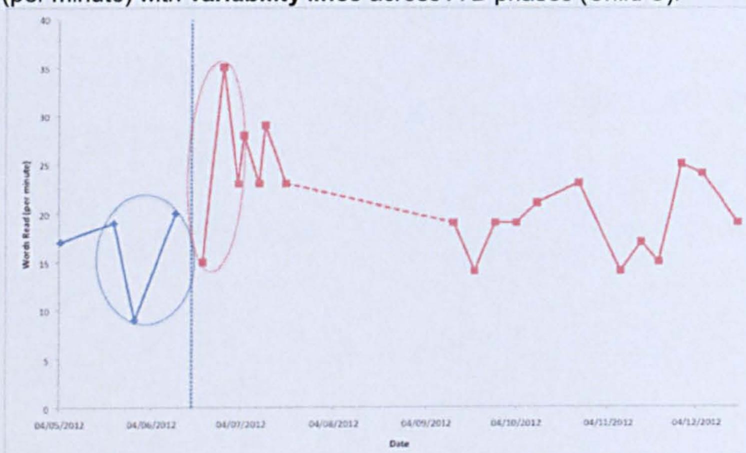
Graph 4.164 A line graph showing the number of individual words read (per minute) with **trend lines** across A-B1-B2 phases (Child C).



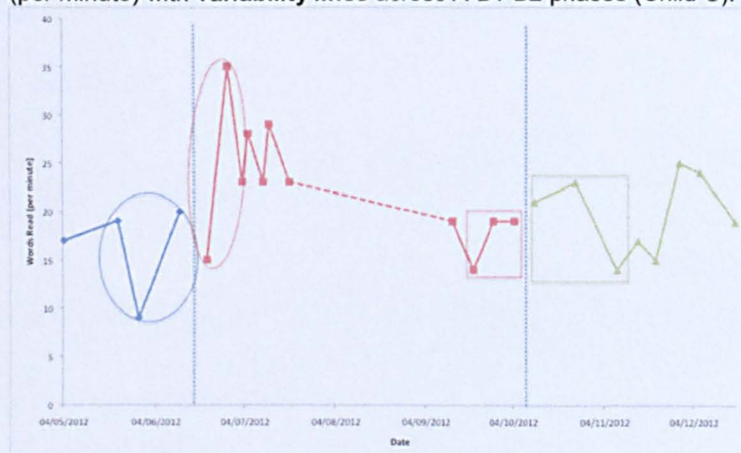
Graph 4.165 A line graph showing the number of individual words read (per minute) with **variability lines** across A-B phases (Child C).



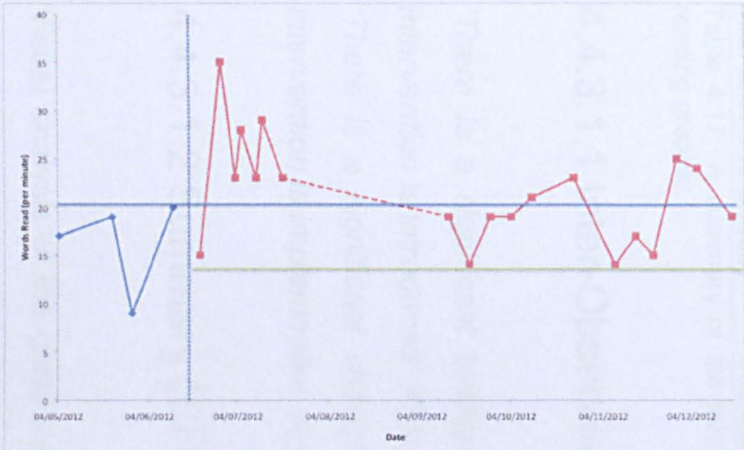
Graph 4.166 A line graph showing the number of individual words read (per minute) with **variability lines** across A-B1-B2 phases (Child C).



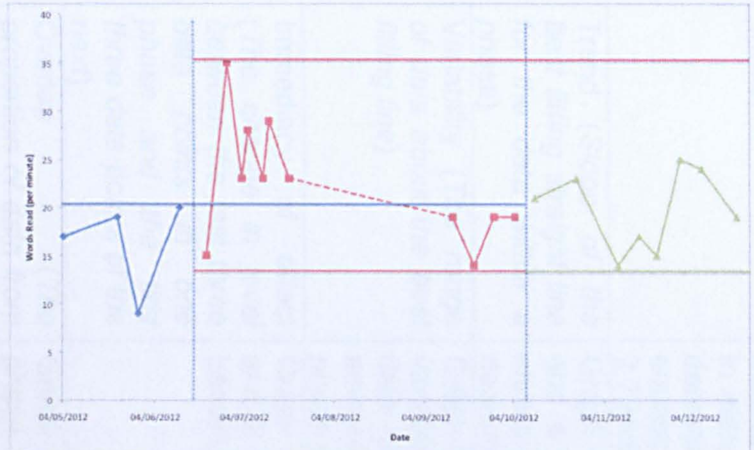
Graph 4.167 A line graph showing the number of probe individual read (per minute) and **immediacy of effect** across A-B phases (Child C).



Graph 4.168 A line graph showing the number of individual words read (per minute) and **immediacy of effect** across A-B1-B2 phases (Child C).



Graph 4.169 A line graph showing the number of individual words read (per minute) and **overlap between data points** of phase A and B (Child C).



Graph 4.170 A line graph showing the number of individual words read (per minute) and **overlap between data points** of phase A, B1 and B2 (Child C).

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.161 shows an increase in mean between phase A (16.25) and B (21.32). This equates to a +5.07 shift between phase A and B. Graph 4.162 shows an increase in mean between phase A (16.25) and B1 (22.45), and a decrease between phase B1 (22.45) and B2 (19.75). This equates to a +6.2 shift between phase A and B1, and a -2.7 shift from phase B1 to B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.163 shows an increasing trend line for phase A and a decreasing trend line for phase B. Graph 4.164 shows an increasing trend line for phase A and B2, and a decreasing trend line for phase B1.
Variability (*The range of data about the best fitting line*)	Graph 4.165 shows phase A to have a fairy large variability, and phase B displays even greater variability in data. Graph 4.166 shows phase A and B2 to have a similar amount of variability. Phase B1 has a larger variability than phase A and B2.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.167 shows a change in level between phase A and B. Graph 4.168 shows little evidence of change in level between phase B1 and B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.169 shows approximately 50% of data points in phase B overlapping with phase A. Graph 4.170 shows approximately 50% of data points in phase B1 overlapping with phase A, and 100% of data points in phase B2 overlapping with phase B1.

Table 4.17 A summary of the outcome of the visual analysis of Child C's individual word reading graphs.

4.4.3.1.1 Inter-Observed Agreement (IOA)

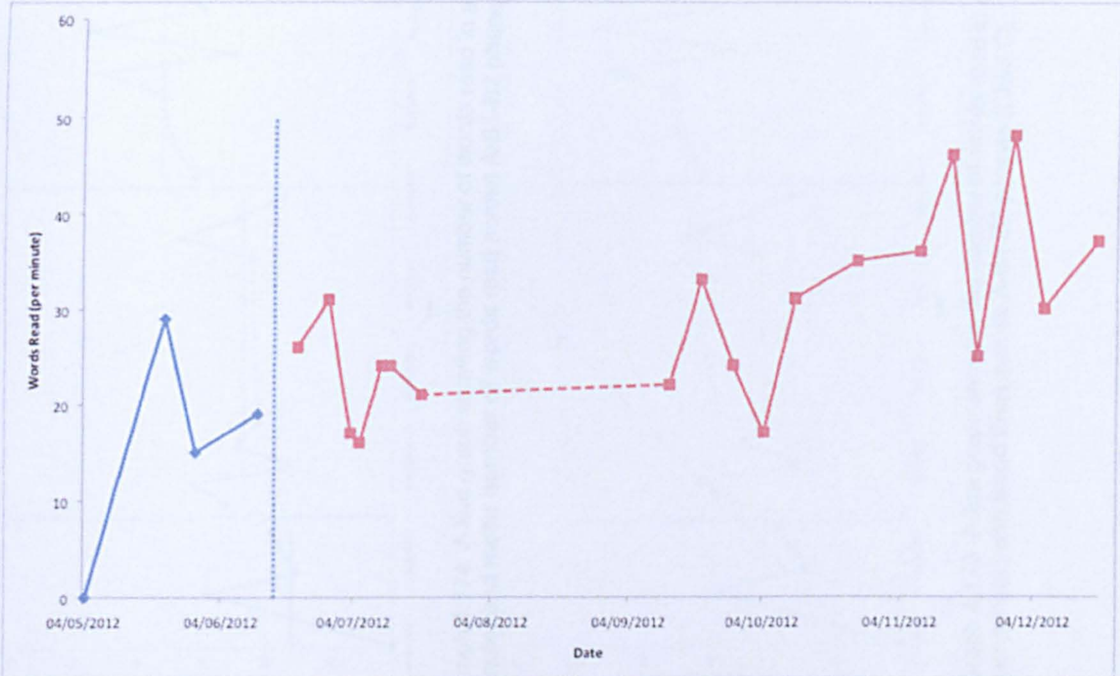
'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 66%

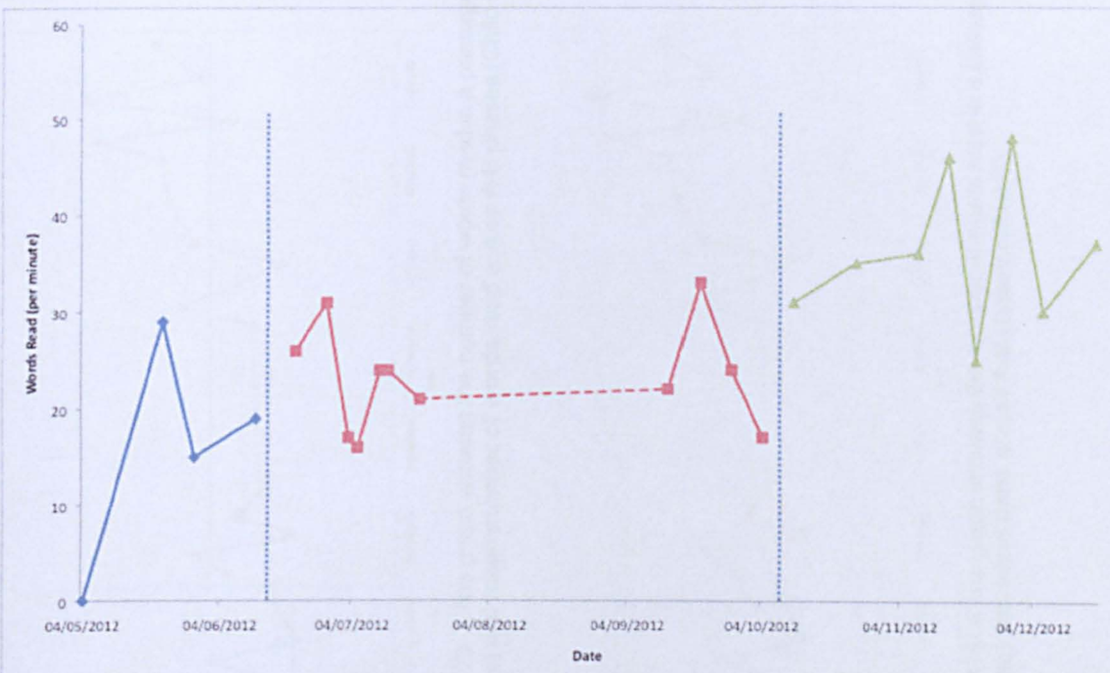
4.4.3.1.2 Summary (Child C)

Visual analysis of the graphs exploring the effect of the precision teaching on individual word reading does not suggest an effect. The A-B design presents a possible initial effect of the intervention, with a clear change in level at the beginning of phase B. However, there is a declining trend line in comparison with phase A's inclining trend line, the large proportion of data overlaps from each phase, and there is a large variability. Examining the A-B1-B2 design an effect is also not apparent. It should be noted that during phase B2, Child C began to put the single word in a sentence which would have affected the number of words read per minute. This occurred despite prompting Child C to say only the individual word.

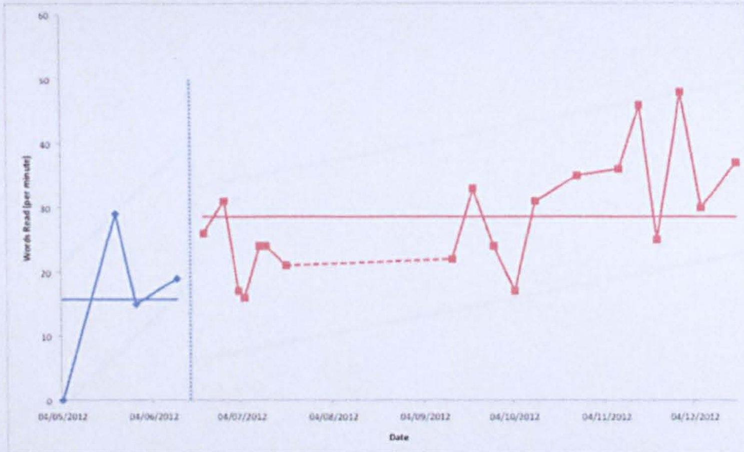
4.4.3.2 Number of Words Read in a Passage (per minute) (Child C)



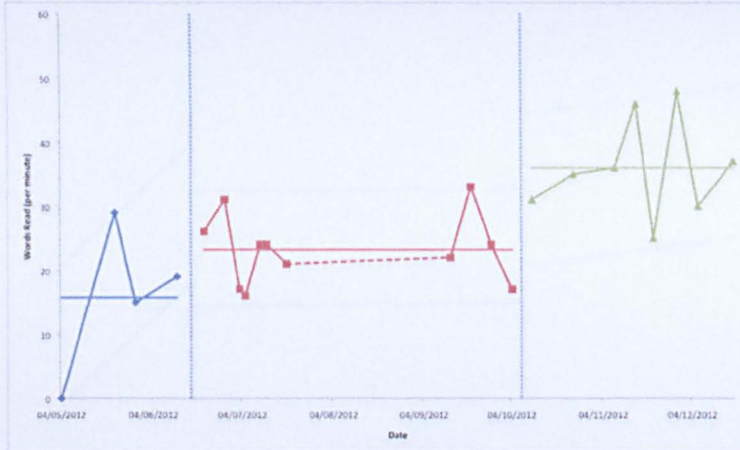
Graph 4.171 A line graph showing the number of words read in a passage (per minute) across phases A and B (Child C).



Graph 4.172 A line graph showing the number of words read in a passage (per minute) across phases A, B1 and B2. (Child C).



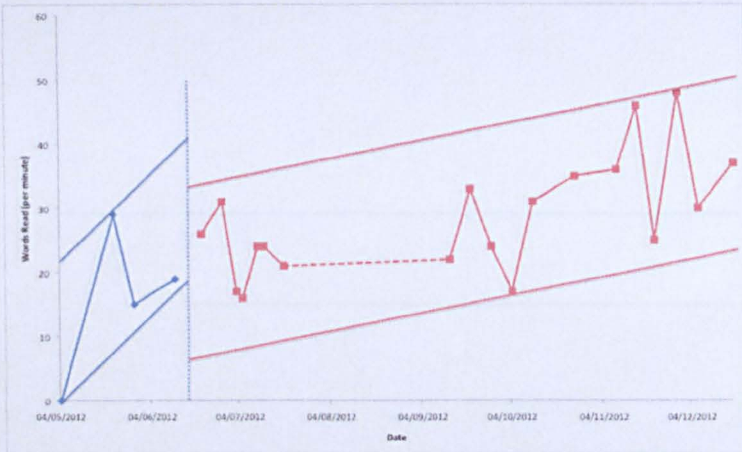
Graph 4.173 A line graph showing the number of words read in a passage (per minute) and **mean number of words** read across A-B phases (Child C).



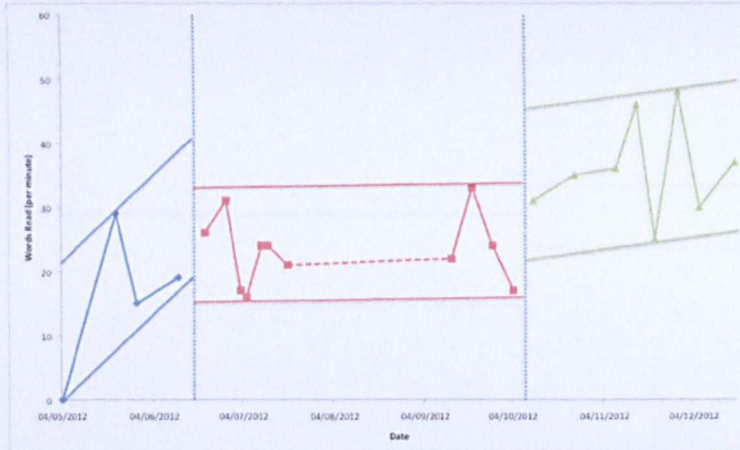
Graph 4.174 A line graph showing the number of words read in a passage (per minute) and **mean number of words** read across A-B1-B2 phases (Child C).

Graph 4.175 A line graph showing the number of words read in a passage (per minute) with **trend lines** across A-B phases (Child C).

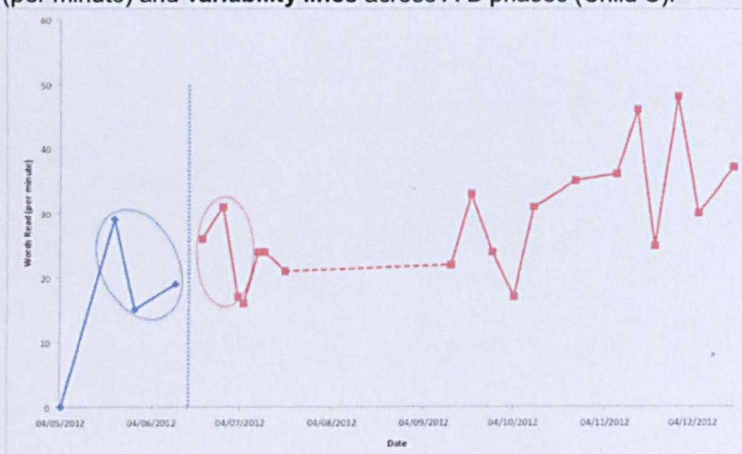
Graph 4.176 A line graph showing the number of words read in a passage (per minute) with **trend lines** across A-B1-B2 phases (Child C).



