Activity Schedules for Children with Severe Diagnoses: Teaching Independent Play in the Absence of Adult Prompting

Sarah K. Hedley Dray
Tizard Centre, School of Social Policy, Sociology and Social Research
University of Kent

PhD Applied Psychology
August 2018

Total word count: 97, 296

Acknowledgements

"To accept behaviorism fully and freely requires a slow growth – putting away of old habits and the formulation of new: Behaviorism is new wine that cannot be poured into old bottles" (Dr John Watson, 1928).

My thanks go to Dr Mecca Chiesa for introducing me to applied behaviour analysis; the knowledge she shared transformed my teaching practice and without her this research would not have taken place. Thanks also go to Prof. Bob Johnston whose contribution to both theoretical and practical aspects of this study is appreciated. Further thanks go to Prof. Peter Langdon for his advice, positivity and belief in me during my final year. Thank you all for your guidance and support.

To friends and family: thank you for your understanding, patience and good humour, which kept me going. To Gwen, Richard, Rob, Amelia and Harry: I could not have done this without you.

Finally, I thank the school community. Thanks go to the Senior Leadership team for facilitating this study, and in particular to the Head of Education who encouraged the applied research. To the teaching assistants: thank you for supporting our pupils with enthusiasm and dedication. To parents and carers: thank you for welcoming new teaching procedures and providing valuable feedback. Most importantly, thank you to the children who participated in this study, it was a pleasure learning from you.

Abstract

Children diagnosed with severe intellectual disabilities (ID) and autism spectrum disorders (ASD) often lack independence, relying on adult prompting to engage in play activities. In the absence of adult prompting or access to reinforcers (R+), independent engagement typically does not occur. Activity schedule (AS) interventions have been successfully implemented to develop a wide range of skills in this population, but many AS studies incorporated additional prompts and therefore do not adhere to the original protocol designed by MacDuff et al. (1993), named here as PCDI-AS. While other methods have been successful, it is not clear if adding gestural and/or verbal prompting improves effectiveness. To investigate the effectiveness of PCDI-AS and AS using other methods for individuals diagnosed with severe ID and/or ASD, two studies were completed:

Study One - Systematic Review:

Aims. To a) to systematically assess both effectiveness and quality of all studies using AS with participants with ID or ASD, and compare results of PCDI-AS versus AS using other methods, and b) provide a narrative synthesis of all studies with a focus on interventions designed to develop independent play skills.

Method. A systematic review was conducted, including a narrative synthesis. Each study was assessed for quality using the single case experimental design (SCED) scale (Tate, McDonald, Perdices, Togher, Schultz & Savage, 2008). The percentage of non-overlapping data (PND) method was used to estimate effect size (Scruggs, Mastropieri & Casto, 1997).

Results. Comparison of both quality and effectiveness data indicate that while AS are moderately effective, the PCDI-AS approach is highly effective. PCDI-AS evidenced more generalisation than AS using other methods. While only one study implemented PCDI-AS to develop independent play skills in those with severe diagnoses, results indicate it was effective

Conclusion: Findings are limited to use of PND and SCED as measurement systems, as other measurement systems may have yielded different results, however, data collected via these methods suggest that for developing independent play skills in those with ID and/or ASD diagnoses PDI-AS is more suitable than AS using other methods.

Study Two – Intervention:

Aims. To a) identify if PCDI-AS are suitable for teaching engagement with play materials to individuals with severe ASD or ID, in the absence of adult prompting, and b) to see if skills acquired during training would generalise to other settings under the control of naturally occurring stimuli.

Method. Following pre-requisite skill training, PCDI-AS was introduced, at different time points, to a cohort of 9 pupils presenting with ID and/or ASD within the severe range. To measure the effect of PCDI-AS on independent engagement with play materials in another setting, for each individual, different aspects of play skills were measured during child-initiated play sessions both prior to and during the intervention. Data were compiled to create non-concurrent multiple baseline across participants designs.

Results. PCDI-AS appears to be effective for developing independent play skills in participants with severe diagnoses; six pupils mastered schedule following. Play observations suggested that PCDI-AS impacted upon behaviour in other settings. Following the start of training, for most, levels of engagement increased and variety of play materials widened.

Conclusion: The current study is limited to 9 pupils in one location, therefore, results must be interpreted with caution. However it has significance for pupils with severe diagnoses who are prompt dependent and lack independent play skills, and for those professionals who seek to develop their skills.

Discussion

While AS are effective in general, the systematic review suggests that PCDI-AS are more effective than AS using other methods, and are associated with more generalisation. To develop their independent play skills, pupils with severe diagnoses were introduced to PCDI-AS. The intervention appeared to be successful; independent schedule following occurred under the stimulus control of visual cues alone, in the absence of adult prompting. Furthermore, evidence suggested that skills can be generalised to other settings under the control of naturally occurring stimuli.

CONTENTS

APPENDICES

List of Tables

List of Figures

Introduction

Children diagnosed with intellectual disabilities (ID) and autism spectrum disorder (ASD) face numerous challenges within the classroom environment, generating a need for specialist teaching methods and an increase in adult supervision. Discrete trial teaching (DTT) can be an effective teaching strategy during which a pupil typically sits facing an adult who provides frequent and systematic opportunities for learning. In this highly controlled learning environment, the learner can achieve a high percentage of success. However, a drawback of DTT is that passive sitting and waiting for instruction is reinforced (Carr, 1983). This can result in pupils becoming prompt dependent, and in the absence of these prompts, skills that occur during DTT sessions may not generalise to other settings (Scott, Clark and Brady, 2000; Smith, 2011; MacDuff, Krantz & McClannahan, 2001). Therefore, a particular concern for educational practitioners is the transfer of pupil skills from one situation to another and more importantly, for skills to be demonstrated in the absence of adult prompting, that is independently. The current study centres on educational provision to develop independent play skills in the absence of adult prompting. The following summary of each chapter provides an overview of the thesis:

Chapter 1: Challenges of Teaching and Learning in the SEN Classroom

To consider the impact that diagnoses of ID and ASD have upon adaptive functioning, Chapter 1 provides an overview of the wide spectrum of characteristics and potential deficits demonstrated by individuals with these diagnoses. Degree of impairment can vary widely within these diagnoses; diagnostic descriptors used to specify degree of impairment are referred to within this chapter (DSM-5, 2013), and the size of the population with dual diagnoses of ID and ASD, both in the severe range, is considered. The general challenges and difficulties experienced in the special education needs (SEN) classroom by those with more severe ID and ASD diagnoses are explored and summarised.

Chapter 2: Play and Independence

Within special needs schools, social skill development, encompassing play and independence, is challenging. In Chapter 2, further consideration is given to the concepts of independence and play, which are defined and explored. Children diagnosed with ASD engage in stereotypy (DSM-5, 2013); when stereotypy with play materials occurs, differentiating between what is and is not “play” can be particularly challenging. The actions involved with play and stereotypy can have similarities and differences, and these are considered. The rights of individuals to engage in stereotypical manipulations of play materials are discussed and balanced with the rights of these same individuals to have an effective education. Finally in Chapter 2, different approaches to observing and measuring pupil play skills are considered.

Chapter 3: Teaching Strategies in the SEN Classroom

A number of teaching procedures developed by behaviour analysts are explored in Chapter 3. Methods of teaching individual, discrete skills such as Discrete Trial Teaching (DTT) and Incidental Teaching (IT) are summarised. This is followed by an overview of procedures used to teach chains of behaviour including the use of visual cues, task analysis and prompting strategies. The advantages and disadvantages of using multi-component prompting procedures are explained which provided insights into how the AS, as designed by MacDuff, Krantz and McClannahan (1993), differed from other teaching strategies. Consideration was made as to whether or not their procedure is more effective than other multi-component procedures.

Chapter 4: Activity schedules for Individuals diagnosed with ID, ASD and/or other Developmental Disorders: A Systematic Review

A systematic review of AS is provided in Chapter 4. A description of the AS as designed by MacDuff et al. (1993) is given; while all AS used visual cues to prompt a chain of behaviour, not all activity schedules followed the procedures suggested by MacDuff et al. (1993). These, referred to as PCDI-AS, are described.

Several reviews explored the use of AS; these are summarised to give an overview of existing research, identify what is already known and identify areas for further research. Research into AS for those with a more severe diagnosis is limited. No review had compared the effectiveness of PCDI-AS with the effectiveness of AS using other methods for teaching independent play skills to those with severe ASD or ID diagnoses.