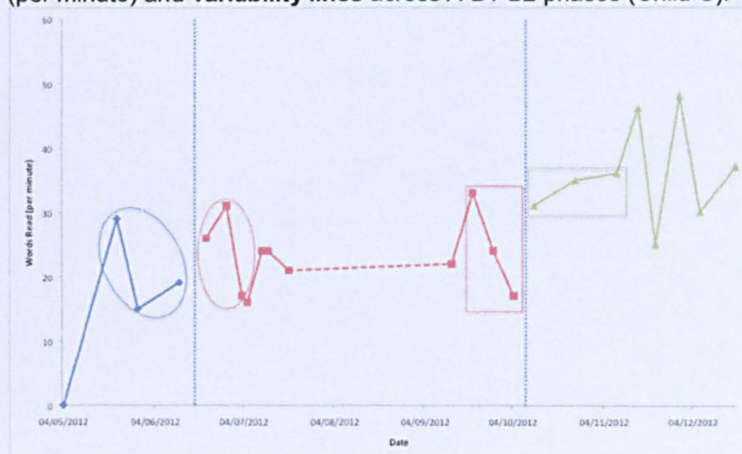
Graph 4.177 A line graph showing the number of words read in a passage (per minute) and **variability lines** across A-B phases (Child C).



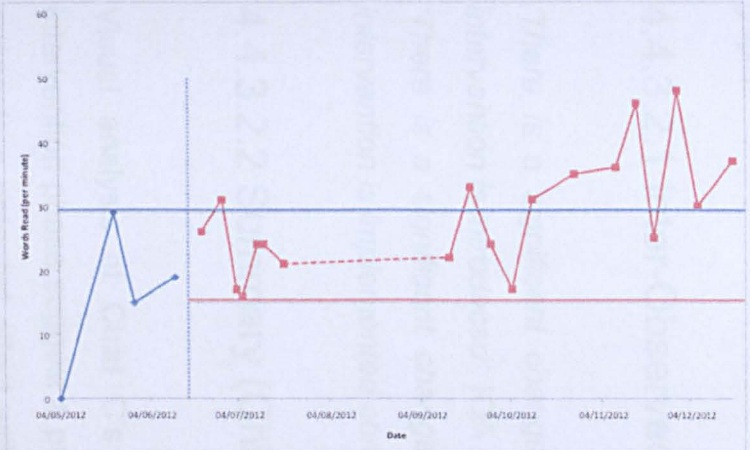
Graph 4.178 A line graph showing the number of words read in a passage (per minute) and **variability lines** across A-B1-B2 phases (Child C).



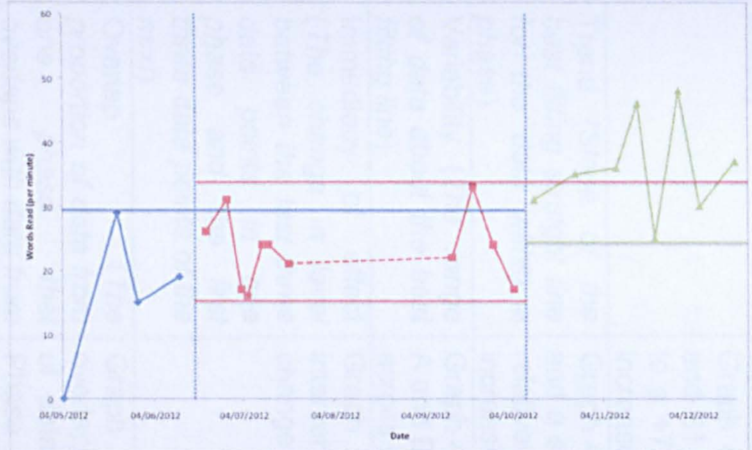
Graph 4.179 A line graph showing the number of words read in a passage (per minute) and **immediacy of effect** across A-B phases (Child C).



Graph 4.180 A line graph showing the number of words read in a passage (per minute) and **immediacy of effect** across A-B1-B2 phases (Child C).



Graph 4.181 A line graph showing the number of words read in a passage (per minute) and **overlap between data points** of phase A and B (Child C).



Graph 4.182 A line graph showing the number of words read in a passage (per minute) and **overlap between data points** of phase A, B1 and B2 (Child C).

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.173 shows that there is a substantial increase in mean between phase A (15.75) and B (28.58). This equates to a +12.83 shift in mean between the phases. Graph 4.174 shows an increase between phase A (15.75) and B1 (23.18), and B1 (23.18) and B2 (36). This equates to a +7.43 increase from phase A and B1, and a +12.82 increase between phase B1 and B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.175 shows a steep incline for phase A's trend line and a shallower incline for phase B. Graph 4.176 shows a relatively horizontal trend line for phase B1, and an increasing trend line for phase B2, shallower than phase A.
Variability (*The range of data about the best fitting line*)	Graph 4.177 shows a fairly large variability for both phase A and B. Graph 4.178 also shows a fairly large variability across the three phases.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.179 shows little evidence of an effect of the intervention from phase A to B. Graph 4.180 shows a slight change in level between phase B1 and B2.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.181 shows 50% of data points in phase B overlapping with phase A. Graph 4.182 shows the majority of data points in phase B1 overlapping with phase A. Phase B2 has approximately a third of data points overlapping with phase B1.

Table 4.18 A summary of the outcome of visual analysis of Child C's passage word reading graphs.

4.4.3.2.1 Inter-Observed Agreement (IOA)

'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

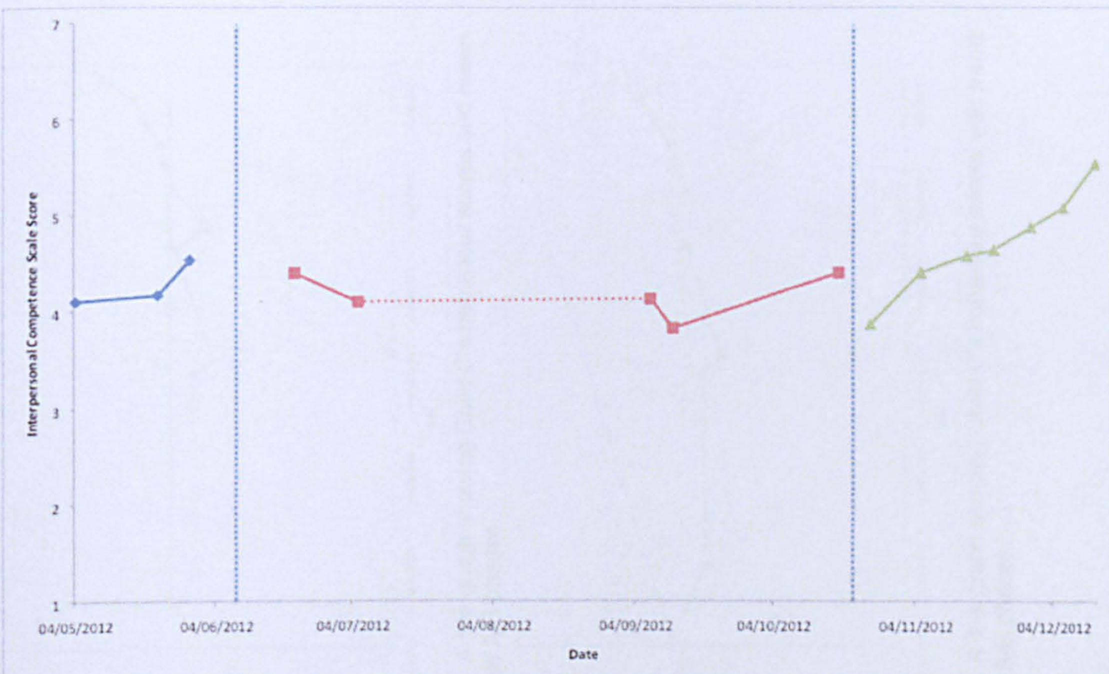
'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 75%

4.4.3.2.2 Summary (Child C)

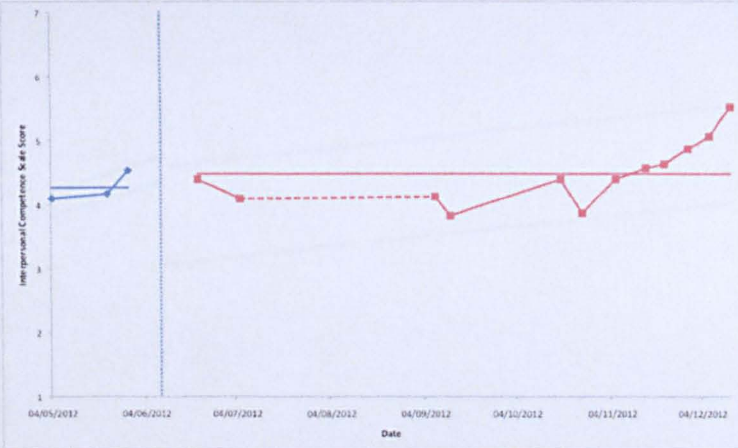
Visual analysis of Child C's passage word reading across baseline and intervention phase suggest a possible effect of the intervention. The A-B design suggests a potential effect with a large increase in mean across the phases. However, the immediacy of effect is not apparent and there is a large proportion of the data that overlaps between the phases. The large variance within each phase also makes it difficult to infer intervention causation. The A-B1-B2 design presents a stronger case for an effect of the intervention on passage word reading during the B2 phase. There is a large increase in mean between phase B1 and phase B2, the trend line is increasing, in comparison to phase B1's horizontal trend line, and there appears to be an immediate effect at the start of phase B2. There is a small overlap of data between phase B1 and phase B2. The variability in phase B2 is fairly large and makes inferring the effect of the intervention more difficult.

4.4.4 Single Case Experimental Design – Behaviour (Child C)

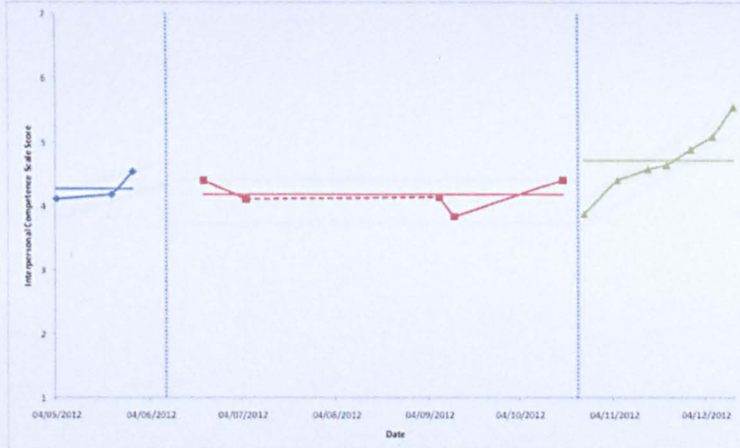
Graph 4.183 A line graph showing Child A's behaviour scores across phase A and B.



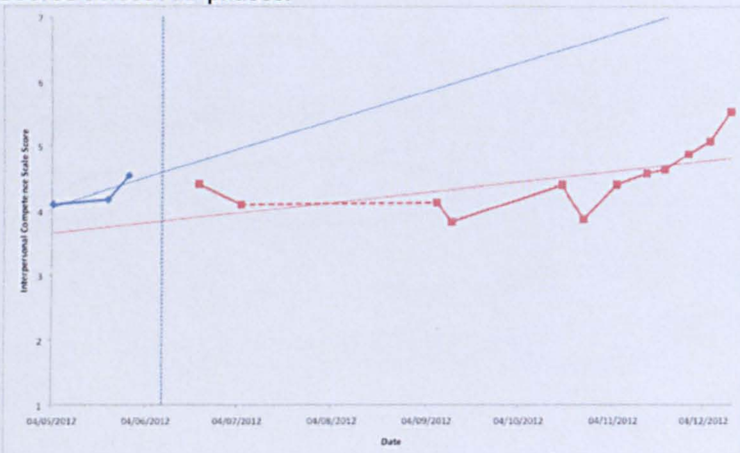
Graph 4.184 A line graph showing Child A's behaviour scores across phase A, B1 and B2.



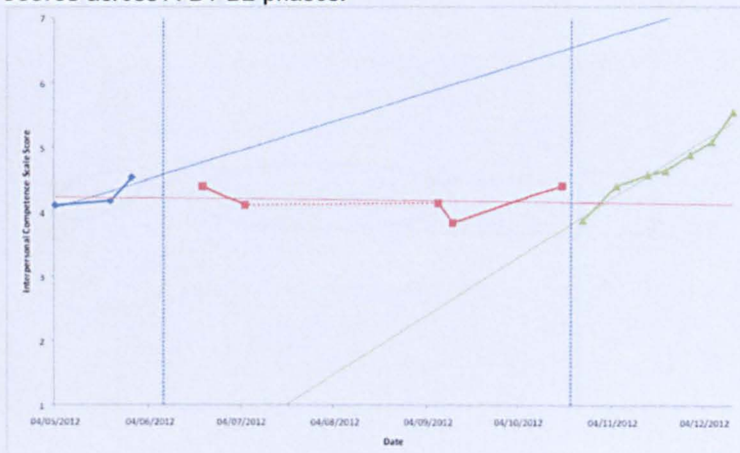
Graph 4.185 A line graph showing Child C's behaviour scores and **mean scores** across A-B phases.



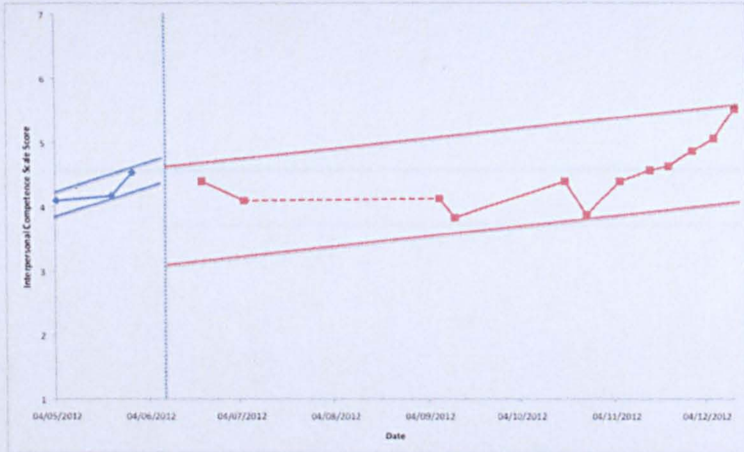
Graph 4.186 A line graph showing Child C's behaviour scores and **mean scores** across A-B1-B2 phases.



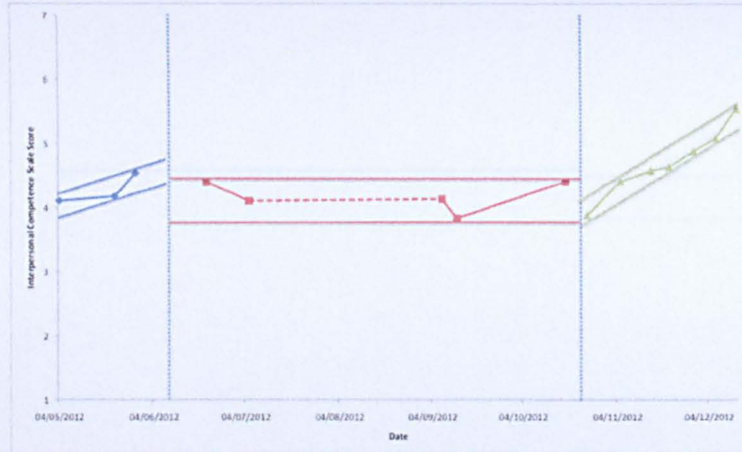
Graph 4.187 A line graph showing Child C's behaviour scores with **trend lines** across A-B phases.



Graph 4.188 A line graph showing Child C's behaviour scores with **trend lines** across A-B1-B2 phases.



Graph 4.189 A line graph showing Child C's behaviour scores with **variance lines** across A-B phases.

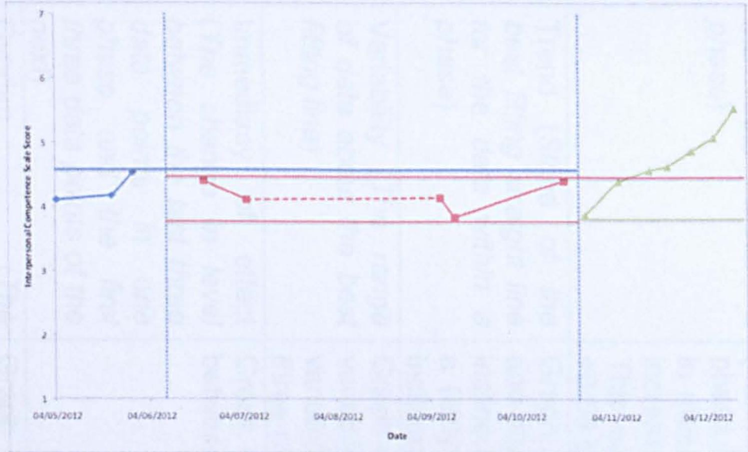


Graph 4.190 A line graph showing Child C's behaviour scores with **variance lines** across A-B1-B2 phases.

Graph 4.191 A line graph showing Child C's behaviour scores and **immediacy of effect** across A-B phases.

Graph 4.192 A line graph showing Child C's behaviour scores and **immediacy of effect** across A-B1-B2 phases.

Graph 4.193 A line graph showing Child C's behaviour scores and **overlap of data** across A-B phases.



Graph 4.194 A line graph showing Child C's behaviour scores and **overlap of data** across A-B1-B2 phases.

Feature	Visual Analysis
Level (*Mean score for the data within a phase*)	Graph 4.185 shows a slight increase in mean from phase A (4.27) to phase B (4.48). This equates to a +0.21 shift from phase A to phase B. Graph 4.186 shows a slight decrease in mean from phase A (4.27) to phase B1 (4.17), and an increase in mean from phase B1 (4.17) to phase B2 (4.71). This equates to a -0.1 shift from phase A to B1, and a +0.54 shift from phase B1 to phase B2.
Trend (*Slope of the best fitting straight line for the data within a phase*)	Graph 4.187 shows an increasing trend line for phase A and phase B. Phase B's trend line has a slightly shallower incline than phase A's. Graph 4.188 shows phase B1 with a fairly horizontal trend line and phase B2 with a steep inclining trend line.
Variability (*The range of data about the best fitting line*)	Graph 4.189 shows phase A with a small range of variability and phase B with a slighter larger range of variability, although relatively small. Graph 4.190 shows all three phases to have a small amount of variability.
Immediacy of effect (*The change in level between the last three data points in one phase and the first three data points of the next*)	Graph 4.191 and graph 4.192 show limited change in level between the phases.
Overlap (*The proportion of data from one phase that overlaps with data from the previous phase*)	Graph 4.193 shows approximately two thirds of the data points in phase B overlapping with phase A data. Graph 4.194 shows all of the data points in phase B1 to overlap with phase A, and approximately a third of data points in phase B2 to overlap with phase B1.

Table 4.19 A table providing information regarding visual analysis of Child C's behaviour scores graphs.

4.4.4.1 Inter-Observed Agreement (IOA)

'There is a significant change in performance when the precision teaching intervention is introduced': IOA = 100%

'There is a significant change in performance when the precision teaching intervention is implemented consistently': IOA = 88%

4.4.4.2 Summary (Child C)

Visual analysis of the graphs exploring the effect of the precision teaching intervention on Child C's behaviour does not indicate a strong effect in regards to the A-B design. There is small increase in mean, the trend line of phase A is steeper than phase B, and there does not appear to be any change in level between the end of phase A and the beginning of phase B. There is also a fairly large overlap of data between the phases. Examining the graphs as an A-B1-B2 design there appears to be greater evidence regarding an effect of the intervention. There is a notable increase in the mean from the previous phase, the variability is small, showing a clear upwards direction of the data, and the trend line also indicates an increasing score. The overlap of data from phase B2 and phase B1 is small. The visual analysis of the A-B1-B2 design therefore suggests that the consistent use of precision teaching positively effects Child C's behaviour.

4.4.5 Thematic Analysis (Child C)

The thematic analysis of Child C's focus group discussion found two themes that emerged when exploring the precision teaching intervention. The two themes that emerged were:

- Self-concept as a learner
- Consistency and structure

The two main themes also encapsulated sub-themes that made up the overarching themes which will be explored.

4.4.5.1 Main Theme 1: Self-Concept as a Learner

Figure 4.6 Thematic map for *Self-Concept as a Leaner* theme.

Self-concept as a learner theme emerged through the identification of a number of sub-themes that suggested Child C's own self-concept regarding his ability to undertake tasks and subsequent learning enjoyment and approach to tasks had positively improved.

4.4.5.1.1 Sub-Theme 1: Approach to Learning

Staff identified that the introduction of the precision teaching intervention appeared to support Child C's approach to learning. Staff commented about Child C's enjoyment with precision teaching sessions:

'He happily goes to the sessions for precision teaching'

Child C's approach to tasks was thought to have also improved in regards to the intervention sessions and other curriculum related activities:

'Willing to give tasks a go'

'Approach to task improvement'

4.4.5.1.2 Sub-Theme 2: Independence

The focus group commented that there was less reliance on staff in undertaking work, and a shift in his attitude towards learning, possibly as a result of his improved self-concept.

'More independence'

'Becoming clearer and needing less reminding to use big voice'

4.4.5.2 Main Theme 2: Consistency and Structure

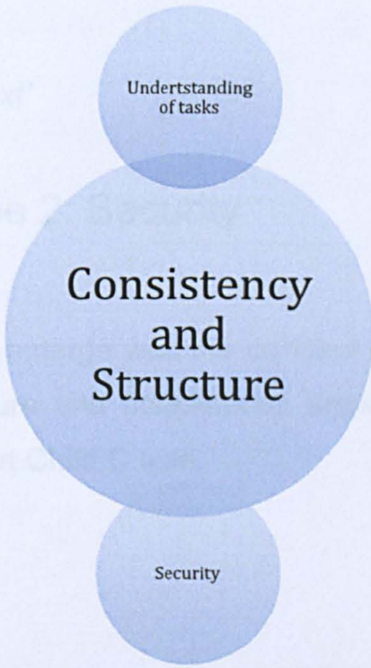


Figure 4.7 Thematic map for *Consistency and Structure* theme.

The second main theme that emerged was *consistency and structure*. This theme emerged in addition to the intervention process as there was a number of key aspects that related to the intervention and Child C's characteristics.

4.4.5.2.1 Sub-Theme 1: Understanding of Tasks

Child C was supported by the precision teaching intervention through the use of structure and routine. The steps of precision teaching meant that Child C was able to understand and access tasks more readily.

'Enjoys little and often learning – format good for him'

'Doesn't engage with anything if it isn't structured'

The use of structure and routine in the precision teaching sessions also had an impact on the generalisation of the skills learnt.

'Understands what the words mean'

'Knows the words in context'

4.4.5.2.1 Sub-Theme 2: Security

The second sub-theme to emerge was the concept of security and reduction of anxiety due to the structure and consistency apparent in precision teaching. The focus group stated that Child C was:

'More emotionally stable'

This sub-theme links with the previous overarching theme of 'self-concept as a learner', but appears to be an important prior step before being able to develop his self-concept. Child C's access to structure and consistency may allow him to develop his self-concept as a learner as a result of a reduction in anxiety.

4.4.5.3 Thematic Analysis Interrater Reliability (Child C)

An interrater reliability of 69% was obtained when a reliability check of the themes was undertaken. This is slightly below the 75% recommended by Joffe (2011) for a reliable coding frame. However, the researcher asserts that the secondary observer did not have the full context of the data extracts, and was not privy to the thematic analysis process, therefore accounting for some of the variance seen.

4.4.5.4 Summary of Thematic Analysis

The two overarching themes that emerged from Child C's thematic analysis were regarding his development of his self concept as a learner and the importance of structure and consistency that was apparent in the precision teaching intervention. Child C was perceived to have developed a more positive approach to tasks and greater independence after the onset of the intervention, it appeared that he had developed his sense of learning self concept and was more willing to undertake tasks. The consistency and structure within precision teaching may have allowed him to access the teaching more readily. Staff were also able to identify that providing Child C with more structure and consistency is beneficial as he engages better with tasks and appears to be less anxious and more emotionally stable.

4.4.6 Summary of Child C's Findings

The single case experimental design findings suggested that Child C's individual word reading ability had an initial effect that was not maintained. However, It should be noted that Child C began incorporating the single word into a sentence which would have had an impact on the number of words read per minute. The passage word reading ability shows a possible effect during the A-B design, and a more convincing intervention effect when the intervention was implemented consistently. This suggests the Child C was able to generalise the words learnt from the intervention to other contexts. The behaviour measure did not find a strong effect when explored as an A-B design but when the intervention was implemented consistently there appeared to be a clear effect suggesting that Child C's behaviour had improved.

The thematic analysis results also 'corroborate' some of the findings from the single case experimental design. Child C's self-concept as a learner appeared to improve and staff report that he was more willing to engage with tasks and work independently, which may be a contributing factor in some of the reading generalisation seen and behaviour improvement. Also, the use of consistency and structure was identified by staff as a key aspect of the precision teaching intervention. Providing structure and consistency, and incorporating it into Child C's day may help to possibly reduce anxiety, subsequently supporting his access to the curriculum.

4.6 Thematic Analysis of the Focus Group's Discussion Regarding Precision Teaching

The thematic analysis of the focus group's discussion regarding their general comments on precision teaching identified three overarching themes:

- Intervention process
- Self-concept as learner
- Learning

4.6.1 Main Theme 1: Intervention Process

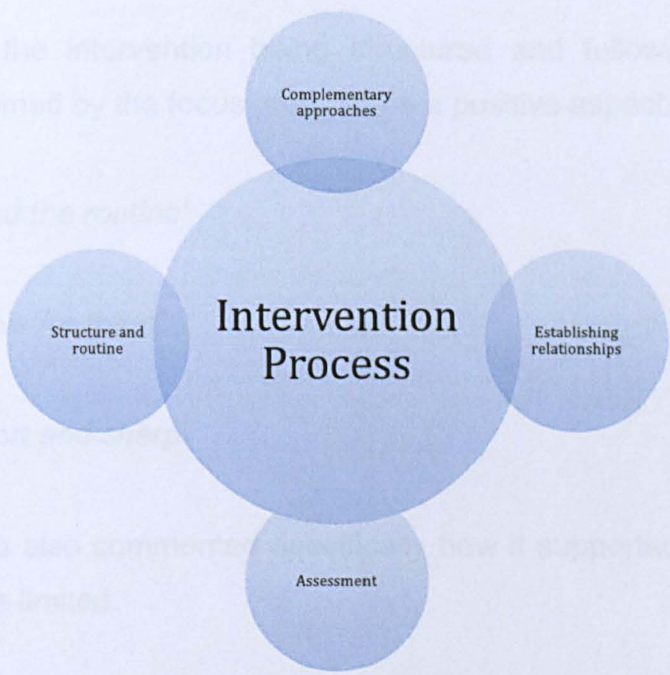


Figure 4.8 Thematic map for *Intervention Process* theme.

Intervention process theme is defined according to the precision teaching procedures. The focus group discussed a number of elements that they found positive and negative about the precision teaching that was themed under *intervention process*.

4.6.1.1 Sub-Theme 1: Assessment

The continual assessment was seen as a beneficial aspect of the intervention as it allowed the teaching to be individualised for each child and differentiated appropriately. The benefits of the ongoing assessment were also apparent in other aspects of the curriculum and supported teaching staff to identify the appropriate level of class work and teaching strategies.

'On-going assessment is useful'

'Helped with assessment approaches'

4.6.1.2 Sub-Theme 2: Structure and Routine

The format of the intervention being structured and following a consistent pattern was deemed by the focus group to be a positive aspect.

'Children enjoyed the routine'

'It was predictable for them'

'Helps being short and sharp'

The focus group also commented specifically how it supported children whose attention may be limited.

'Supported children with attention difficulties'

4.6.1.3 Sub-Theme 3: Building Relationships

The focus group values the time spent building a positive relationship with the pupil. The 1:1 sessions allowed this to happen and was deemed an important part of the process and an important aspect in the positive outcomes that they felt emerged.

'The 1:1 is an important factor'

4.6.1.4 Sub-Theme 4: Complementary Approaches

The focus group felt that the intervention fitted well into their existing practice and complemented their current education approach and practices. The intervention approach also supported staff in adjusting some of their current classroom practices due to the positive outcomes they felt had been achieved.

'Definitely complemented what we do currently'

'Taken aspects of precision teaching into class such as the little and often approach'

It should be noted that one aspect that was initially found limiting was creating time to undertake the intervention. However, this was only an initial concern of the group as it has subsequently been rolled out to the rest of the class due to the positive benefits that they feel have emerged from the intervention. The complementary aspects of the class approach and intervention have been stated to allow it to be incorporated effectively.

4.6.2 Main Theme 2: Self-concept as a learner

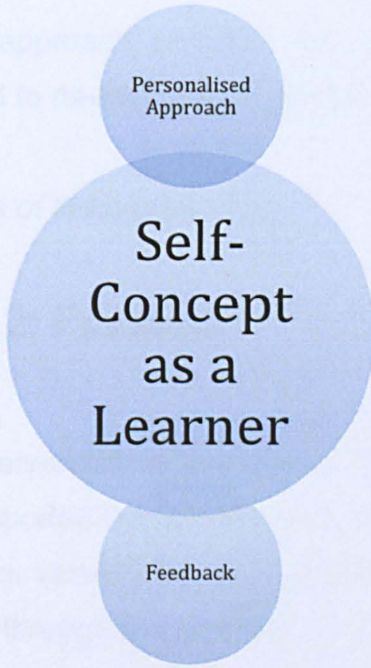


Figure 4.9 Thematic analysis map for 'Self-Concept as a Learner' theme.

The focus group identified a number of aspects that combine to form an overarching theme of *self-concept as a learner*. This theme is defined as the pupil's thoughts and feelings about their learning ability being affected positively after the onset of the intervention. A number of sub-themes were identified that clustered to make the overarching theme.

4.6.2.1 Sub-Theme 1: Personalised Approach

The precision teaching intervention meant that children had sessions that were tailored according to the individual child. Having a personalised approach seemed to support the pupils' self-concept as a learner due to their individual achievements being recognised and the removal of any comparison with peers.

'Children see progress'

'Pupils are aware of other children's abilities. Precision teaching gave them confidence of not being compared'

The precision teaching approach ensured that children would experience success which also helped to develop their self-concept as a learner.

'Children liked the success of the programme'

4.6.2.2 Sub-Theme 2: Feedback

The precision teaching intervention allowed immediate feedback for the pupil in a number of ways that supported the development of their learning self-concept. Children received feedback verbally from the staff member during intervention sessions and also visually through the charting of their scores.

'Instant feedback very useful and worked well for the children'

'Chart being visual works well'

4.6.3 Main Theme 3: Learning

Figure 4.10 Thematic map for *Learning* theme.

The third theme that emerged from the focus group discussion was *learning*. This is defined as the improvement in the pupil's learning attributed to the onset of the intervention. The focus group found that there were significant gains for some children participating in the intervention.

'Improvements speak for themselves'

'Dramatic improvements for some children'

4.6.4 Thematic Analysis Interrater Reliability

An interrater reliability of 66% was obtained when a reliability check of the themes was undertaken. This is below the 75% recommended by Joffe (2011) for a reliable coding frame. However, the researcher asserts that the secondary observer did not have the full context of the data extracts, and was not privy to the thematic analysis process, therefore accounting for some of the variance seen.

4.6.5 Summary of Thematic Analysis

The focus group thematic analysis of the general comments regarding the precision teaching intervention identified three overarching themes from the discussion. All three themes had aspects that interlinked with each other. The process and procedures of precision teaching supported the staff in establishing and appropriately assessing the pupils they were working with. This in turn helped to develop the pupils' self-concept as a learner and their academic attainment. The compatibility of the intervention with their current approach to teaching appeared to support the implementation of the intervention and the further application of it to other pupils in the class.

Chapter 5: Discussion

5.1 Review of the Findings

This research explores the incorporation of a precision teaching assessment method into a 'structured approach' for children with autism. The overarching research question was:

'Can precision teaching positively augment a structured approach for children with autism?'

The research sought to measure the impact of precision teaching, as an augmentation of a 'structured approach,' through measuring the focus pupil's learning, affect, and behaviour. This led to a series of sub-questions:

"Can precision teaching lead to a positive impact on a child with autism's learning when incorporated as part of a 'structured approach'?"

"Can precision teaching lead to a positive impact on a child with autism's affect when incorporated as part of a 'structured approach'?"

"Can precision teaching lead to a positive impact on a child with autism's behaviour when incorporated as part of a 'structured approach'?"

An additional sub-question was also provided to explore the perceptions of staff regarding the precision teaching intervention.

"In what ways is precision teaching perceived to augment a 'structured approach' to teaching a child with autism?"

The findings from this sub-question sought to provide additional information for the preceding sub-questions as well as information of a more general, and exploratory nature.

The research was undertaken as a series of three case studies and therefore the ability to generalise findings is limited. However, common themes emerging across the case studies will be discussed, the possible reasons for the findings, and implications will be considered.

5.1.1 "Can precision teaching lead to a positive impact on a child with autism's learning when incorporated as part of a 'structured approach'?"

The exploration of precision teaching's incorporation into a 'structured approach' on learning was measured firstly through the impact on the pupils' reading ability. Staff undertook the precision teaching sessions focusing on the pupils' word reading. Additional information was also obtained from the focus groups. Two measures were used to explore word reading ability, individual word reading, and passage word reading. The individual word reading measure required the pupil to read a series of single words, approximately half that the pupil knew securely and half that he would progress to in a systematic fashion. The second reading measure required the pupil to read a passage from a familiar reading book for one minute. The researcher was attempting to explore whether the single words learnt in isolation could be generalised to the reading book.

5.1.1.1 Key Findings

Child A

Child A appeared to show an improvement in the two measures used to explore his reading ability. The findings from the individual word reading measure suggested that when the intervention was not implemented consistently, i.e. not daily and not following the precision teaching training procedures accurately, there did not appear to be an effect from the intervention. However, when the precision teaching was implemented more consistently and in accordance with the training received there appeared to be an improvement in Child A's word reading ability as a result of the intervention.

The passage word reading measure identified a similar pattern, with Child A's findings suggesting no intervention effect when the precision teaching was not implemented consistently, but an apparent intervention effect when the precision teaching was implemented consistently and in accordance with the training received, suggesting that the individual words learnt in the precision teaching sessions had been generalised to a different context.

The thematic analysis of the focus group data relating to Child A's response to precision teaching highlighted *learning* as a key theme that emerged. The focus group discussion highlighted two sub-themes that were encompassed within the overarching *learning* theme. These two sub-themes were *accelerated learning* and *generalisation of learning*. The focus group felt that Child A's basic skills had improved and the learning improvements were being seen in areas of the curriculum not focused on with the precision teaching intervention. The focus group discussion related to Child A's academic improvements at the onset of the precision teaching intervention.

The overall findings for Child A suggest that the precision teaching positively effected their learning in terms of the intervention's specific focus and also in other areas of the curriculum.

Child B

The findings from the individual word reading measure suggested an effect when the intervention was implemented consistently. When the findings were explored as an A-B design it was difficult to identify an intervention effect on Child B's reading. The passage word reading measure suggests an effect at the onset of the intervention but it becomes more apparent when the intervention is implemented consistently. The A-B design's graphs may have been enhanced by the data at the end of the phase when the intervention was implemented consistently. Similarly to the first measure, when the precision teaching intervention is implemented consistently Child B's reading ability appears improved.