The subsequent systematic literature search provided 49 primary studies for further analysis. To limit any bias, the quality of individual activity schedule studies was measured using the Single Case Experimental Design (SCED) scale (Tate, McDonald, Perdices, Togher, Schultz & Savage, 2008). The effectiveness of studies was measured using the Percentage of Non-Overlapping Data (PND) method (Scruggs & Mastropieri, 2013). A comparison was made between PCDI-AS and AS using other methods. Mean data was calculated so that the quality and effectiveness of PCDI-AS could be directly compared with quality and effectiveness of AS using other methods. Comparisons between the effectiveness of the two approaches were also made for participants with severe diagnoses, and for studies implementing independent play procedures. A narrative synthesis of the 49AS studies examined how they had been used to positive effect. The various formats, settings and populations for whom AS have been helpful were considered and those designed to develop independent engagement with play materials were explored in more detail. Studies are evaluated with regards to their effectiveness and quality.

Since MacDuff et al.'s (1993) paper, only one other study followed their PCDI-AS procedure to develop skills in individuals with severe ID or ASD diagnoses (Krantz & McClannahan, 1993) and none had done so to develop independent play skills. While evidence presented in the systematic review suggested the PCDI-AS approach would be suitable for developing independent play skills in individuals with severe ID and/or severe ASD, the evidence was limited.

Chapter 5: Intervention Overview

Within Chapter 5, research aims and questions are presented on teaching independent play skills to individuals with severe ID and/or severe ASD diagnoses. Nine participants are described, each presenting with severe to profound

ID as well as ASD or in the case of one, “autism-type characteristics”. While all had different behavioural repertoires, they each lacked independence skills. This was particularly noticeable during child-initiated play sessions when, in the absence of adult prompting, independent engagement with play materials was low. While under DTT conditions each learner picked up a range of traditional play materials, these same actions did not occur when adult prompting was not available.

An overview of the intervention is given, which consists of three components; pre-requisite skill training, activity schedule training and child-initiated play observations. MacDuff et al. (1993) suggested three pre-requisite skills were required in individual repertoires prior to activity schedule training; these are described. A plan to teach these skills to pupils, and to subsequently teach AS following is presented. A means of monitoring pupil independent engagement with play materials prior to and during activity schedule training is outlined. An overview of the project is given with a timeline to provide a visual framework for the whole project. Procedures followed to obtain ethical approval and to measure social validity are outlined.

Chapter 6: Pre-requisite Skill Training

Methods used to teach pupils the three pre-requisite skills recommended by MacDuff et al. (1993) prior to activity schedule training, are outlined in Chapter 6. Materials used and procedures followed are described. Results of pre-requisite skill training for each of the pupils is given and discussed. Additional observations on pupil performance are reported.

Chapter 7: Activity Schedule Training

The main intervention is presented in Chapter 7: teaching activity schedules following procedures described by MacDuff, Krantz and McClannahan (1993). Methods used to deliver training are outlined in detail. Procedures used to measure independent engagement during training are described. Results of training are presented for each of the nine pupils on an individual basis and outcomes of the intervention analyzed. Additional notes were taken during activity schedule training sessions and these are summarised. A return visit to the school 11-months following the end of the study provided an opportunity to observe pupils using their activity schedules. The results of these observations provided evidence of the longevity of the intervention, and are reported.

Chapter 8: Independent Play Observations

Prior to and during AS training, pupils were observed in regular child-initiated play sessions. This provided a means of estimating the effect of activity schedule training on independent play skills in other settings. This is described within Chapter 8. Methods of measuring independent pupil engagement with play materials during play sessions, as well as any occurrences of self-injurious behaviour or aggression, are outlined in detail. Further measurements are taken on variety and number of different types of play materials engaged with across sessions; these are described. Results from both quantitative and qualitative data are presented individually. A non-concurrent multiple baseline across participants design presents a comparison of results prior to and during activity schedule training. An additional observation section summarised further information noted during observation sessions; these are discussed.

Chapter 9: Social Validity

Members of school staff, parents and carers were asked for their opinions on AS training. In Chapter 9 methods to obtain social validity measures are presented and the results described, indicating that the project was considered valid by all concerned.

Chapter 10: Discussion

An evaluation of the project as a whole is presented in Chapter 10 by re-considering the background theory and systematic review in light of results obtained. Firstly, limitations are summarised for each aspect of the study; pre-requisite skill training, activity schedule training and independent play observations. Then, the main research questions are addressed; namely if pupils presenting with severe intellectual disabilities and autism could be taught to follow a sequence of visual cues using PCDI-AS procedures, and in the absence of adult prompting. Of particular interest was if schedule-following behaviour could come under the control of naturally occurring environmental stimuli rather than under the control of another individual. Also considered is the secondary question of whether play skills would generalise to other child-initiated sessions. Key findings are discussed in detail, and recommendations for practitioners implementing different aspects of the intervention, are made.

A conclusion section summarises the two studies; the systematic review and the intervention, and final conclusions are reached. During the course of applying the intervention and analysing the results, ideas for further research were generated. Suggestions for how the current research could be extended are given.

Chapter 1

Challenges of Teaching and Learning in the Special School Classroom

Overview

Schools for children with special educational needs are maintained for pupils with a wide range of diagnoses, encompassing intellectual, physical and/or developmental disorders. While all pupils diagnosed with an intellectual disability (ID) are unique, they have certain characteristics in common as, by definition, those who are disabled under the Equality Act, 2010 endure “a physical or mental impairment” that has a “substantial and long-term adverse effect on ability to do normal day-to-day activities” (Equality Act, 2010, p.4). This impact on everyday functioning presents a wide spectrum of challenges for both pupils and teachers.

This chapter begins by providing an overview of what it means, in practical terms, to be diagnosed with ID or autism spectrum disorder (ASD). For each diagnosis, the spectrum of difficulties encountered by those with a mild to a more severe or profound diagnosis is considered in reference to the diagnostic criteria given by the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association [APA], 2013).

Consideration is given to the estimated proportion of individuals with co-morbid diagnoses of ID and ASD, each within the severe range. Pupils with diagnoses at the severe ends of the ID and ASD spectrums face specific difficulties within the classroom environment posing a range of challenges for both pupils and teaching professionals. These challenges are summarised.

The importance of distinguishing educational strategies appropriate to the needs of pupils with a severe diagnosis is considered while acknowledging that terminology used to describe intellectual disabilities and differences varies across English speaking nations. A summary of findings is given to establish equivalency of diagnostic terms and accompanying severity levels.

Characteristics of Intellectual Disability

The International Statistical Classification of Diseases and Related Health Problems (10th Revision; ICD-10; World Health Organization [WHO], 1992) refers to mental retardation, or intellectual disability as a “condition of arrested or incomplete development of the mind, which is especially characterised by impairment of skills manifested during the developmental period; skills which contribute to the overall level of intelligence i.e. cognitive, language, motor and social abilities” (P. 176). More specifically, individuals with intellectual disabilities demonstrate impairments within three core domains; conceptual understanding, social interactions and practical functioning (DSM-5, 2013).

For school age pupils, a deficit in conceptual functioning results in difficulties in meeting age-related expectations, as academic skills are impaired. A deficit in the social domain primarily affects communication with others and can impact upon the regulation of emotion and behaviour. Whereas a deficit in the practical domain results in individuals requiring support with daily living tasks such as eating, dressing and bathing.

Degree of impairment. Degree of intellectual impairment can vary widely across individuals. Categories of intellectual disability can be considered as “arbitrary divisions of a complex continuum, and cannot be defined with absolute precision” (p.177, ICD, 1992). However, severity indicators can be used to estimate the extent to which an impairment affects individual lives (APA, 2013), and impacts directly upon how much support is likely to be required. When diagnosing severity of ID, the DSM-5 (2013) advises considering the three domains (conceptual, social and practical) separately. An individual can be diagnosed as demonstrating mild, moderate, severe or profound deficits in each of these 3 areas.

Mild ID. A mild ID may not be obvious within preschool aged children, however difficulties may become apparent at school age, with “support needed in one or more areas to meet age-related expectations” (DSM-5, 2013, p.34). Socially, an individual with a mild impairment may seem immature. Within the practical domain, individuals “may function age-appropriately in personal care” however they may “need some support with complex daily living tasks in comparison with peers” (DSM-5, 2013, p.34).

Moderate ID. Those with a moderate impairment within these domains are likely to require “on-going assistance on a daily basis” to complete “conceptual tasks of day-to-day life”, and their friendships with typically developing peers are “often affected by communication or social limitations" (p.35, DSM-5, 2013). With practical matters, they are likely to require an "extended period of teaching" to become independent in self care needs such as dressing and eating (p.35, DSM-5). Therefore, while support in each area is required, after targeted and extensive teaching, educational progress can be made.

Severe ID. For those with severe impairments within these domains, attainment of concepts is so limited that "caretakers provide extensive supports for problem solving throughout life" (p.36, DSM-5, 2013). While individuals may use single words or phrases, these communications are focused "on the here and now within everyday events", and with practical matters they require constant supervision as they "cannot make responsible decisions regarding well-being of self or others" (p.36, DSM-5). These impairments, resulting in the need for extensive support and supervision, mean that those diagnosed with severe ID have limited opportunities to be independent.

Profound ID. This lack of independence is even more evident in those with profound impairments within the three domains. Conceptual skills "generally involve the physical world rather than symbolic processes" as even when an individual can match objects based on visual characteristics they "cannot translate to appropriate use" (p.36, DSM-5, 2013). For these individuals, understanding of speech or gesture is very limited and they are "dependent on others for all aspects of daily living" (p.36, DSM-5).

Effect of ID on independence. Degree of ID impacts specifically upon individual independence: the most severe intellectual disabilities correlate directly with least independent functioning. Individuals with a severe diagnosis are likely to need continuous support, while a profound diagnosis is likely to result in severe limitations in self-care, continence, communication and mobility (ICD 10, 1992). A diagnosis of ASD also impacts on individual adaptive functioning and independent living, as described in the following section.

Characteristics of Autism Spectrum Disorder

The diagnostic features of ASD are persistent impairment in reciprocal social communication and social interaction as well as restricted, repetitive patterns of behaviour, interests or activities that limit or impair everyday functioning (DSM-5, 2013). These impairments in social skills, along with the presence of repetitive behaviours, inevitably affect capacity to learn.

When determining the nature of support required for an individual, the DSM-5 (2013) provides criteria for diagnosing ASD severity based on social communication impairment and restricted repetitive patterns of behaviour. ASD severity is currently measured by deficits in functional skills and levels of support required; level 1 requiring support, level 2 requiring substantial support and level 3 requiring very substantial support. Those with a more severe diagnosis inevitably require more support and specialist intervention than those with more mild diagnoses.

Level 1 diagnosis of ASD. Those with a level 1 diagnosis require support with social communication, as although they may speak in full sentences, social interactions are atypical. Restricted, repetitive behaviour interferes with functioning and “problems of organization and planning hamper independence” (p.52, DSM-5, 2013).

Level 2 diagnosis of ASD. Independence for those with level 2 diagnoses is further affected; even with supports in place, social interactions are limited and include “reduced or abnormal responses” to others. Furthermore, restricted/repetitive behaviours “interfere with functioning in a variety of contexts” (p.52, DSM-5, 2013).

Level 3 diagnosis of ASD. However, for those with level 3 diagnoses, deficits impact most severely on independence and everyday functioning, as the “inflexibility of behaviour and extreme difficulty coping with change, or other restricted/repetitive behaviours markedly interferes with functioning in all spheres” (p.52, DSM-5, 2013). Impairments in functioning are a result of severe deficits in verbal and nonverbal social communication skills. A lack of communication skills has repercussions for all aspects of daily life and has a profound impact within a learning environment.

Prevalence of ID and ASD

While intellectual disability has an overall general population prevalence of approximately 1%, those diagnosed with intellectual disability in the severe category represent a smaller minority of approximately 6 per 1,000 (DSM-5, 2013), accounting for 0.6% of the population worldwide.

Reported prevalence rates of ASD vary, with rates of between 0.3% and 0.9% being reported in the United States of America (USA) (Crosland & Dunlap, 2012). As many as 50% of children with an ASD diagnosis are reported to be high functioning i.e. with average to high intelligence quotient measurements (Crosland & Dunlap, 2012).

While ASD and ID do not always co-occur, autism is often associated with intellectual disability. A report into ASD in adults in England found that prevalence of ASD increased with the greater severity of learning disability (Brugha, Cooper, McManus, Purdon, Smith, Scott, Spiers & Tyrer, 2012). Therefore, those diagnosed with severe learning disabilities are more likely to have an ASD diagnosis than those with a mild to moderate learning disability.

A co-morbid diagnosis of autism and intellectual disability can result in significant difficulties associated with learning (DSM-5); those who fit the criteria for severe diagnoses in both ID and ASD are in a very small minority of individuals. According to National Health Service (NHS, 2016) it is estimated that up to 50% of people with severe learning difficulties in the United Kingdom (UK) also have an ASD, which accounts for less than 0.3% of the population. This minority population, with dual diagnoses of severe ID and severe ASD face specific challenges in the classroom.

Challenges within Special School Classrooms

The population of children diagnosed with autism presents multiple challenges and is difficult to teach (Ghezzi, 2007). Those with dual diagnoses of ASD as well as ID present further challenges; teaching these individuals is inherently different from teaching those with a mild to moderate diagnosis and, inevitably, those with more severe impairments require most specialist interventions if they are to succeed. Unless ASD or ID is referenced individually, any reference to ‘severe diagnoses’ within this thesis refers specifically to dual diagnoses of both ID and ASD in the severe to profound range.

Learning to imitate. Early childhood is the time when typically developing children engage in imitating behaviour and subsequently acquire new skills (Rogers, Young, Cook, Giolzetti & Ozonoff, 2010). However, new skill acquisition is problematic for those diagnosed with autism who have particular difficulties with imitation (Rogers & Williams, 2006). Such is the need to acquire these skills, imitation tasks form learning objectives within specialist educational curricula for young learners diagnosed with autism. The Assessment of Basic Language and Learning Skills ([ABLLS-R], Partington, 2008) for example, contains 27 motor imitation tasks comprising imitation using objects as well as imitation of gross and fine motor movements. Imitation aids goal-directed actions or the “tools and tasks of the world” (Rogers et al., 2010, p.2), and with a skill deficit in this area, learning new skills is inherently more difficult.

Acquisition of functional skills. Imitation is a crucial aspect of learning a wide range of practical skills. For those with ASD diagnoses, deficits in imitation skills hinder the acquisition of functional, daily living skills. Therefore, a common goal for those working with individuals diagnosed with ASD is to develop functional skills that maximise engagement in personal, academic and play activities (MacDuff, Krantz and McClannahan, 1993). Difficulties in this area can be further compounded when an individual also has a diagnosis of severe intellectual disabilities.

Typically developing individuals acquire functional skills via watching demonstrations and listening to instructions, however, for those diagnosed with severe ID, this can be problematic. For this population, individual support and supervision is required for all activities of daily living (DSM-5, 2013); acquisition of functional skills such as getting changed for exercise lessons, eating lunch and going to the toilet can pose challenges and require substantial time for training. Such skills are often prioritised as learning objectives on school individual education plans (IEPs). While those with more moderate diagnoses can learn after extended training, those with more severe diagnoses, by definition, require substantial and/or specialist teaching, and are likely to require continued supervision (DSM-5, 2013).

Acquisition of social skills. Imitation skills are not limited to successful acquisition of motor tasks; social interaction skills are also typically acquired via imitation. Deficits in social-emotional reciprocity mean that those with autism diagnoses at the severe end of the scale may show little or no initiation of social interaction and reduced or absent imitation of others' behaviour (DSM-5, 2013). Imitation of another person's vocal behaviour, facial expressions, gestures and actions is important for the development of behavioural repertoires but for those diagnosed with autism, imitation of these acts is more problematic (Rogers, Young, Cook, Giolzetti & Ozonoff, 2010) and therefore social interactions are hindered.

For those diagnosed with ID, while relationships with familiar others can be a source of pleasure, relationships are affected by social limitations and significant support is needed (DSM-5, 2013). Children diagnosed with ID and ASD often lack age-appropriate social skills, which "disrupts their social functioning" and results in the need to "explore alternative opportunities for social skill acquisition" (Brooks, Floyd, Robins & Chan, 2015, p.678).