The thematic analysis of the focus group data for Child B's response to the precision teaching intervention suggested that Child B had improved his approach to learning. Staff perceived Child B as more engaged in tasks and suggest a general improvement observed across the curriculum.

The overall findings for Child B with regard to precision teaching and its impact on learning suggest that for Child B, the intervention has supported and improved his learning. This can be seen in Child B's reading measure findings and his perceived improved approach to tasks as identified by the focus group.

Child C

The findings for the individual word reading measure for Child C does not indicate an intervention effect. The graphs were examined across A-B and A-B1-B2 designs with limited evidence of an intervention effect. There was an initial substantial increase when the precision teaching intervention was implemented (onset of phase B), however this increase in the number of words read declined to baseline levels. It should be noted, as discussed in Chapter 4, that during B2 phase, Child C would put the single word into a short sentence thus slowing his response time down. Child C was prompted to read only the single probe word but continued to incorporate it into a sentence for the majority of the B2 phase. During phase B2, Child C's data continued to be of a similar level as the previous phases. A tentative conclusion suggests that Child C's reading ability improved and became more fluent during phase B2 as he was able to identify and construct a sentence but still responded at a similar rate to the measure as previous phases. However, as this was not controlled for by the researcher, any conclusions drawn are speculative.

The findings from the passage word reading measure for Child C indicated an intervention effect. An intervention effect appears to be apparent when exploring the graphs as an A-B design and A-B1-B2 design. The latter design shows a potentially greater significant intervention effect when the intervention was implemented consistently.

The thematic analysis of the focus group's discussion suggests that Child C's response to the precision teaching intervention indicate a perceived improvement in his learning as he was suggested to be better able to understand and generalise information. The thematic analysis information linked the precision teaching approach and procedures as supporting Child C's learning, helping to improve understanding, as well as his approach to learning.

Overall, the precision teaching intervention appears to have had a positive impact on Child C's learning. One of the reading measures showed a clear improvement in reading ability after the onset of the intervention and the focus group discussion highlighted the structure of the intervention in supporting his understanding and application to learning tasks.

5.1.1.2 Common themes identified across the three case studies

The word reading measures were essentially a proxy measure of the pupil's learning. It should be noted that the conclusions drawn from the measures taken can only be applied to literacy learning rather than learning in general, as the ability to extrapolate literacy learning to a more general learning construct could be considered highly contentious. The three case studies suggest that the precision teaching intervention improved the pupil's word reading ability. The effect of the intervention was more apparent when the intervention was implemented consistently and according to the training received. In all three case studies the children made gains in their passage word reading during the intervention phase indicating that the intervention supported their generalisation of individual words learnt. Two case studies showed improved rates of reading individual words from a probe sheet. The researcher asserts that the third case study, Child C, also demonstrated an improvement in individual word reading from a probe sheet but this was not captured by the measure. During phase B2, when the intervention was implemented consistently, Child C would apply the individual word to a short sentence. Child C's number of words read in phase B2 did not fall below the number read in phase A or B, indicating an improved fluency of word reading. It also indicates Child C was able to draw meaning from the words and apply them in an appropriate context.

A common theme from the focus group data for all of the case studies presented was that the pupils' approach to learning was perceived to have improved, as a result supporting their learning. The pupils' engagement in class based tasks also appeared to improve and was also suggested to positively support their learning.

5.1.1.3 Possible Explanations for the Findings Relating to Learning

The precision teaching intervention was incorporated within an individual word reading programme and the words learnt were linked to the words used in the two learning measures. When the intervention was not implemented consistently the intervention effect was not apparent, thus suggesting that the key concepts of fluency building procedures used in precision teaching are necessary for a pupil's fluent response to the targeted skill.

The key procedures used are setting time based targets for mastery criteria, to provide daily opportunities to practice the skill, to provide time measurements, and to chart on a Standard Celeration Chart (Binder, 1988). Pupils also received immediate feedback in the form of verbal praise and visual presentation of the chart. When the precision teaching was implemented according to the training, the findings in the current research were consistent with research by Bicklin, Dickinson and Brethower (2000). Their research found that developing fluency in a skill produced faster response rates and better retention of information.

The 'instructional hierarchy's' (Haring, Lovett, Eaton, & Hansen, 1978) theoretical model of skill mastery can be applied to the findings. When the sessions were not consistently implemented according to the precision teaching procedures, the pupil was learning skills to accuracy but did not have sufficient repetition and overlearning to develop their fluency and subsequent generalisation of the targeted skill. In the case of Child C, it could be argued that he developed his individual probe word reading to a fluent level as he was able to adapt the skill learnt by putting the words in context.

The findings also support the research with regard to precision teaching supporting the careful monitoring and assessment of the pupil to ensure that they work on an appropriate level of task, and move on only when they have successfully achieved fluency (Bernard-Optiz, 2005; Snow & Swanson, 1982). The gains in attainment seen in this research are consistent with the evidence base with regard to the development of basic skills (Downer, 2007; Boys & Lydon, 2008; Lindsley, 1992; Raybould & Solity, 1988).

Interestingly, the findings support the researcher's assertion that developing fluency will enable a pupil with autism to generalise the skills learnt. Theories that offer explanations for the difficulties that people with autism have generalising learnt skills are 'executive dysfunction', 'weak central coherence' and 'context blindness'. The research findings indicate that some of these difficulties can be overcome by developing skills to fluent levels in the context of word reading. This appears to be in contrast to Vermeulan (2012) who states that context sensitivity cannot be learnt.

5.1.2 "Can precision teaching lead to a positive impact on a child with autism's affect when incorporated as part of a 'structured approach'?"

The second set of measures explored the child's self-concept related to learning. To measure this, the participants were asked four questions, half that focused on reading and half that focused on learning in general. The pupils were asked to point to a smiley face from a seven-point scale that best represented how they felt about the question asked. Child C did not complete this aspect of the SCED as it was deemed by the researcher and classroom staff that he did not have a firm understanding of the questions being asked.

5.1.2.1 Key Findings

Child A

The measures taken to explore Child A's affect in relation to the intervention did not show any clear effects of the intervention. Child A's self-concept regarding his ability to learn new information did not indicate a change in response to the intervention. His enjoyment at learning new information declined at the onset of the intervention but relatively quickly returned to baseline levels. Child A's reading enjoyment also did not show a clear effect in response to the intervention. However, Child A's reading ability self-concept showed a more stable pattern of responding when the intervention was implemented consistently suggesting a more stable self-concept in relation to this area.

The staff focus group discussion indicated that they felt that Child A had a better self-concept as a learner in response to the intervention. Staff perceived Child A as having an increased confidence in his approach to learning, taking on tasks and activities that previously he may not have felt secure in, and responding better to tasks that he found challenging. He also appeared to enjoy learning more as a result of the intervention, showing enthusiasm to undertake tasks. Child A's emotional responses were reportedly perceived to also be more appropriate in class and he was felt to be better able to deal with his emotions in an appropriate manner.

Child B

Child B's measures regarding their learning self-concept did not indicate an effect of the intervention for any of the measures taken, suggesting that Child B's self-concept was unaffected by the intervention. However, the staff focus group data indicated that they felt there had been an improvement in Child B' self-concept as a learner. The sub-themes that emerged indicated that staff perceived Child B's approach to learning had improved and he was more engaged in tasks and thinking for himself. Also, the improved self-concept as a learner appeared to have had an impact on Child B's social behaviour, showing a perceived improved social maturity and behaviour.

Child C

Child C did not undertake SCED affect measures as it was deemed that his understanding of the task was not sufficient to obtain valid data. However, focus group data analysis suggested that Child C showed a perceived improvement in his self-concept as a learner. The sub-themes that emerged from the overarching theme of *self-concept as a learner* were *approach to learning* and *independence*. Child C's approach to learning was perceived to have improved, he was felt to be more willing to give tasks a go and showed enjoyment at the precision teaching sessions. Child C was also felt to show a greater independence after the onset of the intervention, relying less on staff to support him in undertaking class work.

5.1.2.2 Common Themes Identified Across the Three Case Studies

The SCED measures used for each participant did not identify any common themes. The majority of the measures indicated no intervention effect, suggesting that there was no change in the participants reported affect or that the measure was not adequate to capture the data sufficiently.

The focus group data indicated a perceived improvement in each participant's self-concept as a learner. The focus group data had a common theme that emerged across the three case studies that suggested the precision teaching intervention supported the participants' approach to learning and engagement in tasks. These improvements were encapsulated within the overarching *self-concept as a learner* theme.

5.1.2.3 Possible Explanations for the Findings

The research base for precision teaching identifies precision teaching as motivating for the pupil (Raybould & Solity, 1982; Kessissioglou & Farrell, 1993; Downer, 2007; Roberts & Norwich, 2010). This is due in part to the fact that the pupil is competing against their own previous score, and is not compared to their peers (Raybould & Solity, 1982), and also because the pupil has systematically and precisely assessed objectives with immediate feedback through praise and the Standard Celeration Chart (Downer, 2007; Kessigolon & Farrell, 1995). Roberts and Norwich (2010) also state that a pupil develops a positive view of themselves through precision teaching as they are able to access the curriculum in a way that they were not able to previously. The findings from this research are mixed as the quantitative, self-report measures did not indicate an affective intervention effect. However, the focus group data thematic analysis suggested a perceived affective element of the intervention, suggesting that the intervention supported their self-concept as a learner, in particular their improved ability at approaching tasks and managing situations in class more appropriately. The findings from the focus group correlate with the evidence base suggesting that the pupils positively develop their self-concept as a learner and learning enjoyment when precision teaching approaches are employed (Roberts & Norwich, 2010; Downer, 2007; Kessissoglou & Farrell, 1995; Raybould & Solity, 1982). These findings were not indicated in the pupils' self-report measures and may be a limitation of the measure's sensitivity in identifying change, or may be a consequence of the child's inability to reflect on and recognise their enjoyment and self-concept as a learner. It is also possible that the intervention did not affect their enjoyment and self-concept as a learner. The perceived improvements identified by the focus group were based upon perceptions and not observed behaviours so may not be indicative of an improvement in this area. The ability to measure change in this area is fraught with difficulties and conclusions are tentatively drawn.

The literature suggests that pupils with autism may find the typical learning environment confusing and suggests they will find increased structure and routine supportive (Kusmierski and Henckel, 2002). Precision teaching may allow for improvements in affective aspects for pupils due to its structured and consistent approach to learning. The structured approach to teaching new skills identified in precision teaching may allow pupils' to be able to engage in the sessions more thoroughly as it can provide consistency and predictability, encouraging self-control and independent functioning (Kusmierski & Henckel, 2002). Erba (2000) also states that children with autism need structure and task analysed goals in order to learn. The process of precision teaching may therefore have allowed the pupils to engage in the tasks which in turn helped to improve their self-concept and learning enjoyment.

Pupils in this study had precise and systematically assessed targets that ensured that the work was appropriately differentiated for them and their progress. Without the work being regularly assessed through an 'assessment through teaching' approach, pupils may not be taught at an appropriate level which may affect their motivation to tasks and their self-concept as a learner. This is again supported by Erba's (2000) research regarding task analysed goals being required for learning to take place and Snow and Swanson's (1982) article highlighting the importance of effective assessment procedures that provide feedback regarding the students' performance and instructional effects. Therefore the process of precision teaching appears to allow the pupil to be able to access the task and experience success which will potentially raise their self-concept as a learner and also their enjoyment of learning.

Precision teaching provides feedback of success through visual methods. Children with autism are suggested to be able to process visual information easier than auditory information (Kusmierski & Henckel, 2002). Therefore, the Standard Celeration Chart may allow the pupil to see their success in a method that allowed them to engage with the information easier, thus, helping to support the potentially positive affective aspects of precision teaching. The one to one sessions were also suggested, by the focus group, to be an important aspect in supporting the child. The potential benefits of the precision teaching one to one sessions are that the pupils were able to develop a positive relationship with the staff member through focused sessions that allowed them to achieve. They may have developed trust with the staff member and felt comfortable in engaging the tasks, supporting their learning, motivation, and self-concept as a learner.

5.1.3 "Can precision teaching lead to a positive impact on a child with autism's behaviour when incorporated as part of a 'structured approach'?"

The third measure used a staff questionnaire to assess whether the intervention had an effect on the participant's behaviour. The questionnaire focused on the participant's social and interpersonal competence. This measure was completed on a weekly basis by class staff, focusing on the child's behaviour over the past week.

5.1.3.1 Key findings

Child A

The SCED measure for behaviour did not indicate an effect of the intervention for Child A. The focus group data analysis indicated that Child A was perceived to be better able to deal with his emotions after the onset of the precision teaching intervention. This was linked to his improved self-concept. Also, linked to the overarching theme of self-concept as a learner was his perceived increased confidence in undertaking activities that he was not secure with. Child A was also felt to have established more positive relationships with staff and engaged with them in an appropriate manner, willing to take on board advice and guidance.

Child B

The data obtained for Child B in the baseline phase was not sufficient for a comparison to be made with the intervention phase. Therefore, a full analysis of data was not undertaken due to the limitations of the data. A highly tentative and speculative analysis of the data suggests that Child B's behaviour improved when the intervention was consistently implemented. The focus group data analysis suggested a perceived improvement in behaviour linked to his developed self-concept as a learner. The focus group felt that Child B displayed improved social behaviour, with greater maturity and improved behaviour at school and home. Child B was also felt to have engaged better in tasks, willing to 'think for himself' and requiring less adult support to undertake class activities.

Child C

The SCED measure for Child C did not indicate an effect of the intervention when explored across the baseline and intervention phases. However, when the intervention phase was examined as two phases, an effect was apparent when the intervention was implemented consistently. Therefore, this suggested that when the intervention is implemented consistently Child C's behaviour improved. The focus group data analysis also identified perceived sub-themes that linked to an improvement in Child C's behaviour. The focus group felt that his approach to learning improved, and he was willing to undertake classroom tasks without complaint, happily going to precision teaching sessions when required. He was also perceived to display less reliance on staff to support him in undertaking tasks, and showed a greater independence in conducting himself appropriately in class.

5.1.3.2 Common Themes Identified Across the Three Case Studies

There are mixed findings across the three case studies when exploring the SCED measures. Improvements in behaviour was indicated in two case studies when the intervention was implemented consistently. However, the findings of one case study should be treated cautiously. The focus group data analysis perceived improvements in certain types of behaviour across the three case studies. This perceived behaviour improvements was associated with the participant's approach to learning and engagement with class activities. The relationship with class staff and peers was felt to have improved, and they were perceived to be more willing to undertake class activities without the support of an adult.

5.1.3.3 Possible Explanations for the Findings Regarding Behaviour

The findings indicate that precision teaching may have positive effects on a pupil's behaviour. This is consistent with the research by Downer (2007) whose findings identified positive behaviour changes in pupils who undertook precision teaching sessions as a hypothesised result of improved self-esteem. It could be hypothesised from the findings in this research that the pupils improved behaviour was linked to their improved self-concept as a learner and learning enjoyment. Their improved self-concept as a learner and learning enjoyment may have facilitated their engagement in class tasks as they enjoyed learning and they felt that they were able to complete the tasks. This links to the research identified previously regarding effective assessment methods being needed (Snow & Swanson, 1982) and tasks that are appropriately differentiated for the pupil (Erba, 2000). Feelings of frustration and potential behaviour issues are likely to be less apparent if the work is appropriately differentiated for the pupils.

The focus group felt that precision teaching supported their own personal skills and strategies in general classroom approaches for the pupils participating. This may also aid in the pupils' positive behavioural changes as the pupils were better able to access class tasks and staff were potentially more aware of the pupils' needs. Previous behavioural issues were identified in the focus group data in relation to some of the pupils' resistance in undertaking a task or responding inappropriately when they became frustrated with a task. Precision teaching possibly enabled the pupils to be able to respond appropriately due to an increased sense of self-concept and recognition of their own ability as identified in Roberts and Norwich's (2010) research. Also, the increased self-concept may have allowed the pupils to be able to deal with negative emotions because they have experienced success on a consistent basis through precision teaching as highlighted in Downer's (2007) research.

The SCED findings indicated a positive behaviour change for two of the pupils participating in the research. The pupil where an effect on his behaviour was not apparent in the SCED methodology, was reported in the focus group as displaying improved behaviour and confidence in learning. Child C's behaviour improvement may relate to the addition of structure provided by the precision teaching intervention. Kusmierski and Henckel's (2002) research identified the implementation of structure within a TEACCH approach reduced maladaptive behaviours. Child C was identified by class staff as needing a greater level of structure to support his learning. The focus group also stated that Child C needed structure to access the curriculum and undertake activities. The implementation of precision teaching increased the amount of structure, whilst ensuring that he was accessing an appropriate level of task. The structure and consistency of precision teaching may have allowed a greater understanding for Child C regarding task expectations, in turn reducing anxiety levels. Distributed practice may also have aided all pupils engagement in the tasks, as identified in Solity *et al's* (2000) research, subsequently supporting the development of the participants' self-concept as a learner. The addition of structure and predictability may also have benefitted all of the pupils in encouraging self-control and independent function (Kusmierski & Henckel, 2002).

The limitations of the findings associated with behaviour are that they rely on self-report staff measures and staff perceptions. The self-report SCED measures are prone to bias making it difficult to make firm conclusions regarding the intervention's impact. Again, the focus group's data is based upon perceptions and not observed behaviour leading to potential issues of bias. In addition, the SCED measure may lack sensitivity in identifying an intervention effect for the participants in this study. The supplementary use of behavioural observations may have increased sensitivity regarding behaviour change, thus enhancing the findings for this sub-question.

5.1.4 *"In what ways is precision teaching perceived to augment a 'structured approach' to teaching a child with autism?"*

Additional information was provided from the focus group data analysis that did not relate to the preceding sub-questions, but provided information based on staff perceptions of precision teaching in general and also in relation to the participants.