Acquisition of communication skills. Imitation also plays a crucial role in the acquisition and development of communications skills; its importance and function within the context of language acquisition has been much debated (Bloom, Hood & Lightbrown, 1991). Typically developing children first acquire joint attention skills, and subsequently develop communication skills via reciprocal interactions. Babbling sounds gradually sound more similar to the conventional speech sounds modelled by a caregiver, and eventually become discernable words. Between the age of one and two years, typically developing children can imitate new actions, pretend with objects in play and use words to refer to objects and events (Wetherby, 2006). However, as language learning occurs within the context of modelling and imitation, any deficits in initiating and responding can have a "cascading effect on language development" (p.11, Wetherby, 2006). While some children with mild ASD diagnoses eventually develop large vocabularies and complex grammar, those with more severe ASD diagnoses may have little to no meaningful use of words and comprehension of language (Thurm, Lord, Lee & Newschaffer, 2007). An individual with a severe diagnosis may have speech (or other forms of communication) limited to single words or phrases while those diagnosed with profound deficits within the social domain have very limited understanding of speech or gesture, and may communicate through nonverbal, non-symbolic methods (DSM-5, 2013).

Acquisition of conventional play skills. Children diagnosed with ASD typically lack imagination and flexibility of thought, which can inhibit social engagement with others. This skill deficit can also hinder participation in the type of conventional play activities that would ordinarily be observed in classrooms, or outdoor play environments, within school settings. This could explain why there can be an apparent preference for solitary activities (DSM-5, 2013) in those diagnosed with severe autism. Within a classroom or playground setting, it is a challenge for children with ASD diagnoses to play alongside each other, and even more so to co-operate with each other. Restricted interests or stereotypic behaviour can result in children diagnosed with autism having limited opportunities for peer interaction and play skill acquisition (Jung & Sainato, 2013). A lack of shared social play and imagination results in individuals with autism diagnoses having fewer play skills than their typically developing peers (Baron-Cohen, 1987). The area of play is discussed more fully in Chapter 2, Play and Independence.

Academic skill acquisition. It is widely acknowledged that while typically developing children learn from their environments via exploration and interaction with others; the acquisition of new academic skills is particularly difficult for individuals diagnosed with ASD (White, Keonig & Scahill, 2006). Furthermore, attainment of new concepts is limited for those diagnosed with severe ID (DSM-5, 2013), resulting in the need for educators to provide extensive supports for problem solving. For example, attainment in mathematical concepts such as money, time and quantity can be limited. Limitations in the area of receptive and expressive communication have significant impact on skill acquisition and the development of core language skills of speaking, listening, reading and writing.

Acquisition of independence skills. Children diagnosed with severe ID require support for all practical activities of daily living; by definition therefore, they are less independent than their typically developing peers. The need for increased levels of support can lead to prompt dependency; pupil lack of engagement can result in increased adult prompting and as prompts become more frequent, pupils become further reliant on adults (Milley & Machalicek, 2012). Inevitably, this can present a challenge for teaching professionals. Independence skills form part of educational curricula; learning objectives to measure and develop independence are explicitly part of subjects such as personal, social and heath education (PSHE). Furthermore, skills in working independently are inherent to all aspects of conceptual, social and practical tasks within a school environment. A challenge for education professionals therefore is to provide pupils with support sufficient to achieve their educational goals while simultaneously facilitating the development of independence skills. The concept of independence is further explored in Chapter 2, Play and Independence.

Generalisation of skills. While teaching new skills to individuals diagnosed with ASD and/or ID is difficult, teaching individuals to use skills in multiple settings and with different individuals presents additional challenges: transferability of skills is a major goal of educators. To have a skill truly embedded within his or her repertoire, an individual should demonstrate the skill in novel environments and in different situations; this generalisation of skills is what teachers strive for. As Cooper, Heron and Heward (2007) state, “practitioners face no more challenging or important task than that of designing, implementing and evaluating interventions that produce behaviour changes that continue after the intervention is terminated, appear in relevant settings and stimulus situations other than those in which the intervention was conducted, and/or spread to other related behaviours that were not taught directly” (p.613). For all educators, whether they work with nursery-aged children, pupils in schools or university students, skill generalisation is vital for teaching to be meaningful and effective. However, for educators of individuals diagnosed with intellectual disabilities, due to the intensive teaching often required for skills to transfer to novel materials, individuals and environments, generalisation is not only more of a challenge but is arguably a greater priority.

Challenging behaviour. Challenging behaviours such as aggression, tantrums, property destruction and self-injury occur in a range of individuals diagnosed with developmental disabilities but are most prevalent amongst those diagnosed with ID and ASD (Matson, Kozlowski, Worley, Shoemaker, Sipes & Horovitz, 2011). As discussed, learners diagnosed with ASD and ID demonstrate difficulties with skill acquisition, and compared with their typically developing peers, they display relatively few desirable behaviours that can be reinforced by a teacher (Smith, 2001). An inflexibility of behaviour and extreme difficulties in coping with change can interfere with learning for those diagnosed with ASD, and in classroom situations there is a tendency for individuals to engage in a range of behaviours that can be challenging to teachers and peers.

Problematic behaviours are often associated with difficult or non-preferred tasks; while they sometimes function as a means of accessing tangibles, the most commonly reported functions are attention and escape (Matson et al., 2011).

There is also strong correlation between challenging behaviour and communication deficits (Carr & Durand, 1985; Sigafoos, 2000): the less "communicatively able" a person is, the more likely there is to be inappropriate behaviours present, and vice versa (p.76, Kevan, 2003). Difficulties in receptive or expressive language skills can lead to inappropriate behaviour born of frustration. An inability to articulate needs or desires verbally, or with another form of communication such as the Picture Exchange Communication System (PECS) or sign language, can result in inappropriate forms of communication. If the challenging behaviour serves to access or escape social attention then appropriate functionally equivalent behaviour needs to be taught.

Problematic behaviours can be counteracted in schools via positive behaviour support plans (BSP) which focus on eliminating problematic behaviour while teaching socially appropriate alternative behaviours (Mesibov, Browder & Kirkland, 2002). The design of effective BSPs is one of the challenges faced by those who teach individuals diagnosed with ID and ASD within the severe range. Ideally, an effective BSP is used alongside pro-active teaching strategies such as teaching appropriate forms of communication so that individuals do not resort to challenging behaviour in order to get their needs or desires met (The Challenging Behaviour Foundation, http://www.challengingbehaviour.org.uk/learning-disability-files/03).

Identifying Appropriate Teaching Interventions

As new learning is so difficult for children diagnosed with severe ID and/or severe ASD, the most important issue for those who provide their education is to find appropriate ways to increase learning opportunities while developing motivation to learn (Smith, 2001). Identifying appropriate teaching strategies is essential for any educational establishment to be successful in their quest to develop pupil skills.

As stated by Handleman and Harris (2008), it is "important to know the type of children that are attending a particular program in order to assess whether the children attending one program are similar to those in another. This information is useful in determining to what extent differences in outcome may be the result of differences in population as opposed to educational methods" (p.5, 2008).

By estimating parity between groups of individuals, differences in populations can be minimised and further emphasis can be placed on the efficacy of interventions. A teaching strategy suitable for those with a mild diagnosis is unlikely to be appropriate for those with more severe impairments. Given their need for more specialist and intensive support, when teaching the minority population of children with severe diagnoses, identifying appropriate teaching strategies is essential. Studies reporting success with particular interventions designed for those with severe diagnoses in the US may, therefore, be of interest to those teaching individuals with severe diagnoses in the UK.

Discrepancies in terminology. There is, however, some discrepancy between and amongst terminology used to describe intellectual differences, disabilities and disorders across English speaking nations. These differences, if not fully understood, can potentially cause more confusion than clarity. While it is not within the scope of this thesis to debate or discuss at length the variations in terminology, for reference, Appendix A includes a table summarising similarities and differences in terminology commonly used in the UK and USA as well as an interpretation of how these terms apply to the children in the present study. In summary however, merely interpreting diagnoses based on diagnostic labels alone can be potentially misleading. Although there are discrepancies in terminology, within the UK those with a 'learning difficulty' and an SEN code used within education, can be considered to have a 'learning disability' as described by health and social care. In turn, this is equivalent to an 'intellectual disability' as used in the US.

Meaningful descriptors. To provide an accurate estimation of individual need requires closer examination of a person's adaptive functioning skills. Estimating the extent to which an impairment impacts on individual lives provides a more meaningful and realistic assessment of individual need and a predictor of support required, than can an IQ test or label.

Establishing terminology for the current study.

Having considered the variety of terms used to describe a generalised impairment of intelligence (see Appendix A), ‘intellectual disability’ is the preferred term used within this project as it is in common everyday usage within the USA, and has begun to be used within the UK (Mansell, 2010). When referring to participants with ‘severe diagnoses’ within the systematic review or elsewhere in the current study, this term encompasses either a diagnosis of severe ASD or severe ID, or both. Within the systematic review, terminology to describe mild, moderate or severe diagnoses reflects information provided in individual studies (based on diagnoses made by, for example, healthcare professionals or educational psychologists). Information regarding pupil participants in the current study is provided in Chapter 5 (p.127-128).

Summary and Conclusion

This chapter began with a summary of the characteristics of ID and the broad topography of behaviour typical of those with a mild, moderate, severe or profound diagnosis. This was followed by a summary of ASD characteristics and the accompanying range of three levels that describe the level of support an individual is likely to require. The population of individuals with co-morbid diagnoses of ID and ASD were considered; they constitute a minority population. Challenges encountered within special schools were described; in particular, difficulties facing individuals with diagnoses in the severe range. A lack of imitation skills impacts on learning in many ways; on acquisition of functional, social, communication, play and academic skills, these were summarised. Difficulties for many children to generalise skills across environments, materials and individuals were discussed. The correlation between problematic behaviour and skill deficits was acknowledged.

The requirement for educational strategies tailored to individual need was identified; interventions proven effective for similar cohorts of individuals being advisable. It was acknowledged that diagnostic terminology varies across English speaking nations, and consequently, identifying appropriate interventions could be problematic. Having considered how severe diagnoses affect skill acquisition on a broad level, the following chapter considers the impact of these diagnoses on play.

Chapter 2
Play and Independence

Overview

As discussed in Chapter 1, children diagnosed with severe intellectual disabilities and autism face more challenges within the classroom and the playground than their typically developing peers. This often results in pupils becoming overly reliant on adult prompting for academic and social activities. Consequently, teachers aim to increase independent engagement. Child-initiated play sessions provide pupils with opportunities to engage independently with a wide range of play materials. Yet these sessions can be problematic for those who lack independence and do not display conventional play skills. In these circumstances pupils may engage with prompts, however in the absence of adult prompting play behaviour may not occur. If engagement with play materials only occurs when an individual is prompted and the action would not occur otherwise, describing the activity as 'play' is debatable.

This chapter begins by examining the concept of independent play. The parameters of what is and what is not play are considered. Opportunities provided for children to develop their independent play skills within schools are explored. This is followed by a description of the developmental stages, characterising the acquisition of skills. Those diagnosed with ASD experience play differently and these differences are considered. This leads to a discussion on the difference between stereotypy and play, followed by a debate on the right to choose to engage in stereotypy versus the right to an education. Finally, some studies that observed and measured the play behaviour of children diagnosed with ASD and/or other developmental disabilities are examined.

Defining Independent Play

As a definition of any behaviour to be measured and changed needs to be concise, it should also indicate what is not included in the definition (Cooper, Heron & Heward, 2007). Definitions of 'independence' and 'play', and what they are not, are therefore essential components of any procedure designed to increase independent engagement with play materials. Yet what is meant by the term 'independence' is difficult to define and indeed measure. It can simply be "the quality or state of not being under the control of, reliant on, or connected with someone or something else" (www.merriam-webster.com/dictionary/independence). This definition is more about what independence is *not* than what it *is*. Conversely, independence can be thought of as "the freedom to organise your own life, make your own decisions etc. without needing help from other people" (www.oxfordlearnersdictionaries.com).

Arguably, and even more difficult to define, is the concept of play, which has been described as "slippery and ambiguous, overused and ill-defined" (Zimmerman, 2004, p.155). Although complex by nature, play can be defined simply as "to occupy oneself" in an activity (Collins Dictionary, 2009). By combining these definitions of independence and play, engaging in independent play could mean 'to occupy oneself in leisure activities without being under the control of someone else or needing their help'. This is arguably easy for a typically developing child, however, as discussed in Chapter 1, those with severe diagnoses have particular difficulties with independence and therefore may not engage with play materials in the absence of adult prompting.

Zimmerman (2004) in his chapter "Narrative, Interactivity, Play and Games: four naughty concepts in need of discipline" examines how difficult it is to define these concepts stating, "play is the free space of movement within a more rigid structure. Play exists both because of and also despite the more rigid structures of a system" (p.159). This rather paradoxical statement has some relevance when considering a typically developing individual who understands and operates within the constraints of a system. An opportunity to behave in a different way can perhaps be liberating and presents a temporary freedom from the usual rules. Although playtime opportunities are free of many of the behavioural expectations of the classroom (Lang et al. 2011), this freedom in itself could induce anxiety. For an individual with an ASD diagnosis, who lacks imagination skills, the structure of a system is often what helps to make sense of daily living. Indeed, a change in routine and a lack of rigid structure can induce great distress (DSM-5, 2013), thus school playtimes can result in behaviours such as aggression, self-injurious behaviour or elopement. Research into play behaviours of children diagnosed with ASD is limited, especially in school settings (Holmes & Willoughby, 2005). However, when developing play skills, research has shown that a collateral side effect of the increase in play skills is the decrease in challenging behaviour (Jung & Sainato, 2013). Potentially therefore, the reverse can occur; a lack of play skills could coincide with the occurrence of undesirable behaviour.

The opportunity to "play" independently is not always beneficial for either relaxation or educational purposes. To consider the benefits of including playtime on a school timetable, firstly we need to examine the types of play sessions that are available to pupils and secondly, the educational intentions behind the opportunities given. Given the broad skill deficits of individuals with severe ASD and ID diagnoses (as discussed in Chapter 1), especially within the areas of independence, imitation, social and communication skills, we must question the educational value of playtime for these pupils in particular.

Opportunities to Develop Independence and Play in Education

Within educational settings from nursery through to secondary education, playtime is when pupils are typically left to run around and explore their environment independently with little or no intervention from supervising adults. Playtime is the activity between what is considered to be lessons or more formal opportunities for learning. It does not usually include targeted learning objectives for individual pupils. In Saracho and Spodek's (1998) historical overview of theories of play, a claim is made by Lilliard (1998) that educational outcomes of play could be limited by lack of teacher intervention, stating that "while teachers value children's play they often do not know how to guide that play to make it more educational" (p.9). Lang et al. (2011) also claimed that educational opportunities for playtime in the United States are often overlooked and that time allocated for recess is being reduced or eliminated. Furthermore, “potentially valuable time may be largely wasted” (p.1297). They cite two main reasons for this: firstly, teachers may view recess as “free-play” and may not want to intervene, and secondly, children diagnosed with ASD may lack the play skills necessary to benefit from this unstructured time without support. When teacher direction is withdrawn, pupils are consequently given more independence; they are expected to make independent choices regarding the type and nature of play activities with an inherent assumption that this independence leads to positive play experiences.

Child-initiated sessions. Pupils in early years settings are typically provided with frequent opportunities for independent play or exploration of materials. Besides the playtime scheduled between lessons, the educational timetable often includes *child-initiated* sessions. These sessions typically form part of the curriculum within special schools when it is developmentally appropriate. The purpose of what is described as play time often contrasts with that of child-initiated sessions; although both provide time, space and resources for independent engagement with play materials/activities, the intended outcomes of each session are different. The planned activities of child-initiated sessions typically include provision of an array of age and developmentally appropriate materials such as a book corner, a table top train set, a role play area, a dolls house, a construction area, a sand and water area, and so forth. The reasoning behind these child-initiated sessions is that it encourages pupils to explore and make independent choices for themselves. They are not directed by adults but are free to select from an array of activities and play independently.

Acquiring skills like a sponge absorbing water. For some, there is an assumption that while they actively explore, children automatically learn and develop their independence skills. It is sometimes said that children developing new skills are like sponges soaking up water. By merely being in contact with water the sponge will absorb it, and similarly, if children are presented with a variety of play materials they will automatically acquire knowledge. For typically developing pupils, child-initiated sessions can be educational if the children are in fact developing social interaction skills, developing skills in making independent choices and extending the amount of time during which they are engaged in an activity. For pupils diagnosed with severe ASD or ID however, this may not be the case. As discussed in Chapter 1, those with more severe diagnoses are often lacking in generalised imitation skills. As social and communication skills develop within a context of modelling and imitation, children with deficits in imitation skills are therefore at a disadvantage compared to their typically developing peers. Those with severe ASD diagnoses will not automatically benefit from opportunities to engage in reciprocal activities; without a carefully planned intervention, their impairments and skill deficits decrease their likelihood of developing social skills.