5.1.4.1 Key Findings

Child A

The thematic analysis of the focus group data identified three perceived overarching themes that emerged from the discussion regarding Child A and precision teaching. These are *self-concept as a learner*, *relationships*, and *learning.* Some of the findings have already been discussed in the preceding sub-questions. *Self-concept as a learner* was identified within the focus group discussion as Child A was perceived to have displayed an increased confidence in approaching situations that he was not secure with, a greater ability to deal with his emotions, and to display appropriate behaviour when frustrated. He also appeared to show a greater enjoyment for learning.

Relationships referred to Child A reportedly establishing positive relationships with staff through the precision teaching intervention, and engaging staff more appropriately in the classroom environment. The focus group felt that the precision teaching sessions supported the relationship to be developed between Child A and themselves. The fostering of more positive relationships was felt, in part, to be due to Child A being able to establish trust with staff through the one-to-one sessions. Child A subsequently was reported to engage staff more appropriately in lessons, being more willing to listen and take on board advice.

Learning was another main theme identified. The focus group identified that the precision teaching intervention appeared to facilitate Child A's accelerated learning, with him going on an upward trend with learning. The focus group also indicated that they felt the precision teaching intervention supported Child A's learning in other areas of the curriculum, perceiving improvements in other areas than those targeted by the precision teaching sessions.

The themes that emerged from the focus group were interlinked with each other. Improvements in Child A's self-concept as a learner was felt to have a large effect on his progress in literacy and other areas of the curriculum. The sessions supported and fostered the development of positive relationships to develop, but also appeared to improve his self-concept as a learner, giving him greater confidence in dealing with situations that he may have felt unsure about previously. The precision teaching intervention appeared to support staff and pupil alike in establishing relationships.

Child B

The thematic analysis of the focus group data identified two overarching themes. These were *intervention process* and *self-concept as a learner. Intervention process* was defined as the features and processes involved in the precision teaching intervention. The focus group felt that for Child B, the overlearning aspect of precision teaching worked well for him. It was perceived to support his acquisition and consolidation of key skills. The one to one sessions were felt to support Child B's task engagement as he was perceived to enjoy the focused attention that was felt to subsequently support his task application. It appears that through the careful monitoring and adjustment of tasks, Child B experienced success in his precision teaching sessions which supported his self-concept as a learner. Through the success that he experienced, he may have felt that he could undertake tasks for himself and have less reliance on staff to support him. Also, the precision teaching intervention appeared to support staff in ways to support Child B in other areas of the curriculum as it was an ongoing, 'assessment through teaching' approach which they felt worked well.

Self-concept as a learner theme related to Child B's improved approach to learning and his social behaviour. As Child B's self-concept as a learner developed in response to the precision teaching intervention it appeared as if his approach to learning and general classroom behaviour improved too. Child B was stated to be more engaged in tasks and to show more signs of 'thinking for himself'. Child B's improved self-concept appeared to support his social behaviour and he showed greater maturity in class and at home.

The themes that emerged from the focus group regarding Child B and precision teaching highlight a perceived positive experience of being involved with the intervention. The two overarching themes are intertwined with each other with the processes apparent with the precision teaching intervention helping to possibly facilitate Child B's self-concept as a learner and the associated outcomes.

Child C

The thematic analysis of the focus group data regarding Child C and precision teaching identified two overarching themes, *self-concept as a learner* and *consistency and structure*. Child C's perceived developing self-concept as a learner was linked to his improved approach to learning and greater independence in class tasks. The focus group stated that they felt that Child C was more willing to undertake tasks and had less reliance on class staff to support him.

The *consistency and structure* theme emerged in response to Child C and the precision teaching discussion. Child C was felt to require a structured approach and was perceived to only engage in activities if it were structured. The precision teaching intervention was suggested to support Child C due to its structured and routine approach in developing new skills. The precision teaching procedures appear to allow Child C to better understand the task and engage with it. Developing words read to fluency may have allowed for understanding and generalisation to different contexts. It was also perceived that the consistency and structure supported Child C as he was said to be more emotionally stable and less likely to display behavioural difficulties. This may link to Child C's possible improved understanding of the situation and task thus reducing anxiety.

The two themes that emerged provided useful additional information in identifying some of the possible underlying factors for positive improvements seen for Child C. As with the previous case studies, the themes that emerged were interlinked with each other. The precision teaching process appeared to support Child C due to its consistency and structure, helping to develop his self-concept as a learner. These overarching themes seemed to have helped to support and develop Child C in other areas such as emotional stability, approach to learning, and independence.

5.1.4.2 Common Themes Identified Across the Three Case Studies

The key themes that emerged across the focus group data were the perceived development of the participants' self-concept as a learner. This manifested itself in slightly different ways for each participant but there was a general sense of an improved approach to learning and engagement in tasks. The precision teaching process appeared to support and develop the participants' self-concept, and allowed the participants to recognise and value their own ability through a structured, and individualised learning environment. Staff also identified the development of their own skills in supporting the participants and the fostering positive relationships between staff and pupil alike.

5.1.4.3 Possible Explanations for the Thematic Analysis Findings (Additional Information)

The information obtained from the thematic analysis findings are closely linked with the three sub-questions previously addressed. The possible explanations for the findings can also be aligned with some of the previous discussions regarding the findings seen. The development of a self-concept as a learner has already been discussed, however it is hypothesised that it is positively developed as a result of the pupils being able to access the task in a consistent and structured manner, ensuring success, and drawing upon their strengths in visual processing. This was highlighted in research by Kusmierski & Henckel (2002) and Snow and Swanson (1982). The structured approach to learning and assessment also provides the pupils with consistency which alleviates potential anxieties and supports their engagement in tasks. Developing skills to fluent levels also means that when the pupils are accessing classroom tasks they are more likely to be able to generalise and retain skills learnt which would improve their self-concept as a learner and engagement in tasks. The 'learning hierarchy' (Haring, Lovett, Eaton, & Hansen, 1978) provides a useful conceptual framework that recognises the process of skill development.

The assessment approach of precision teaching ensures that the pupil has appropriately differentiated tasks, ensuring success, and the immediate feedback of success through visual methods. Visual processing is suggested to be a strength of children with autism and supportive of their understanding of the task and feedback (Kusmierski & Henckel, 2002). Precision teaching supports class staff in developing their relationship with the pupil and also identifying strategies to support the pupil in the sessions and in the classroom.

5.1.4.4 General Comments from the Focus Group Regarding Precision Teaching

Three overarching themes emerged from the focus group when discussing precision teaching in regards to its general application to their pupils and classroom approach. These included *intervention process*, *self-concept as a learner*, and *learning*.

Intervention process was defined according to the precision teaching procedures. The ongoing assessment through teaching process was perceived beneficial and supported staff in other areas of the curriculum for the pupils undertaking the intervention. The structure and routine of the intervention was deemed a positive feature as the children appeared to enjoy it as it was predictable for them in short sessions. The one to one sessions were suggested to allow relationships to be built and was deemed by staff as an important and valuable aspect of the intervention. The procedures used in the intervention were also felt to fit and complemented the educational approach that they employed in the classroom.

Self-concept as a learner was a common theme that emerged throughout the case studies. It also emerged from the focus group when the discussion focused on precision teaching in general. The discussion from the focus group identified pupil's thoughts and feelings about their learning ability being affected positively due to the intervention. It was felt that the personalised approach supported this positive development as it was tailored to the needs of the pupil and they could see progress and were not compared to their peers. The feedback was presented visually which appeared to work well and engage the pupils', as well as being provided immediately after the probe was undertaken.

The third theme of *learning* related to an improvement in the pupils' academic attainment. It was perceived that there were significant gains for some children and these generalised to other areas of the curriculum other than the specific focus of the intervention.

5.1.4.4.1 Possible Explanations for the Findings from the Focus Group's General Comments.

The first theme that emerged from the focus group's general discussion regarding precision teaching identified its process as being a perceived positive aspect. The precision teaching complemented the structured approach as it provided structure and consistency for the children. As previously discussed, structure and consistency for children with autism helps to support their understanding of the environment and task expectations (Kusmierski & Henckel, 2002). Little and often sessions also allowed the pupils to engage in the sessions more readily (Solity *et al.*, 2000), and potentially supported the development of their learning self-concept. Learning self-concept was another key theme highlighted from the focus group. This has been discussed in a previous section but does link to the intervention process theme as it is through the intervention processes that they are able to receive appropriate tasks, ensure success, receive regular feedback, and avoid being compared against peers which may be detrimental to their learning self-concept.

The third theme that emerged is also intertwined with the previous two themes. Precision teaching was deemed to improve the pupils' learning. The possible explanations for the previous two themes would apply to the improvement seen in attainment. The process of precision teaching appears to fit neatly with the 'structured approach'. The research regarding precision teaching highlights the academic attainment improvements seen, in part due to the precision teaching processes and development of their self-concept as a learner and learning enjoyment (Downer, 2007). Developing skills to fluency and applying the 'instructional hierarchy' can explain some of the findings due to the level of competence of a skill required to retain, generalise, and adapt it (Haring, Lovett, Eaton, & Hansen, 1978).

5.1.6 'Can precision teaching positively augment a structured approach for children with autism?'

When exploring the overarching research question of whether precision teaching augments a structured approach for children with autism, a tentative answer would seem to confirm the question when taking into consideration the various findings obtained from each case study. All case studies suggested some improvements across literacy learning, affect and behaviour when data from the SCED measures and focus group thematic analysis were examined. However, due to the nature of autism and the heterogeneity of the population it is only possible to confirm the question in relation to the characteristics of the participants in the research, although common themes have emerged from the three case studies.

The focus group perceived the process of the precision teaching intervention to complement the established educational approach used, thus being deemed to augment the 'structured approach' for children with autism. The intervention process was deemed by the focus group to support the development of the pupil's self-concept as a learner and also being responsible for improvements in academic attainments, specific to the intervention and also generalised to other areas of the curriculum.

Overall, all three case studies, there appears to be evidence that supports the assertion that precision teaching positively augments a structured approach for children with autism.

5.1.6.1 Possible Explanations for the Research Findings

The findings presented across the three case studies suggest positive results in augmenting a structured approach with precision teaching for children with autism. Previous research states that precision teaching is essentially a fluency building assessment method, capable of being applied to any curriculum (Potts, Eshleman, & Cooper, 1993). Whole school approaches utilising precision teaching methods have been identified as being effective (Johnson, 1997; Tucci, 2004; Tucci, Hursh, & Laitinen, 2004) and the current research offers further support for such findings.

The 'structured approach', a derivative of TEACCH's structured teaching, appears to be complemented by precision teaching methods due to its structured and systematic processes. The focus group data identified the complementary practices of their current 'structured approach' and precision teaching. The literature suggests that this is particularly important for children with autism as they tend to struggle with generalising information and understanding contextual information (Brown & Bebko, 2012; Vermaelen, 2013). Children with autism also tend to process visual information easier (Kusmierski & Henckel, 2002), and a structured approach augmented by precision teaching seems to support this strength.

The previous sections identified the implementation of precision teaching as facilitating a positive effect to varying extents on the areas discussed. Applying precision teaching to a structured educational approach for children with autism appears to be beneficial in supporting their fluency on targeted skills, particularly when children with autism display dysfluencies and difficulties responding appropriately in novel situations (Trevarthen, Aitken, Papoudi, & Roberts, 1996).

The development of fluency through the use of precision teaching methods is stated to be important in the development of children with autism in acquiring and retaining basic skills, as well as applying that taught skill in different contexts (Schirmer *et al.,* 2007; Ragnarsdottir, 2007; Holding, Bray, & Kehle, 2011; Almon-Morris & Diakite, 2007), and this view appears to be supported by the current research. Kubina and Wolfe (2005) state that fluency building procedures should be systematically programmed into a curriculum for children with autism as it increases their functionality of skills. The current research supports this assertion and the benefits of developing skills to fluency for children with autism.

5.4 Limitations of the Research

A number of limitations can be identified within the current research. The initial limitation is the ability to generalise the data to the targeted population from which the intervention was aimed. However, it was the researcher's aim to explore and extend the current research evidence base for precision teaching and the underlying theory for its application. Common themes have emerged from the three case studies that may allow for some cautious generalisation of the findings.

The use of an A-B SCED methodology is prone to a number of limitations that may affect the inferences made regarding the current study's findings as discussed in Chapter 3. The use of an A-B-A or multiple baseline SCED would have provided more robust data and limited some of the criticisms levelled at the A-B designs. It was the researcher's assertion that the ethical integrity of the research was paramount throughout the research process even at the expense of a weaker research design. Additional data collection measures were taken to provide a triangulation of the case studies' data.

The measures attempted to explore the research questions that emerged from the literature. The learning measures used word reading as a representative aspect of the learning concept and did not record incorrect words read. Therefore, the pupil may have read more words correctly but may also have read more words incorrectly. The measure focused on fluency and would have benefitted from accuracy data to enhance and provide a more robust argument regarding the positive impact of the intervention. The affective measures relied on self-rating scales and assumed that the pupil had insight into the concept being measured as well as being prone to bias. The rating scale also used a fixed scale, and there were issues regarding movement in ratings when the pupil had reported the highest rating at the start of the research. The behaviour measure was a rating scale completed by staff focusing on each participant's behaviour over the past week. The measure was subjective and therefore prone to bias.

The researcher used proxy measures to extrapolate inferences regarding broader themes. This is potentially a limitation as the proxy measure may not be representative of the broader theme. It could be argued that the results shown may be specific to that particular area and cannot be extrapolated sufficiently to the broader concept, as such the learning findings relating to the SCED measures can only be applied to literacy learning.

The focus group data allowed for triangulation of data but was subject to limitations. The researcher facilitated the focus group with minimal prompts, however the group may have felt the need to be positive about the intervention due to the presence of the researcher. The dynamics of the group may have affected the data obtained from the focus group, as those with potentially higher status in the group may have dominated or had their views upheld due to their status. The researcher attempted to facilitate the group by ensuring that all members had a chance to discuss their views whilst at the same time not interfering and limiting the group dynamics.

The unique characteristics of the participants meant that there were difficulties in obtaining some measures. For example, Child C did not read any words in the first session, possibly as he needed time to understand what the task was. He also spoke very quietly and incorporated words into sentences which affected the data obtained. Child A was keen to rush through tasks without fully focusing on what was required. Repeated measures may have supported his understanding of the task requirements but may have had an impact on the earlier data points. Child B also needed prompting to focus on the words presented and to try and not incorporate alternative words. Again, the repetition of the measures supported his engagement in the tasks but may have affected earlier data points. To an extent, the researcher attempted to negate these issues by ensuring a stable baseline and consistency of responding. However, this was not achieved for all of the participants' measures and which may have affected some interpretation of the data.

Intervention integrity was an issue with the current research as it became apparent during the integrity checks that the intervention was not being implemented consistently and in accordance with the training. The researcher attempted to counteract this problem by providing additional assistance to staff in regards to the interventions processes and procedures. This limitation was built into the research design to provide the reader with information regarding the effective implementation of the intervention versus an inconsistent version. Treatment integrity issues and the other external variables are aspects of real-world research that regularly present in this type of research. However, they provide useful additional information for the research in terms of the practical application of interventions and issues associated with their implementation.

5.5 Implications of the Findings

The research produced a number of interesting findings that have implications at a variety of levels.

Firstly, the research indicated that for children with autism in a special school, utilizing a structured approach, the incorporation of precision teaching can provide some potential benefits in terms of literacy learning, affect, and behaviour. In addition, the precision teaching approach can be utilised with various curricula and may be beneficial to a variety of settings, both mainstream and special. In special school settings it may provide a useful addition, through supporting students in acquiring their basic skills to fluency. It may also aid teaching staff in developing their skills and strategies in supporting the pupils in other classroom activities.

The setting for the current research project has employed precision teaching for all of the pupils in the class due to the benefits highlighted through the current research. Class staff have reported positive gains for pupils not associated with the current research project since the application of precision teaching to the whole class. The school in which the research took place has also started exploring the use of precision teaching in other classes.

The implications for children with autism is that precision teaching may help support and combat some of the difficulties that they may experience such as developing skills to fluency and the subsequent ability to generalise. It also uses procedures that support their particular strengths such as visual processing and also providing structure and routine so that expectations are not ambiguous. These methods will have implications for children with autism in a variety of settings.

As detailed in Chapter 2, educational approaches for children with autism have a limited evidence base and schools usually employ an eclectic mix of approaches (Jones, 2002). Precision teaching has a large evidence base for children within mainstream education and it is beginning to develop for children with autism, both in mainstream and special education (Schirmer, Almon-Morris, Fabrizio, Abrahamson, & Chevalier, 2007; Ragnarsdottir, 2007; Holding, Bray, & Kehle, 2011; Almon-Morris & Diakite, 2007). Therefore, it is suggested that educational approaches for children with autism would benefit from exploring the incorporation of precision teaching within their current practice. Precision teaching methods align neatly with TEACCH's structured teaching but, as it is essentially an assessment approach supporting developing skills to fluency, it may have far reaching implications for other educational approaches for children with autism.

School managers looking to enhance their provision for children with autism may consider from the incorporation of precision teaching within their approach. The benefits highlighted in this research can be seen for pupils and staff alike. Developing provision that builds upon a solid research base is paramount to ensure that children receive appropriate education to meet their needs. School support agencies would also benefit from recognising the potential benefits of augmenting educational approaches for children with autism with precision teaching. It has already been suggested that precision teaching aligns nicely with a structured approach, however it could also be beneficial in other settings. Support agencies identifying difficulties with a pupil's learning or behaviour would be able to draw upon this research to support the pupil in school. Support agencies could also support schools in ensuring that they are providing an educational approach for children with autism that draws from an appropriate evidence base.

Educational psychologists may also be able to utilise this research in their work when looking to support schools regarding educational approaches for children with autism. This research identifies important issues regarding the implementation of interventions, and this information would be beneficial to educational psychologists in ensuring that interventions are appropriately implemented. The research also highlights important considerations regarding applying an assessment through teaching approach, such as precision teaching, and how it can support not only learning, but other aspects of a child's development.

In terms of wider implications, local authorities' approach to supporting children with autism, in special and mainstream education may benefit from incorporating precision teaching within their current recommended approach. It was seen within the researcher's local authority that a 'structured approach' to teaching for children with autism was being promoted and training disseminated. Exploring complementary approaches, such as precision teaching, and incorporating it in their current training would potentially enhance the provision for children with autism. As has already been noted, educational approaches for children with autism lack a large evidence base for their effectiveness (Bernard-Opitz, 2005). Precision teaching has been shown to augment one approach for children with autism (Johnson & Layng, 1994), and has a large evidence base purporting its efficacy (Boys & Lydon, 2008). Local authorities should aim to provide provision for children with autism that has a clear evidence base regarding its effectiveness and the utilisation of precision teaching could potentially augment a number of approaches.

The incorporation of fluency building methods such as precision teaching is an important aspect for all schools to consider when developing basic skills. Ensuring that skills are learnt to fluency is vital for children to be able to move through the 'instructional hierarchy' (Haring, Lovett, Eaton, & Hansen, 1978). Within this research it has been shown to support generalisation, learning enjoyment, self-concept as a learner, and behaviour. Precision teaching also appears to support staff in developing their own skills and strategies to support the children with whom they work. Therefore, the implications are not limited to children with autism within a structured approach to learning, but key aspects of the current research may be potentially relevant for staff and pupils in other settings.

5.6 Implications for Further Research

The current research provided a number of interesting findings that could help support children with autism in a structured approach to education. However, due to the research being a series of case studies the findings are limited to the pupils participating and their individual and environmental characteristics.

There were limitations of the current research associated with the design and measures used as highlighted previously. Employing a multiple baseline approach to the SCED's would provide more robust data. Other quantitative research designs that provide greater rigour would be difficult to employ due to the diverse characteristics of children with autism (Jones, 2002). An action research approach could be a valuable approach and may have worked well in exploring the current research in terms of the difficulties in implementing the intervention. The addition of qualitative methods within the current research provided useful information that was not captured in the SCED measures. A purely qualitative approach may yield useful information by exploring the constructs of staff and pupils regarding precision teaching and a structured approach.

The current research could be extended further through investigating a greater range of children with autism receiving a structured approach and precision teaching. Research could focus on a wide variety of children with autism and the wide variation of a structured approach. It would also be useful to explore different measures and their representation of an overarching concept. For example, using precision teaching with numeracy tasks to investigate the impact on learning.

The one to one time with pupils was viewed as highly beneficial by staff, future research could explore whether precision teaching was the key component or whether it was the one to one time spent with staff and the establishment of their relationship as a key factor.

Precision teaching could of course, be investigated as an augmentation of other compatible educational approaches for children with autism, to ascertain its effectiveness with a range of approaches.

5.7 Researcher's Reflections

The research project provided the researcher with a valuable experience of working closely with a school to support and implement an intervention. The researcher also gained useful experience of undertaking research in real-world settings and the challenges that this presents.

The integrity of the intervention was an aspect of the research project that appeared to have a large effect on the findings and effectiveness of the intervention. The researcher worked to establish positive working relationships with the staff and provide guidance in applying the intervention consistently. The researcher reflected on the need to ensure that staff had a full understanding of the process and rationale for intervention to support its implementation.

The researcher also reflected on the need for the staff members to gain ownership of the intervention and to be empowered to undertake it. This process required class staff to recognise and understand the reasons for the intervention's processes, and to understand the benefits of undertaking it in accordance with the training.

The researcher was also aware of the systems in school that may have been hindering the full implementation of the intervention. Class staff were required to undertake other duties and time was limited to undertake an additional practice. These difficulties became less apparent when improvements were seen with the pupils undertaking the research, highlighting the need to work closely with staff in the training and planning stages of implementing an intervention.

Ensuring that pupils develop fluency in their basic skills has been another area of learning for the researcher. It has led to the researcher utilising this knowledge in his work as a trainee educational psychologist. The theoretical framework of the 'instructional hierarchy' (Haring, Lovett, Eaton, & Hansen, 1978), and development of skills to fluency are important for all staff working in schools to be aware of. Developing skills to a fluent level ensures that there is an automatic recall of information, allowing skills to be maintained, generalised, and adapted (Bucklin, Dickinson, & Brethower, 2000). Staff can support pupils by ensuring that learning is efficient, and meets the needs of the pupil by being aware of how the child is responding through effective assessment techniques such as precision teaching (Snow & Swanson, 1982).

The final area for reflection is working with children with autism and ensuring that they receive appropriate educational provision. There are a plethora of approaches that are used for children with autism but many have very little evidence regarding their effectiveness (Tutt, Powell, & Thornton, 2006). There is also an apparent need for independent research into many of the approaches that pertain to have an evidence base (Jordon, Jones, & Murray, 1998). Further research is required into the educational provision for children with autism. However, as noted with this research, difficulties do arise in research involving children with autism due to their diverse range of characteristics. The use of mixed methods, as used in the present research, can clearly provide a useful approach.

Chapter 6: Conclusion

This chapter will summarise the main findings from the research and present the unique contribution of the research to theory and practice.

6.1 Main Findings

The overarching research question was:

"Does precision teaching positively augment a structured approach for children with autism?"

To answer the overarching question a series of sub-questions were presented:

"Can precision teaching lead to a positive impact on a child with autism's learning when incorporated as part of a 'structured approach'?"

"Can precision teaching lead to a positive impact on a child with autism's affect when incorporated as part of a 'structured approach'?"

"Can precision teaching lead to a positive impact on a child with autism's behaviour when incorporated as part of a 'structured approach'?"

"In what ways is precision teaching perceived to augment a 'structured approach' to teaching a child with autism?"

The research found that precision teaching positively augmented a structured approach for the focus children.

Three case studies were used within a mixed methods research design, namely a SCED and focus group approaches. Due to the integrity of the intervention being compromised, an additional research design was used within the results section to provide additional analysis of the data when the intervention was consistently implemented.

The measures that focused on literacy learning identified an improvement particularly when the intervention was implemented consistently. The findings also indicated that the learning had been generalised to other contexts and the pupils' approach to learning and task engagement had improved. The SCED measures that explored aspects of the participants affect did not indicate an intervention effect from the self-rating measures, however the focus group analysis identified perceived improvements in all of the participants' self-concept as a learner and their learning enjoyment. There were indications from the SCED measures that participants' behaviour improved positively when the intervention was implemented consistently, and all participants were perceived to have shown improvements in their behaviour by the focus group. The participants were felt to have shown a greater ability to deal with their emotions and engage with tasks independently.

Additional information obtained from the focus group highlighted the benefits of precision teaching's process and its fit with a 'structured approach' to learning.

6.2 Unique Contribution of the Research

The research set out to examine the use of precision teaching for children with autism due to its limited evidence base.

The use of fluency building procedures, such as precision teaching, was proposed to support children with autism due to their dysfluencies. The evidence base for the use of precision teaching for children with autism was also limited. In addition, the literature highlighted that educational approaches for children with autism have a limited evidence base, and the evidence that pertains to effectiveness is limited by possible bias (Jones, 2002). Schools in the UK generally use an eclectic mix of approaches (Jones, 2002). The local context in which the research took place utilised a derivative of the TEACCH approach. Precision teaching had been shown to be positively combined with an ABA approach for children with autism (Tucci, Hursh, & Laitinen, 2004), although there did not appear to be any research exploring the incorporation of precision teaching within a TEACCH approach. The research therefore aimed to explore the gap in the literature that had been shown to have benefits with other approaches. The findings from the research have shown positive results but require further exploration in adding to the evidence base for educational approaches for children with autism. It has also identified the need for the intervention to be implemented consistently to ensure its effectiveness.

The findings have implications at a number of levels in regards to supporting children with autism and ensuring that they are able to retain and generalise the information that they have learnt, as well as the associated impact on affect and behaviour.

6.3 Conclusion

Precision teaching assessment methods have been found to support children with autism receiving a 'structured approach.' When explored across quantitative and qualitative findings, the researcher asserts that positive improvements were seen with the participants in their literacy learning, affect, and behaviour.

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Appendix 1: Excluded Studies from Systematic Review 1

Study	Reason for Exclusion
Lakimova, Serret, Askenazy (2012)	Not related to fluency intervention
Mua, Hendrickson, Therrien, Woods-Groves, Ries, & Shaw (2012)	Not focused on fluency intervention
Starlin (2010)	Discussion paper
Zambolin, Fabrizio, Ferris, Barclay, Carrier (2005)	Not focused on fluency intervention
Kerr, Smyth, McDowell (2003)	Discussion paper
Vannorsdall, Maroot, Gordon, Schretter (2012)	Not focused on fluency intervention
Minshew, Goldstein, & Siegel (1995)	Not focused on fluency intervention
Turner (1999)	Discussion paper
Kleinhaus, Akshoomoff, & Delis (2005)	Discussion paper
Gernsbacher, Sauer, Geye, Schweigert, & Goldsmith (2008)	Discussion paper
Weiss (2001)	Discussion paper
Spek, Schatorje, Scholte, & Van Berckelaer-Onnes (2009)	Not focused on fluency intervention
Kubina & Wolfe (2005)	Discussion paper
Kubina & Yurich (2009)	Discussion paper
Beacher, Radulescu, Minati, Baron-Cohen, Lombardo, Lai, Walker, Howard & Gray (2012)	Not focused on fluency intervention
Beversdorf, Saklayen, Higgins, Bodner, Kanne, & Christ (2011)	Not focused on fluency intervention
Weiss, Pearson, Foley & Pahl (2010)	Discussion paper

Appendix 2: Ethical Approval

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Monday, March 26, 2012

Dear Paul Beeson,

Ethics Committee Review

Thank you for submitting an account of your proposed research 'Does Precision Teaching augment a structured teaching approach for children with autism?'

That research has now been reviewed by the Ethics Committee and I am pleased to tell you that your submission has met with the committee's approval.

Final responsibility for ethical conduct of your research rests with you or your supervisor. The Codes of Practice setting out these responsibilities have been published by the British Psychological Society and the University Research Ethics Committee. If you have any concerns whatever during the conduct of your research then you should consult those Codes of Practice.

Independently of the Ethics Committee procedures, supervisors also have responsibilities for the risk assessment of projects as detailed in the safety pages of the University web site. Ethics Committee approval does not alter, replace, or remove those responsibilities, nor does it certify that they have been met.

Yours sincerely

Dr Alan Sunderland
Chair, Ethics Committee

Appendix 3: Information Sheet and Consent Form for Parents / Guardians

My Ref: PB   Date: 20 March 2012

Dear Parent/Guardian

I am a Trainee Educational Psychologist working within [redacted] Educational Psychology Service. As a trainee I am completing a doctorate course at The University of Nottingham in Applied Educational Psychology. Part of this course involves me undertaking a research project in an area of specific interest to me. This research will explore the use of precision teaching for children with autism in a structured teaching approach to education. I am writing to request consent for your child to be involved in this study (please see attached information sheet for me detail regarding the study and intervention).

If you are happy that your child should participate in this study, please sign and return the consent form to [redacted] School by 26 March 2012.

If you permit your child to participate you still have the right to withdraw from the study at any point without having to give a reason. That is, even if you sign the consent form and start the study you may withdraw your child at any point

If you require any further information on the study, or its results, please feel free to contact myself, or my supervisor, using the details given below.

Yours Sincerely

Paul Beeson

Paul Beeson

Paul Beeson
Trainee Educational Psychologist
Tel: [redacted]
Email: [redacted]

Nathan Lambert
Supervisor/University of Nottingham Tutor
Tel: [redacted]
Email: [redacted]

My Ref: PB Date: 20 March 2012

Information Sheet

Research question: *Does Precision Teaching augment a structured teaching approach for children with autism?*

Researcher: Paul Beeson (Trainee Educational Psychologist / Doctoral Student)

What is precision teaching? Precision teaching is a daily method of monitoring what a child is being taught, helping class staff to plan and identify appropriate teaching. It involves daily assessments of the teaching material and targets, and charting this onto a graph for class staff to use to help aid their teaching decisions. Boys and Lydon (2008) state that precision teaching has a strong evidence base and that most authors would agree that precision teaching increases the acquisition and maintenance of basic skills. The ability for generalisation is a particular area of difficulty for children with autism and their ability to act fluently in social and educational settings. Precision teaching is suggested to help children develop their skills to a level where they can use them fluently and generalise them to other situations.

Research Project Procedures: Class staff will be trained in precision teaching and will incorporate it into the daily sessions of reading. Precision teaching will help them to monitor the child's progress more precisely and adjust the teaching if necessary. A number of measures will be taken by class staff and myself to explore the impact of precision teaching. These include:

- Pre and post intervention assessments of reading.
- Weekly measures of reading fluency (pupil timed for one minute on a reading passage and number of correct words calculated), self-concept as a learner (pupil read a statement regarding learning and asked to point to a smiley face to indicate their view), and behaviour (class staff fill in weekly questionnaire about the child's behaviour).
- Class staff will also be interviewed at the end to provide further information regarding the application of precision teaching.

Findings: All data will be anonymised so that individual pupils cannot be identified and their information will be held securely. Findings will be reported back to parents of the pupils identified, school and the educational psychology service. The data will also form part of the researchers doctoral thesis.

If you have any further questions or concerns please don't hesitate to contact myself or my supervisor on the details provided.

My Ref: PB Date: 20 March 2012

Consent Form

Does Precision Teaching augment a structured teaching approach for children with autism?

Name of Child:..

The parent/guardian should carefully read the questions and cross out as necessary.

Have you read and understood the information sheet YES/NO

Have you had the opportunity to ask questions and discuss the study? YES/NO

Have you received enough information about the study? YES/NO

Do you understand that your child is free to withdraw from the study:

at any time YES/NO

without having to give a reason YES/NO

Do you agree to your child taking part in the study? YES/NO

"This study has been explained to me to my satisfaction, and I agree for my child

..(name) to take part. I understand that I am free

to withdraw at any time."

Signature of Parent/Guardian: Date:

Name (block capitals)

Appendix 4: Gunning Fog Index Calculation

Step 1: Take a sample passage of at least 100-words and count the number of exact words and sentences.

Step 2: Divide the total number of words in the sample by the number of sentences to arrive at the Average Sentence Length (ASL).

Step 3: Count the number of words of three or more syllables that are NOT (i) proper nouns, (ii) combinations of easy words or hyphenated words, or (iii) two-syllable verbs made into three with -es and -ed endings.

Step 4: Divide this number by the number or words in the sample passage. For example, 25 long words divided by 100 words gives you 25 Percent Hard Words (PHW).

Step 5: Add the ASL from Step 2 and the PHW from Step 4.

Step 6: Multiply the result by 0.4.

$$0.4\left[\left(\frac{\text{words}}{\text{sentences}}\right)+100\left(\frac{\text{complex words}}{\text{words}}\right)\right]$$

The Gunning Fog Index can also be calculated via a website:

http://gunning-fog-index.com/fog.cgi

Appendix 5: Precision Teaching Training Presentation

Precision Teaching

Paul Beeson
Trainee Educational Psychologist

My Research

- The use of precision teaching for children with autism.
- Emphasis on building skills to fluency – greater ability to generalise and retain information.
- It has been used with ABA approaches instead of discrete trial training.

"Precision Teaching is the nearest thing to a magic wand that has ever been given to a SENCO."

Teacher, Powys, 2004,

Research base

"Teaching Assistants were trained to spend 4 minutes a day on a precision teaching programme with selected pupils whose progress in word recognition was a cause for concern. The sessions were set up to be 'fun' times. All the pupils made progress and the majority were also reported to have improved in self-confidence. Junior boys particularly benefited from this stringently targeted regime with immediate feedback of results. Some had been displaying behaviour difficulties, and TA's also reported improved social performance and attendance rates."

Downer, A. (2007). The National Literacy Strategy Sight Recognition Programme Implemented by Teaching Assistants: A precision teaching approach. *Educational Psychology in Practice, 23 (2), 129-143*

Special Educational Needs

Gickling and Havertape (1981) argue that:

"the most pervasive cause of learning difficulties is that for some children 'the curriculum moves too fast and demands too much in relation to their existing skills. They get further behind and are entrenched in a failure cycle'."

Aims

To provide:

- An introduction to Precision Teaching
- An overview of the underlying principles of Precision Teaching
- Basic information and materials to plan a Precision Teaching Programme

Main Components of PT

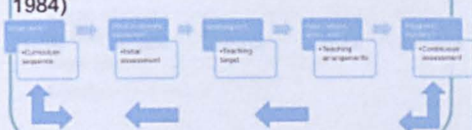
- Specifying desired pupil performance in observable, measurable terms.
- Recording the performance on a daily basis
- Charting performance on a daily basis
- Recording teacher behaviour/approach in relation to pupil performance
- Analysis of the data

Precision Teaching as a tool

- Precision Teaching fits well with the Code of Practice
- Moves focus away from child's failure, towards a search for the most effective teaching strategies
- Short daily teaching sessions give opportunity for child to learn
- Provides monitoring and review of progress with the child
- Small steps are recognised and valued, helping the child's motivation and self esteem
- Idea is to develop accuracy and fluency when a child is learning a new skill

Assessment Through Teaching

'*Without assessment there can be no adequate teaching: without teaching there can be no adequate assessment*' (Raybould 1984)



Instructional Hierarchy (Haring & Eaton, 1978)

Acquisition	Child is shown a skills so that s/he becomes accurate e.g. *read all the words from their reading book*
Fluency	Child is given regular practice and reinforcement to become fluent e.g. *they can read all words in their book at a rate of 60 words in a minute.*
Maintenance	Child has reached a stage where s/he can maintain a level of accuracy **and** fluency e.g. *when tested 2 weeks later they can still read all of the words.*
Generalisation	With instruction the child can apply their skill to new situations e.g. *they can read the words in different contexts (fonts, formats + colours etc.)*
Adaptation	Child can apply their skills to new situations independently and appropriately e.g. *they can use the knowledge of the words in their reading book to read new words.*

What is Precision Teaching?

What is it?

It is **NOT** a method of teaching, it IS:

1. A way of **PLANNING** a teaching programme to suit the needs of the individual
2. A way of **MONITORING** the pupil's progress
3. A way of **EVALUATING** the effectiveness of the programme

Benefits

1. Helps to determine the pupil's position on the curriculum
2. Helps you to decide when to move on to new work
3. Helps to inform IEPs with very specific SMART targets
4. The chart gives both staff and pupil a visual display of the pupil's performance
5. Helps to ensure that teaching is precise and therefore cost-effective

Does it work?