If educational play activities are evaluated by the degree of children's involvement and their effectiveness in helping children attain educational goals, then these activities require planning and monitoring. If, after observing a play session, children have a low rate of independent engagement with play materials and the rate or quality of engagement has not increased over time, then their involvement in play activities cannot be seen as educationally effective. In this instance child-initiated sessions would not be appropriate for helping them reach their educational goals. As Lilliard (1998) points out "the use of hands-on activities to support children’s learning through the primary grades is based on the notion that children's manipulation of symbolic materials leads to a greater understanding of the concepts underlying the symbols and their manipulation" and furthermore "just because children play with an object does not mean that they have learned from the experience" (p.xi).

Ironically, by allowing children with severe ID or ASD diagnoses complete freedom to play independently, instead of facilitating the development of independence skills we may in fact be hindering them. If their skills have plateaued they will not continue to develop their skills further. In these circumstances, alternative methods need to be sought. As, to continue to allow the children to engage in these play sessions we are, in effect, denying them the opportunity to acquire functional, independent skills through direct teaching.

Successive Development of Independent Play Skills

In order to teach functional play skills, it is advisable to first consider the topography and function of the physical actions that constitute independent play.

Independent Play - manipulation to symbolic. For typically developing children it is thought that the development of independent play skills is learned through successive phases (Casby, 2003); manipulation (e.g. grasping, holding, mouthing), relational (e.g. stacking, joining, banging together), functional (e.g. pushing a car, stirring a spoon in a cup) and finally symbolic (e.g. teddy drinks from a cup, a car is pushed over an imaginary bridge). Typically developing children usually acquire these skills sequentially, one skill building upon the previous forming a successive development of skills. For example, a child will first learn to independently grasp and mouth individual building blocks, at a later stage join them together, eventually forming structures and models that represent items in the real world. Finally, symbolic play involves the use of an object as if it is something else, for example, pretending a block is a car. The play item is used in place of another item, in that it represents or symbolises a specific item. This form of play requires imagination skills to, for example, pretend that a banana is a mobile phone or that a hairbrush is a microphone.

From parallel play to co-operative play. When developing social skills in young children, the first aim for educators is often for the individual to independently engage with play materials while in the proximity of another pupil. Once this occurs parallel play can be developed. This entails two or more pupils accessing the same play materials within the same play area. For typically developing children these skills are readily acquired in a nursery setting.

The next step from parallel play is co-operative play, involving two or more individuals following rules and conventions to work together or compete against each other. For example, co-operative play between two individuals could be achieved at the Lego table via sharing materials, passing and receiving items from each other and perhaps working to build a structure such as a house together. Co-operative play could also be developed through use of simple games such as dominoes or snakes and ladders. This involves understanding of rules and a willingness to take turns. These skills are acquired in typically developing children through adult guidance and repeated exposure to play activities.

Development of independent play skills for those with ASD diagnoses. Children diagnosed with autism, however, do not learn in the same way. The differences in independent play skills for children diagnosed with autism are well observed and documented (Wong and Kasari, 2012). As discussed in Chapter 1, for those with severe ASD diagnoses, social engagement is hindered by a lack of imagination and inflexibility of thought. Furthermore, a deficit of imitation skills diminishes opportunities to develop both motor skills and communication skills. If pupils do not attend to others and engage in reciprocal acts involving modelling and imitation then they cannot ‘play’ with others.

Pupils with severe ASD diagnoses often show difficulties in the first phase of play development that involves simple manipulation of objects; they typically show a lack of variety in object manipulation, restricting their play to a small selection of objects (Van Berckelaer-Onnes, 2003). When comparing the functional play actions of children diagnosed with ASD with other children, Williams, Reddy and Costall (2001) found that their play was "less elaborated, less varied and less integrated" than that of their peers (p.67). Left to engage with materials independently, children with autism are likely to engage repeatedly with the same selection of objects and actions rather than to develop their skills. Limitations in manipulative play can have consequences for the succeeding phases of play development; progressing to further exploration of play materials and subsequent functional play is hindered as they "get stuck at the level of sensation" (p.417, Van Berckelaer-Onnes, 2003).

For example, when considering a child who independently picks up a building block, places it on top of another, and does this action repeatedly, this could be regarded as playing with the blocks. This child has progressed from the manipulation stage of development and has begun to build, to use the blocks functionally. A child who picks up two blocks and bangs them together could also be regarded as playing; it is a functional action that produces a sound. These independent actions would likely be seen as appropriate play for a young child or for an older child who is developmentally younger. However, when considering a child who picks up an individual block and without looking at it taps it on the table, bangs it against their own face or walks around the classroom holding it; stating that the child is "playing" is questionable. If the child repeatedly puts the block in their mouth, this action is likely to be seen as a form of sensory stimulatory behaviour. If in the absence of adult prompting this behaviour continues year after year and the child does not progress, then the child is "stuck" and without carefully targeted intervention is unlikely to progress through the subsequent stages of play.

Many subsequent stages involve the presence of others. As children diagnosed with ASD are often uncomfortable being in close proximity of another child, developing parallel play can be problematic. Difficulties in acquiring co-operative play skills can be even more challenging. For two people to play co-operatively with one another, following the conventions associated with the activity is a prerequisite. If individuals do not use materials independently of adult direction and in a conventional way, co-operative play cannot be achieved. For example, co-operative play at the Lego table requires individuals to be alongside each other, independently picking up and joining Lego bricks, and communicating with each other. If they are picking up a brick and walking off with it, mouthing it or throwing it, then no building is taking place and they are not engaged in conventional play. For co-operation to occur, each individual requires an understanding of the social rules of sharing and turn taking. They must also demonstrate conventional play skills such as passing and receiving materials, building, matching and imitation. And as discussed in Chapter 1, for those with severe diagnoses, imitation can be particularly problematic

The play behaviour of children diagnosed with autism is qualitatively different from their typically developing peers (Williams et al. 2001). Some may argue that play does not need to be conventional. If it exists both because of and despite the rigid structures of a system (Zimmerman, 2004) then surely it is acceptable for an individual to use Lego in any way he chooses. Sometimes this qualitative difference can present as stereotypy, which is particularly common when autism is also associated with intellectual disability. To distinguish between what is play and what is stereotypical manipulation of play materials requires an understanding of what constitutes stereotypy. The following section examines the boundaries of stereotypy and play.

Stereotypy versus Play

Stereotyped behaviours include simple motor stereotypies (such as hand flapping or finger flicking), repetitive use of objects (such as spinning coins or running objects across one's peripheral vision) and also repetitive speech. Stereotypical patterns of behaviour, while not confined to, are often observed during unstructured activities. There is a wide variety of topography encompassing stereotypical behaviour such as repetitive and obsessive fixation on specific parts of objects, as well as obsessional interests in particular routines or rituals (Cunningham and Schreibman, 2008). All individuals with ASD diagnoses exhibit some form of stereotypy, the presence of restricted, repetitive patterns of behaviour being one essential diagnostic feature of autism (DSM-5, 2013). Examples of stereotypic behaviour with play materials include a child who rather than engaging with the toy as a whole, may attend only to specific, small parts of objects such as car wheels or dolls eyes. Alternatively, rather than using the toys in the manner in which they were intended to be used, a child may insist on playing with their toys in a specific, inflexible fashion such as repeatedly lining up blocks in identical rows.

Functions of stereotypy. There is some evidence to suggest that stereotyped behaviours serve a self-stimulatory and sensory function (Lovaas, Newsom & Hickman, 1987), which has led to the term 'self stimulatory behaviour' being interchangeable with 'stereotypy'. However, as Cunningham and Schreibman (2008) identify, there are other contingencies that maintain stereotypic behaviours such as social and external reinforcement, both negative and positive. Put simply, not all stereotypy is self-stimulatory.

Research suggests that the causes and contingencies that maintain stereotypy are complex, but can be established via functional behavioural assessments (Kennedy, Meyer, Knowles & Shukla, 2000); while some behaviour can be topographically similar, the function is different. What is perceived to be independent play could have a sensory function, be a form of task avoidance or indeed a way to gain attention. For example, consider two pupils who each engage in loud, high pitched, repetitive vocalization and are both removed from the class when this occurs. For the first pupil, who subsequently ceases the vocalization when offered time on the computer, the vocalization likely functioned as a means to access a preferred activity. Prior occurrences of being given computer time following high-pitched vocalization have reinforced the vocalization behaviour. In contrast, the second pupil continues to vocalise when taken to a different environment and offered a preferred activity. The vocalization also continues regardless of adult presence, and for this pupil it is likely to serve a sensory function.

Stereotypy as a legitimate form of independent play. Some question whether self-stimulatory behaviour or stereotypy constitutes a legitimate form of independent play. Academics attending a workshop to explore concepts in play concluded that it is not (Hedges et al., 2013). Their definition of play was "an active and emergent process of engagement with the world, which encompasses exploratory processes" that is "repetitive but not stereotyped, and is spontaneous in nature" (p.18). Spontaneity is also considered an important component of play by Zimmerman (2004), whose broad-spectrum definition includes both formal and informal, or ludic, activities. Ludic, meaning spontaneous play, represents a form of behaviour that is not defined by boundaries or systems. It represents choice and the freedom to choose. We must consider therefore the legitimacy of stereotypy as a form of independent play, and the rights of those diagnosed with ASD to independently engage in stereotypical manipulations of play materials if they so choose.

The right to engage in stereotypy. Parents and professionals are likely to agree that children diagnosed with ASD should be given the same rights, choices and freedoms as typically developing children. They should therefore be given the opportunity to play independently even if this is a self-stimulatory form of stereotypy. Surely they have the right to choose to engage in repetitive acts such as spinning CDs on a flat surface, moving pieces of string up and down in front of their eyes, tapping a Lego block repeatedly against their face or mouthing an action figure.

However, consider the child who gets stuck with these actions during every child-initiated play session over a period of days or weeks. Consider the repetitive behaviour extending over a period of months or even years. The right to choose to engage in this kind of independent, repetitive behaviour has consequences. If the role of the educator is to extend learning, to develop pupil ability to complete actions and to increase independence, the educator must consider intervening. The educator could ask when it would be appropriate to limit time spent on child-initiated sessions and plan to teach more appropriate forms of engagement with play materials instead.

Stereotypy as problematic behaviour. Much research has found that children with ASD diagnoses tend to spend time engaging in self-stimulatory behaviour, which can be problematic within educational environments (Lovaas et al. 1987; Kennedy et al., 2000; Horner, Carr, Strain, Todd & Reed, 2002, Machalicek, O'Reilly, Beretvas, Sigafoos & Lancione, 2007; Lang et al., 2011). When stereotypy interferes with learning it can be considered as problematic behaviour. As problem behaviours are “not likely to decrease in the absence of intervention” (Horner et al., 2002, p.423), an intervention to decrease stereotypy would therefore be desirable. As Horner et al. (2002) point out “purposefully not intervening or ‘waiting out’ problem behaviours in the hope that children will ‘outgrow’ them is not effective” (p.424).

It could be argued that to not intervene would in fact be unethical. If an individual is stuck at the sensory level of play, then without intervention, they may not learn to use play materials in a functional or symbolic way. They will not independently progress through successive developmental stages to learn co-operative play in a conventional way. Researchers have focused on the development of these more complex aspects of play; co-operation, turn taking and socio-dramatic play. However, very little research exists that has explored the early stages of play (Jung & Sainato, 2013) and the teaching of basic skills of independently picking up, putting down, joining and breaking apart. These are the skills that are learned and developed by typically developing children during child-initiated sessions. While children have the right to play, if play skills are not within individual repertoires, they must also have the right to effective teaching. The rights of individuals diagnosed with intellectual disabilities, including educational rights, warrant further exploration.

The Right to Effective Teaching

In Van Houten et al.’s (1988) paper on the right to effective behavioural treatment, a number of rights for individuals diagnosed with intellectual disabilities are proposed. To ensure ethical and appropriate application of behavioural treatment, the authors suggest that an individual has a right to: 1) a therapeutic environment, 2) services whose overriding goal is personal welfare, 3) treatment by a competent behaviour analyst, 4) programmes that teach functional skills, 5) behavioural assessment and ongoing evaluation and 6) the most effective treatment procedures available. While few would argue with these rights, balancing them is not always straightforward.

Within the first of these rights, Van Houten et al. (1988) specified the right to access "therapeutic services, leisure activities and materials that are enjoyable as well as instructive" (p. 381-382). The environment should impose "fewest restrictions necessary" with the defining characteristics of a least restrictive environment being "freedom of individual movement and access to preferred activities" (p.382). However, the preferred activities of an individual could be potentially damaging to their personal welfare and do little to develop functional skills. To honour the first right could be to dishonour the second and fourth rights.

In a classroom environment, during a child-initiated session, pupils are given freedom of independent, individual movement and access to a range of leisure activities. However, if these individuals have not acquired the necessary skills to independently use play materials in appropriate ways, this lack of conventional skills can result in the “preferred activities” being self-stimulatory behaviour. The ethics of being a bystander while individuals spin, flick or throw toys repeatedly because they cannot, or choose not to, engage with toys in conventional ways must be questioned. The right to access preferred activities needs to be balanced with the right to acquire functional skills that promote independence and the ability to function effectively in society. However, to function effectively within a play environment, conventional play skills need to be acquired. This presents us with a paradoxical dilemma.

The right to eat doughnuts. Bannerman, Sheldon, Sherman and Harchik (1990) explored the conflicting rights of those with intellectual disabilities to access effective instruction and treatment while also having the right to personal liberties. They ask "is it in the best interests of a client with significant independent living skill deficits to be allowed to skip a teaching session, choose a hobby over an academic habilitative goal, refuse to go on a shopping trip or eat too many doughnuts and take a nap?" (p. 81-82).

The main goal of behavioural intervention is to effect change that is meaningful and promotes positive outcomes for individuals. As Sheldon (1995) asserts "rather that fretting over the issue of free will or questions of self determination, the concern of those of us who wish to use psychological knowledge for good should be to widen the range of possible responses the individual can make to his or her environment, including responses which seek to change it" (p. 41). In order to extend a person's behavioural repertoire, to include conventional, independent play skills is a worthwhile goal: Learning to play conventionally will potentially lead to an individual developing reciprocal, social relationships with others. Conversely, to assume an individual cannot learn to play conventionally because conventional teaching methods have not resulted in skill acquisition is to restrict a person's behavioural potential. To allow pupils to continue to engage in stereotypical behaviour places a limitation on individual achievement. For an educator this is wholly unacceptable.

Placing limits on individual capacities for acquiring new skills affects those within education; however, it can also have long-term consequences. There are historical difficulties in promoting desirable leisure activities among adults diagnosed with severe disabilities in residential and home settings (Wilson, Reid & Green, 2006), to the extent that some research indicates individuals can spend upwards of 75% of leisure time with no apparent activity, or engaging in inappropriate behaviour (Felce, 1991). Evidently, if not specifically addressed, the deficits discussed in Chapter 1 in relation to communication, social and independence skills, will persist throughout a lifetime. Interventions to promote active engagement in leisure pursuits should therefore be encouraged; time invested in teaching individuals to engage independently in play or leisure activities when they are younger could pay dividends when they are older.

Observing and Measuring Independent Play

Three studies have been identified that focused on observing and measuring play behaviour in children diagnosed with autism and/or other developmental disabilities (Holmes & Willoughby, 2005; Kishida & Kemp, 2006; Wong & Kasari, 2012). These are examined in an attempt to identify appropriate measures for observing play, and to establish any observed environmental variables that have positively or negatively affected the play behaviour of individuals with ASD diagnoses.

As already discussed, play is difficult to define and perhaps due to this complexity a preference for the term "independent engagement" has been observed in several play-based studies. In the first, Kishida and Kemp (2006) observed children with mild to severe disabilities in a childcare setting across 4 types of structured or unstructured activities: routine, 1:1 teaching, planned and child-initiated sessions. A 15-second momentary time sampling procedure was used to observe engagement during sessions lasting up to 10 minutes. 'Engagement' was described in 5 categories; 1) active engagement, 2) passive engagement, 3) undifferentiated engagement, 4) active non-engagement and 5) passive non-engagement. These variables provided a wide and complex variation within engagement.

To avoid confusion, Kishida and Kemp (2006) attempted to distinguish engagement in play from engagement in stereotypy. In their study, of the three categories that included levels of engagement, the term 'repetitive behaviour' was included within the definitions of two of them. To be *actively engaged* the child participated in the activity by either manipulating materials or by vocalizing, and specifically the child did “not demonstrate repetitive and/or inappropriate behaviours” (p.110). For *undifferentiated engagement*, the child interacted with the environment “in a repetitive manner” (p.110). By including or precluding repetitive behaviour, they distinguished between conventional play behaviour and stereotypical behaviour.