1. Evidence based practice
2. PT ensures that success in learning is explicit which helps to improve self-esteem and motivation

Teaching Methods

Little and often with regular feedback is more effective than one long teaching session.

Things to consider:

- Type of teaching method e.g. multi-sensory, flash cards, games
- Presentation of materials
- Frequency and duration of teaching
- Time of day

Probes

See-to-say e.g. Reading
See-to-write e.g. Copying
Hear-to-write e.g. Spelling
Hear-to-point e.g. Language Comprehension

swim	the	Come	Hide	Don't
Out	Come	The	Out	Don't
Swim	Hide	Don't	The	Hide
Come	Swim	Out	The	Swim
Hide	Don't	Out	Come	Don't
The	Out	Swim	Come	Hide
Out	Swim	Hide	Come	Don't
The	Come	Swim	Hide	out

Placement Probe

Child reads the words in the grid for **1 minute** and the score is recorded (use tally chart)

If the child reaches the bottom of the probe before the minute is up they go back to the top and continue to the end of the minute.

If the child hesitates allow 5 seconds exactly then move them on to the next word.

Emphasise accuracy first, fluency second

went	like	go	can	see
like	go	went	see	can
go	went	like	can	see
can	see	go	went	like
see	like	can	go	went
can	went	see	like	go
went	like	go	can	see
like	go	went	see	can

Aim Rates

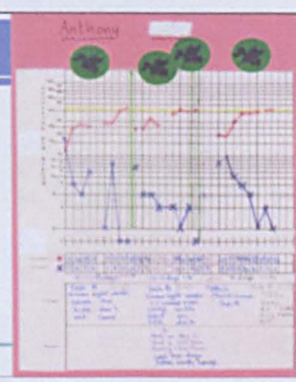
- How good does a child's performance have to be before we can be sure they've mastered the task and can move to the next?
- Many basic skills (particularly see-to-say), the range of 40-60 items correct per minute with 2 or fewer incorrect is generally appropriate.
- Slow speech, articulation difficulties
- Merely a provisional target

Have a go!

- In pairs
  - One person a teacher and one person a learner.
  - Teach for 3 minutes – probe for one minute.
  - Repeat this process again.
  - Switch over.
  - Select an aim rate of 40 words correct / 2 incorrect.

Charting

- The number of correct responses is denoted by a dot.
- The number of errors is denoted by a cross x
- Each weeks dots and crosses are joined with straight lines giving a clear view of the pupils progress.
- Dots and crosses are **not** joined up across **'No chance days'** or weekends (i.e. when there is 'no chance' to do any teaching.)
- When a new probe / task is started a vertical line is placed between the relevant day lines.

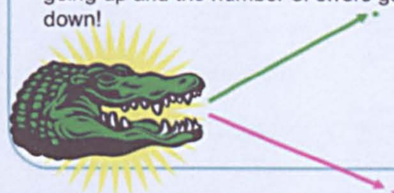


Charting Practice - Plot a set of results on a ratio graph

Days of the week	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F
Correct	16	21	26	28	28	30	34	A	43	49					
Incorrect	11	7	5	3	2	2	2	A	0	0					

The Crocodile Effect

A chart plotting a successful programme shows the number of correct responses going up and the number of errors going down!



How do I interpret data from the chart? 3 day / 8 day rule

- Correct rate increasing / incorrect rate decreasing (accuracy)
- Pupil reaching 'aim rate'
- Inspect slope to see if progress is fast enough (fluency)

Rule of thumb – 3 day / 8 day rule

- Is the task too hard or unrealistic
- Task slicing? Reduce demands of the task
  - E.g. reduce the number of items, simplify the task, pre-requisite skill

Cont…

- 8 day rule
  - If the pupil is *not at* or *near* the aim rate you should not proceed without a change.
    - Increase motivation
    - Check teaching methods are as effective as possible
    - Consider accepting the final rate achieved

When making a change – keep it simple!

Moving on

- When the young person reaches their aim rate on two consecutive days – change the target (words to be taught)
- Remember to keep checking up on the words learnt!

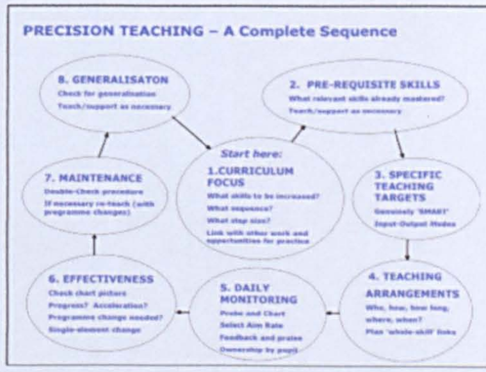
Planning it into the curriculum

- When?
- Where?
- Who (staff and pupil)?

Summary

Precision teaching:

- It is simple to use once you get going!
- It is popular with staff and pupils alike.
- Provides a structured approach to refining teaching strategies to provide effective learning environments
- Provides immediate feedback and highly visible recording of success
- It is a flexible tool for a range of learning styles and needs.
- It is about accelerating learning and improving self-esteem.



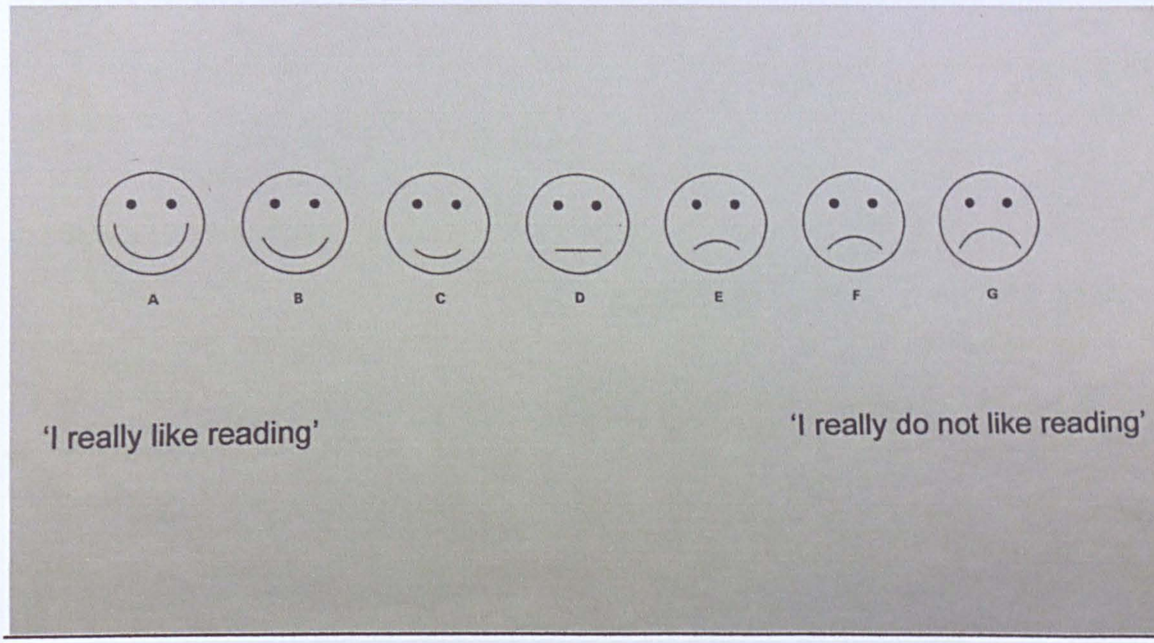
Appendix 7: Learning Measure

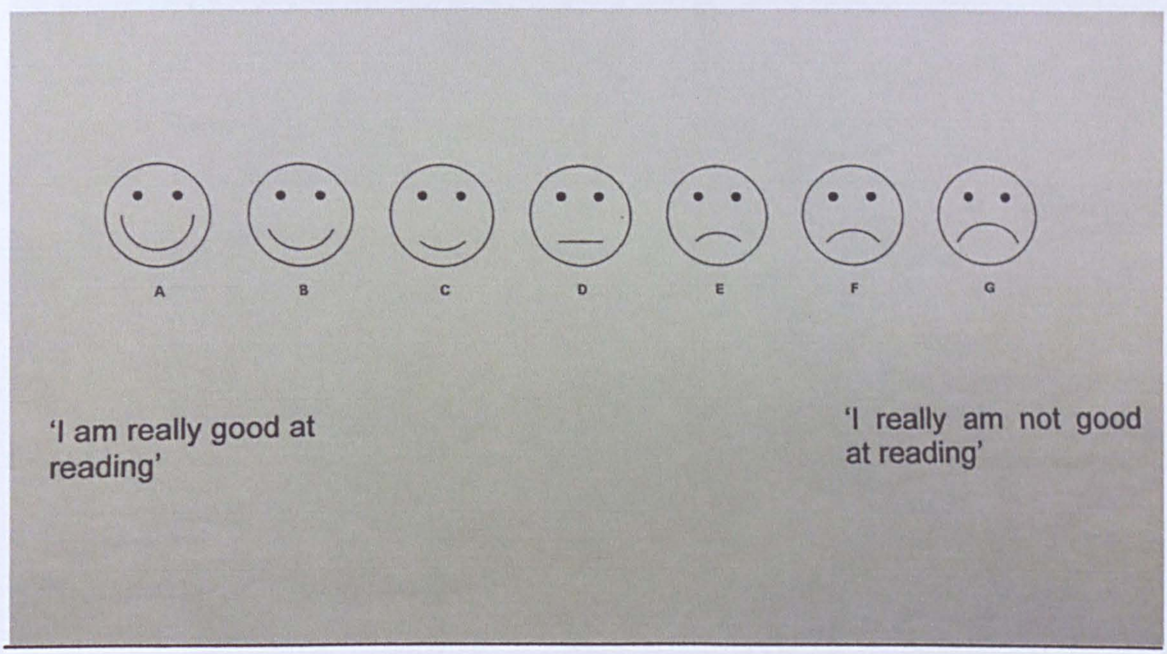
Example of an individual word reading probe sheet.

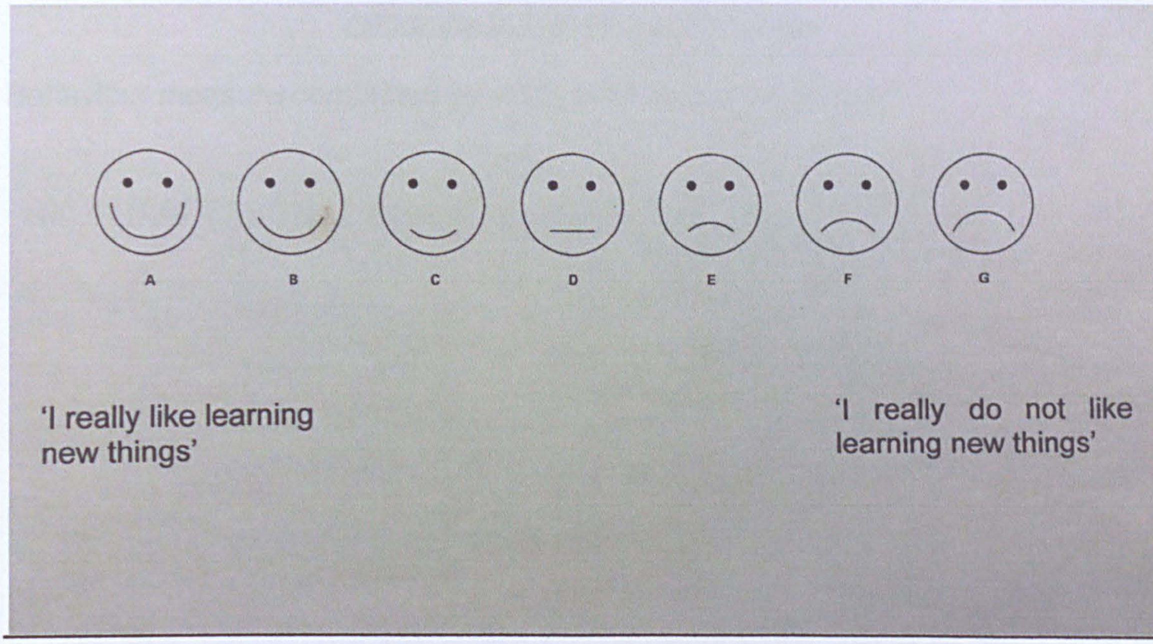
they	this	came	we	half
laugh	you	many	yes	little
been	down	got	she	do
last	all	live	did	just
and	from	mum	first	make
back	girl	get	could	if

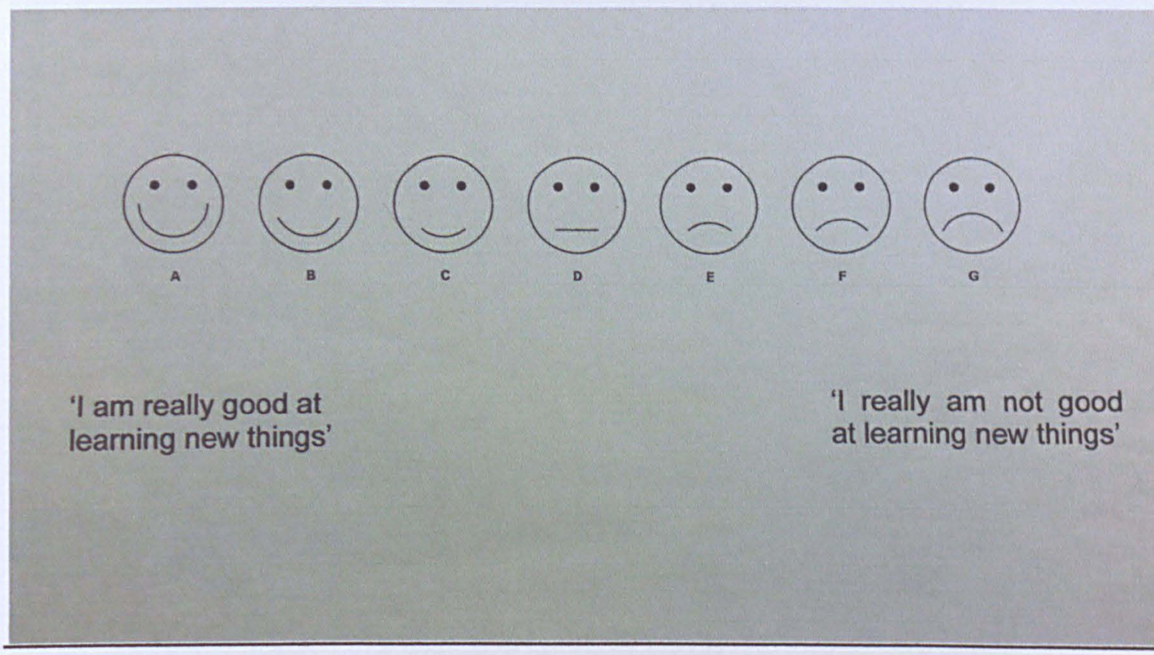
Appendix 8: Affect Measures

Pupils' self-rating affect measure sheets.






A B C D E F G
'I really like learning new things'
'I really do not like learning new things'


A B C D E F G
'I am really good at learning new things'
'I really am not good at learning new things'

Appendix 9: Behaviour Measure

Behaviour measure completed by class staff on a weekly basis.

THE INTERPERSONAL COMPETENCE SCALE

GL assessment
the measure of potential

Name .... Date ....

Age .... Class .... Please circle: Male / Female

Please mark the appropriate rating for this young person on each of the 18 items below using your knowledge of them as a guide.

You will see that each item is a scale with opposing descriptions at each end and seven points in between. If one of these descriptions is a good one of the young person, in your view, put a cross (X) at or near that end of the scale; if you think the description is applicable sometimes or 'so-so' put your cross at the appropriate point towards the middle of the scale. Be careful not to leave any out and use the full range of scale points.

1.	Never argues.								Always argues.
2.	Always gets into trouble at school.								Never gets into trouble at school.
3.	Always smiles.								Never smiles.
4.	Not popular with boys.								Very popular with boys.
5.	Not shy.								Very shy.
6.	Very good at sports.								Not good at sports.
7.	Very good looking.								Not good looking.
8.	Very good at spelling.								Not good at spelling.
9.	Always gets in a fight.								Never gets in a fight.
10.	Never sad.								Always sad.
11.	Not good at maths.								Very good at maths.
12.	Very popular with girls.								Not popular with girls.
13.	Lots of friends.								No friends.
14.	Never gets their way.								Always gets their way.
15.	Never worries.								Always worries.
16.	Wins a lot.								Never wins.
17.	Never friendly.								Always friendly.
18.	Cries a lot.								Never cries.

This measure is part of *Measures of Children's Mental Health and Psychological Wellbeing: A Portfolio for Education and Health Professionals*, edited by Norah Frederickson and Sandra Dunsmuir.

THE INTERPERSONAL COMPETENCE SCALE

GL assessment
the measure of potential

Scoring Sheet

Item number	Raw score	Subtract raw score from 8?	Scale score	Factor
1		No		AGG
2		Yes		AGG
3		Yes		AFF
4		No		POP
5		No		INT
6		Yes		OLY
7		Yes		OLY
8		Yes		ACA
9		Yes		AGG
10		No		INT
11		No		ACA
12		Yes		POP
13		Yes		POP
14		No		–
15		No		INT
16		Yes		OLY
17		No		AFF
18		No		–

Factor	Items	Score
POP	(4+12+13)/3	
AGG	(1+2+9)/3	
ACA	(8+11)/2	
AFF	(3+17)/2	
OLY	(6+7+16)/3	
INT	(5+10+15)/3	

Overall Competence Score	((8-AGG)+POP+ACA+AFF+OLY)/5	

Appendix 10: Example of Focus Group Thematic Analysis Process

Phase 2 – Generating initial codes: During the focus group discussion the researcher reflected back key features of the discussion to ensure that the most pertinent points were emerging. Focus group participants also had the opportunity to validate, reject or add further thoughts.

Data Extracts from Focus Group Discussion
Understands what the words mean
Any structure is beneficial
Doesn't engage with anything if it isn't structured
Happily goes to the sessions for precision teaching
More emotionally stable
Becoming clearer and needing less reminding to use big voice
Used to copy write. More willing to write independently
More independence
Approach to tasks improved
Willing to give tasks a go
Routine supports his reading and writing
Enjoys little and often learning – format good for him
Knows words in context

Phase 3 – Searching for themes: The 'chunks' of data from the focus group were reviewed by the researcher and potential themes were sought.

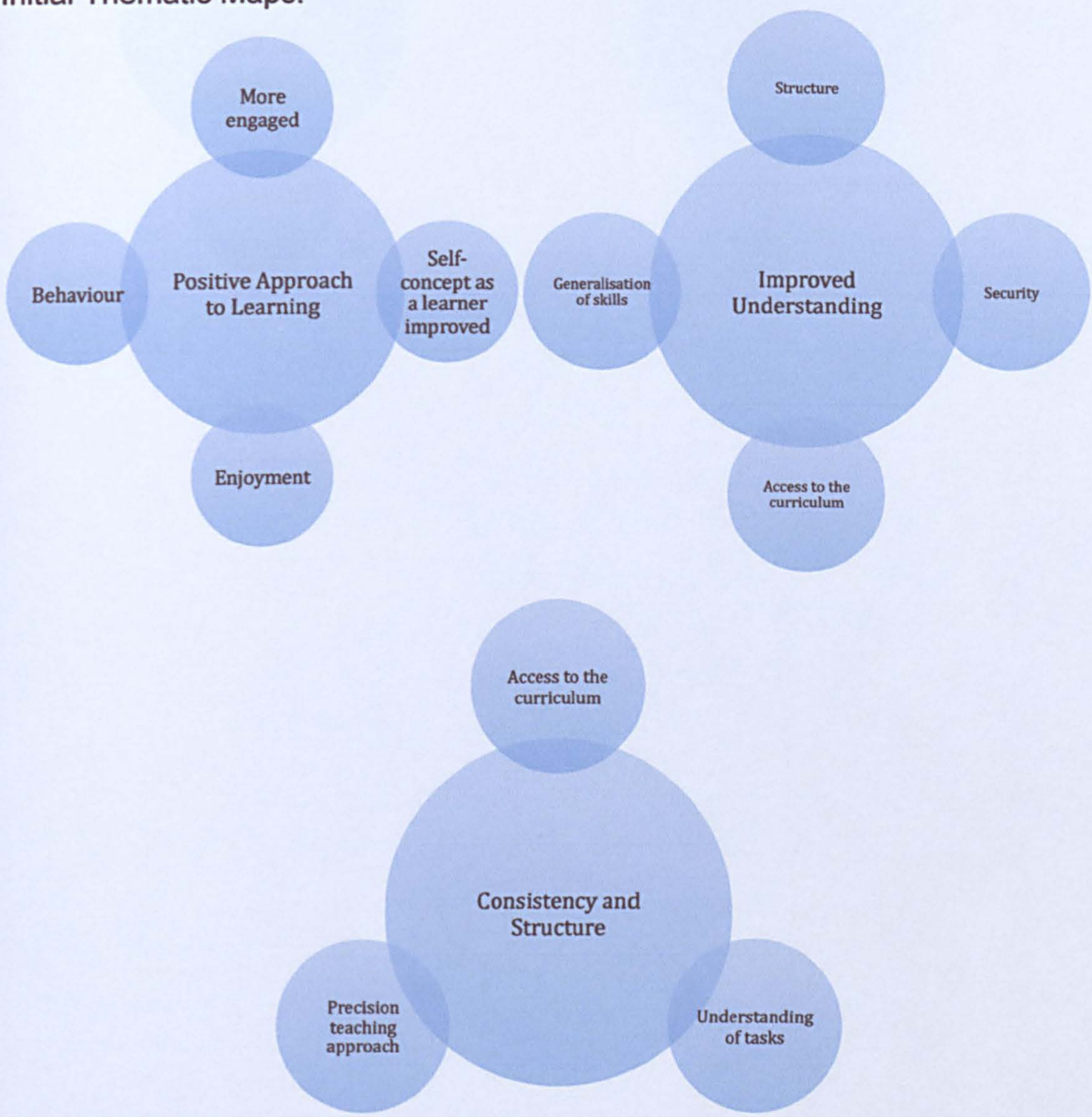
Data Extracts from Focus Group Discussion	*Potential Themes*
Understands what the words mean	2, 5
Any structure is beneficial	1, 4, 11
Doesn't engage with anything if it isn't structured	1, 4, 11
Happily goes to the sessions for precision teaching	1, 3, 11
More emotionally stable	4, 6, 3, 7, 8, 9
Becoming clearer and needing less reminding to use big voice	6
Used to copy write. More willing to write independently	2, 4
More independence	2, 6
Approach to tasks improved	2, 6, 11
Willing to give tasks a go	2, 5, 11, 10
Routine supports his reading and writing	1, 4
Enjoys little and often learning – format good for him	1, 4
Knows words in context	2, 5

1: Structure
2: Improvements in learning
3: Enjoyment
4: Understanding of tasks

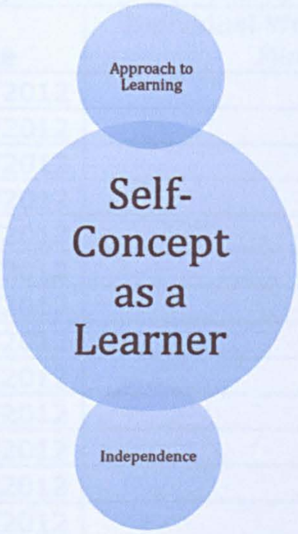
5: Generalising skills
6: Self-concept as a learner
7: Learning enjoyment improved
8: Behaviour improvements
9: Environmental consistency
10: Approach to learning

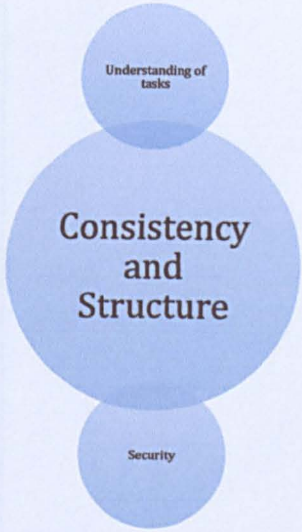
Phase 4 – Reviewing themes: The researcher went through the emerging themes and extracts to check for their validity. These were then grouped together within a 'thematic map'.

Initial Thematic Maps:



Revised and final thematic maps:





Appendix 11: Child A's SCED Raw Data

Learning Measures (Child A)

Date	Individual Words Read (Per Minute)
26/04/2012	20
03/05/2012	22
09/05/2012	22
17/05/2012	25
29/05/2012	21
12/06/2012	25
15/06/2012	25
21/06/2012	17
28/06/2012	26
05/07/2012	27
10/07/2012	32
12/07/2012	24
19/07/2012	26
13/09/2012	27
27/09/2012	27
04/10/2012	25
11/10/2012	29
25/10/2012	38
08/11/2012	47
15/11/2012	29
21/11/2012	28
29/11/2012	43
06/12/2012	49
18/12/2012	39

Date	Words Read in a Passage (Per Minute)
26/04/2012	27
03/05/2012	29
09/05/2012	15
17/05/2012	19
29/05/2012	26
12/06/2012	31
15/06/2012	17
21/06/2012	16
28/06/2012	24
05/07/2012	24
10/07/2012	21
12/07/2012	22
19/07/2012	33
13/09/2012	24
27/09/2012	17
04/10/2012	31
11/10/2012	39

25/10/2012	24
08/11/2012	38
15/11/2012	38
21/11/2012	35
29/11/2012	29
06/12/2012	26
18/12/2012	28

Affect Measures (Child A)

Date	Enjoys Reading	Good at Reading	Enjoys Learning New Things	Good at Learning New Things
26/04/2012	4	2	5	2
03/05/2012	4	3	4	2
09/05/2012	4	3	4	1
17/05/2012	4	3	4	2
29/05/2012	4	1	4	1
12/06/2012	4	2	4	2
15/06/2012	4	2	7	2
21/06/2012	4	2	6	2
28/06/2012	4	1	4	1
05/07/2012	4	3	4	2
10/07/2012	4	2	4	3
12/07/2012	4	2	4	2
19/07/2012	2	2	4	2
13/09/2012	4	2	4	2
27/09/2012	4	2	4	2
04/10/2012	4	2	4	2
11/10/2012	4	2	4	2
25/10/2012	4	2	4	2
08/11/2012	4	2	4	2
15/11/2012	4	1	4	2
21/11/2012	4	2	4	2
29/11/2012	4	2	4	2
06/12/2012	4	2	4	2
18/12/2012	4	2	4	2

Behaviour Measure (Child A)

Date	POP	AGG	ACA	AFF	OLY	INT	Behaviour Overall
25/04/2012	4.3	2.3	6	4.5	5.3	5.3	6.2
09/05/2012	3	4.3	4	3.5	5	4.6	4.76
29/05/2012	3.3	3	4	3	5	5.6	5.18
05/07/2012	3.3	4.6	4	2.5	4.6	5.6	4.68
07/09/2012	4.3	3	4	4.5	5	5.3	5.62
12/09/2012	2.6	4.3	3.5	3	4	5.6	4.48
18/10/2012	3.6	2	4.5	2.5	4.6	6.3	5.5
25/10/2012	4.6	3.3	4.5	5.5	5	4.6	5.78
05/11/2012	3.6	2	4.5	2.5	4.6	6.3	5.5
14/11/2012	6	4	5.5	5	4.3	4.6	5.8
21/11/2012	5.6	4.6	5.5	5.5	3.6	5	4.72
29/11/2012	5.6	2	5	6	4	5.3	5.32
06/12/2012	6	2.6	6	4.5	4.6	4.6	5.3
13/12/2012	6.6	2	6	5.5	4.6	4	5.74

Appendix 12: Child B's SCED Raw Data

Learning Measures (Child B)

Date	Probe Words
03/05/2012	14
09/05/2012	10
17/05/2012	17
29/05/2012	22
12/06/2012	15
15/06/2012	15
12/07/2012	18
19/07/2012	20
13/09/2012	16
20/09/2012	14
27/09/2012	15
04/10/2012	18
11/10/2012	15
25/10/2012	35
08/11/2012	31
15/11/2012	26
21/11/2012	26
29/11/2012	33
06/12/2012	28
18/12/2012	35

Date	Words Read in a Passage (Per Minute)
26/04/2012	18
03/05/2012	22
09/05/2012	15
17/05/2012	21
29/05/2012	5
12/06/2012	13
15/06/2012	17
12/07/2012	20
19/07/2012	25
13/09/2012	17
20/09/2012	12
27/09/2012	20
04/10/2012	14
11/10/2012	10
25/10/2012	23
08/11/2012	30
15/11/2012	31
21/11/2012	30
29/11/2012	23
06/12/2012	31
18/12/2012	39

Affect Measures (Child B)

Date	Reading Enjoyment	Good at Reading	Enjoy Learning New Things	Good at Learning New Things
26/04/2012	3	2	4	3
03/05/2012	4	4	1	5
09/05/2012	1	4	1	4
17/05/2012	3	2	4	1
29/05/2012	3	4	5	1
12/06/2012	5	2	1	3
15/06/2012	1	1	1	1
12/07/2012	1	3	4	2
19/07/2012	2	3	4	1
13/09/2012	3	2	1	4
20/09/2012	2	3	4	1
27/09/2012	2	3	4	1
04/10/2012	3	2	2	4
11/10/2012	3	2	3	4
25/10/2012	4	2	1	3
08/11/2012	1	3	4	2
15/11/2012	1	3	2	4
21/11/2012	2	4	3	1
29/11/2012	3	1	4	4
06/12/2012	5	4	2	1
18/12/2012	3	4	1	2

Behaviour Measure (Child B)

Date	POP	AGG	ACA	AFF	OLY	INT	OVERALL
25/04/2012	4.3	5	4.5	5	4.67	4	4.29
09/05/2012	5	5.33	5	4.5	3.67	3	4.17
21/06/2012	5.33	5	2.5	5	3.67	4	3.9
07/09/2012	4.67	3.33	3.5	5.5	3.67	3	4.4
12/09/2012	4.67	3.33	3.5	5.5	3.67	3	4.4
05/10/2012	4	4.67	2.5	5	4	2.33	3.77
18/10/2012	4	4.67	2.5	5	4	2.33	3.77
25/10/2012	5.33	5.33	4	6	5	2	4.6
15/11/2012	6	4.33	5	5	4.67	3.33	4.87
21/11/2012	6.33	4	5.5	5.5	5.33	3	5.33
29/11/2012	6.33	4.33	4.5	6	5	2.67	5.1
06/12/2012	7	5.33	6	6	4.67	3	5.27

Appendix 13: Child C's SCED Raw Data

Learning Measures (Child C)

Date	Individual Words Read (Per Minute)
04/05/2012	17
22/05/2012	19
29/05/2012	9
12/06/2012	20
21/06/2012	15
28/06/2012	35
03/07/2012	23
05/07/2012	28
10/07/2012	23
12/07/2012	29
19/07/2012	23
13/09/2012	19
20/09/2012	14
27/09/2012	19
04/10/2012	19
11/10/2012	21
25/10/2012	23
08/11/2012	14
15/11/2012	17
21/11/2012	15
29/11/2012	25
06/12/2012	24
18/12/2012	19

Date	Words Read in a Passage (Per Minute)
04/05/2012	0
22/05/2012	29
29/05/2012	15
12/06/2012	19
21/06/2012	26
28/06/2012	31
03/07/2012	17
05/07/2012	16
10/07/2012	24
12/07/2012	24
19/07/2012	21
13/09/2012	22
20/09/2012	33
27/09/2012	24
04/10/2012	17
11/10/2012	31
25/10/2012	35
08/11/2012	36
15/11/2012	46
21/11/2012	25

29/11/2012	48
06/12/2012	30
18/12/2012	37

Behaviour Measure (Child C)

Date	POP	AGG	ACA	AFF	OLY	INT	OVERALL
04/05/2012	4	3	4	4.5	3	4	4.1
22/05/2012	3.67	4.33	6.5	4	3	4.67	4.17
29/05/2012	2	2.67	6.5	4.5	4.33	3	4.53
21/06/2012	2	3.33	6	5	4.33	4	4.4
05/07/2012	2.33	3.67	5.5	4	4.33	4.33	4.1
07/09/2012	1.33	4	7	4	4.33	3	4.13
12/09/2012	1	5	6.5	4	4.67	3	3.83
18/10/2012	2	4	6.5	4.5	5	5.67	4.4
25/10/2012	3	3.67	5	4	3	3.67	3.87
05/11/2012	2	4	6.5	4.5	5	5.67	4.4
15/11/2012	4.33	3.67	4.5	5	4.67	4.33	4.57
21/11/2012	5	3.33	6	4.5	3	5	4.63
29/11/2012	5	3.67	6	6	3	4	4.87
06/12/2012	5.67	4.33	6.5	5.5	4	5.33	5.07
13/12/2012	5.67	2.67	6	6	4.67	3.33	5.53

Appendix 13: Thematic Analysis Raw Data

Data from the focus group's discussion of Child A and precision teaching.

'Gave him a boost with spellings, previously writing random words'
'Comes straight over for precision teaching sessions'
'Improvements in literacy and numeracy'
'Now asks for help when wouldn't before'
'All revolves around his confidence – used to slam things down on the table and cry if he didn't know the answer. This is a lot less now'
'It is ok not to know something'
'All links in with precision teaching'
'Mum and dad state behaviour is better at home'
'Self-concept as a learner has definitely improved'
'Gone on an upward trend with behaviour and learning'
'Melt-downs are less frequent'
'Better at managing upsets and more confident that solutions can be found'
'Willingness to listen and take on board advice'
'It fostered better relationships through 1:1 work with staff'
'The sessions established trust with staff and more chatty/jokey'
'Reading has improved'
'Happier to read out in front of class'
'He takes on key roles in school plays'
'Accelerated learning'

Data from the focus group's discussion of Child B and precision teaching.

'All of a sudden clicks'
'Keep going and going'
'Over learning works well'
'Repetition works well'
'Enjoyed the 1:1 sessions'
'Liked the attention and kept him focused'
'Matured'
'Better socially'
'Improvements in behaviour at home'
'Good progression with reading'
'Precision teaching facilitated strategies to support learning in all areas'
'Asks for new words'
'General improvement across the curriculum'
'More engaged in tasks'
'Thinking for himself'
'More engaged with the text and not just looking at the pictures'
'Behaviour considerably better because learning and self-esteem improving'
'Having success and realising he can do things himself'

Data from the focus group's discussion of Child C and precision teaching.

'Knows the words in context'
'Understands what the words mean'
'Any structure is beneficial for him'
'Doesn't engage with anything if it isn't structured'
'He happily goes to the sessions for precision teaching'
'More emotionally stable'
'Becoming clearer and needing less reminding to use big voice'
'Used to copy write. More willing to write independently'
'More independence'
'Approach to tasks improvement'
'Willing to give tasks a go'
'Routine supports reading and writing'
'Enjoys little and often learning – format good for him'

Data from the focus group's general discussion of precision teaching.

'Definitely complemented what we do currently'
'Little and often worked well''
Fitted in very well with spellings and high frequency words'
'Improvements speak for themselves'
'The 1:1 is an important factor'
'Taken aspects of precision teaching into class such as little and often approach'
'Chart being visual works well'
'Instant feedback very useful and worked well for the children'
'Some children weren't too bothered by the graph'
'Good that they didn't know each others scores or words'
'Pupils are aware of differences of other children's abilities. Precision teaching gave them confidence of not being compared'
'Time aspect was a disadvantage. Difficult fitting it in'
'Children enjoyed the routine'
'It was predictable for them'
'Helps being short and sharp'
'Benefitted tremendously'
'Children enjoyed the routine'
'Dramatic improvements for some children'
'Supported children with attention difficulties'
'Children see progress'
'On-going assessment is useful'
'Helped with assessment approaches'
'Personalised for each child'
'Children liked the success of the programme'