Only one of the children in their study had an ASD diagnosis. During child initiated sessions he spent more than half of the sessions in "undifferentiated engagement with nearly half of the time in transition, which indicates that he spent approximately half of the activity time wandering aimlessly around" (p.110). This indicated that during these unstructured, child-initiated sessions, valuable learning time for this particular child was, perhaps, being wasted. By giving him complete independence, the opportunity to develop his skills was lost.

Variables used in a study by Holmes and Willoughby (2005) were even more complex. They observed the play behaviour of children diagnosed with ASD in naturalistic classroom settings. Five-minute observation sessions were conducted during which time play was categorised every 10 seconds with a code to describe it. Engagement variables for measurement included: functional, constructive, dramatic, exploratory, parallel, solitary and group play. They also measured transitional, unoccupied, onlooker, and anxious behaviour as well as hovering, aggression and games-with-rules. Two additional variables were added to this complex coding system; perseveration and junk object play, due to suggestions that children diagnosed with ASD engage in these behaviours.

The highest percentage of one type of behaviour was parallel-functional with 13%, meaning that the children played within 3 feet of others using similar materials but did not play co-operatively, and their play included repetition of movement. This is consistent with findings that children with ASD diagnoses spend more time playing alone than typically developing children (Lord, 1984). It confirms research indicating that young children diagnosed with autism will prefer to engage with play materials independently even in familiar settings with well known adults (Restall & Magill-Evans, 1984).

Holmes and Willoughby (2005) included stereotypy, or ‘perseveration’ as a variable during their pilot study. Instances of this were few, so they removed this category from the main study, as it was "difficult to operationalise and happened infrequently" (p.158). However, their operational definition of functional play was "play with an object for the function it denotes; repetition of movements for the pleasure they bring" with the example being "running a toy train along a track, running around". While they class this as 'functional', repetitive play of this kind could also be considered as stereotypy. As perseveration was difficult to operationalise, in an attempt to remove it from the category it seems instead that the occurrence of stereotypy was included within the play definition.

In a third study, Wong and Kasari (2012) examined play and joint attention in children diagnosed with autism compared with children with other developmental delays in special education classrooms. Each child was observed during 12 five-minute intervals over three observation sessions that encompassed both adult and child led sessions. Wong and Kasari (2012) described un-engagement as “not purposely attending to or interacting with objects or other people” (p.2159), while engagement had four categories of person or object engagement and supported or co-ordinated joint engagement.

Levels of engagement during unstructured sessions were compared with levels seen in structured, adult-led sessions. During unstructured sessions those diagnosed with ASD spent 37% of the time in an unengaged state. They initiated fewer functional play acts in unstructured settings compared with the others and they displayed more functional play in the structured activities. A difference in performance across the two conditions was also noticed in levels of object engagement; children with autism diagnoses spent a higher percentage of time being object-engaged in structured than in unstructured activities. Their findings suggest that for those diagnosed with ASD, there is a need to target independent play skills, and that for this population, these skills are more easily acquired in structured rather than unstructured sessions.

Summary of findings. These studies highlight the importance of behavioural definitions, and illustrate the difficulties in defining play and stereotypy. Defining a wide variety of play behaviour is challenging and inevitably with the broad definitions, or summary labels, noted in these studies, some play behaviours fitted multiple categories and could perhaps be considered as stereotypy. The studies confirm Jung and Sainato's (2013) assertion that within the play literature, there are inconsistencies in categorising types of play skills; the same topography of behaviour can be categorised differently. When designing an intervention there is a need therefore to target particular play skills carefully, and to provide clear behavioural definitions.

The main findings of these studies have been considered. In summary, research suggests that independent play skills are more easily acquired in structured rather than unstructured sessions (Wong & Kasari, 2012; Kishida & Kemp, 2006), and that children diagnosed with autism often prefer to engage with play materials independently rather than with others (Wong & Kasari, 2012; Holmes & Willoughby, 2005; Lord, 1984; Restall & Magill-Evans, 1984). In order to develop basic independent play skills, an intervention that is structured and delivered to pupils on an individual basis could therefore be appropriate.

Summary and Conclusion

The concept of independent play has been considered and defined in the present study as ‘to occupy oneself in leisure activities without being under the control of someone else or needing their help’. This chapter has examined opportunities for children to occupy themselves in leisure activities within school settings. In school settings for typically developing children, the teacher is likely to signify that it’s time to select a play activity using an initial verbal prompt and possibly a visual cue (symbol or text based) on a timetable. Following this these initial prompts, typically developing children are likely to select an activity independently. In contrast, it has been established that children diagnosed with autism do not develop play skills in ways consistent with their typically developing peers (Williams, Reddy & Costall, 2001). Some individuals diagnosed ASD and/or ID, without further prompting or support from adults, do not participate in leisure activities in conventional ways. They are often dependent on adult prompting for play to occur and therefore do not demonstrate independent engagement. If they are not taught directly, then it is likely that some individuals diagnosed with ASD will remain 'stuck' (Van Berckelaer-Onnes, 2003) within earlier developmental stages of independent play, engaging in stereotypical manipulations of play materials. Simply ‘waiting out’ (Horner et al., 2002) for the problem behaviour to cease occurring is not effective.

The right to engage in stereotypy versus the right to effective teaching has been debated. While an individual has the right to a therapeutic environment with few restrictions and the freedom to access preferred activities (Van Houten et al., 1988), the same individual also has the right to programmes that teach functional skills using the most effective procedures available. Suitable teaching procedures could potentially result in an individual acquiring a new range of conventional skills to independently access a wider range of play materials. This could lead to a greater choice of recreational activities and more opportunities to develop reciprocal relationships with others, thus minimising the likelihood of individuals spending upwards of 75% of their time as adults with no apparent activities (Felce, 1991). This led to the conclusion that allowing an individual to repeatedly engage in stereotypical behaviour, while denying them the opportunity to develop conventional skills, would be unethical.

Having reached this conclusion, to develop independent play skills in those who are likely to engage in stereotypy and who are ‘stuck’, an effective, targeted intervention is needed. To this end literature on observing and measuring play was considered. Three studies that observed pupil engagement with play materials in special education classrooms were examined. Research suggested that children diagnosed with autism often prefer to engage with play materials individually rather than co-operatively. Furthermore, it seems that independent play skills are more easily acquired in structured rather than unstructured sessions. A conclusion was reached that in order to develop early independent play skills in individuals with ASD diagnoses, an intervention that is structured and delivered on an individual basis could be appropriate.

All children have the right to learn how to occupy themselves in leisure activities without being under the control of someone else. Ideally, an initial verbal or visual cue, that is sufficient for typically developing children, should also be sufficient to induce independent play activities in children with ID or ASD diagnoses. Furthermore, individuals with ID or ASD select activities but are stuck at the manipulation stage, they have the right to develop subsequent relational and functional skills. To identify an intervention that is suitable for developing independent engagement with play materials, the following chapter examines teaching methods developed by behaviour analysts.

Chapter 3

Teaching Strategies in the Special School Classroom

Overview

Within any classroom, be it a mainstream or special school environment, teachers are employed to develop a wide range of skills within their pupils including academic, physical, social and emotional skills. Many teaching methods used in a special school environment are by necessity different from those used within mainstream schools. As discussed in Chapter 1, individuals diagnosed with ID and/or ASD typically have particular difficulties in learning, and consequently, their teachers need to employ alternative methods than those used for typically developing children.

A wide body of literature supports the use of early intensive behaviour analytic intervention to produce effective and long lasting functional improvements in children’s repertoires (Howard, Sparkman, Cohen, Green & Stanislaw, 2005). Researchers have examined and developed a range of behaviour analytic approaches designed to promote both academic and non-academic skills in those diagnosed with autism and/or ID. Those children who receive an intensive behaviour analytic approach to education have been found to make substantial progress compared with those who experienced a more 'eclectic' approach (Howard et al. 2005; Eikeseth, Smith, Jahr & Eldevik, 2002).

This chapter summarises some of the teaching methods designed since the 1960s, to teach individual skills such as discrete trial teaching, incidental teaching and naturalistic teaching. Strategies used to develop chained responses such as task analyses and multi-component teaching programs are explored, as these procedures can be more suitable for teaching the chained responses within self-help or leisure activities that require independent engagement. This provides a historical perspective to the design of the activity schedule by MacDuff, Krantz and McClannahan (1993). An overview of this teaching procedure is given. Measures of effectiveness and efficiency within teaching procedures are considered. This leads to a comparison of prompting procedures typically used within teaching packages.

Teaching Methods to Occasion new Behaviour

Since the 1960s, behaviour analysts have worked to establish different methods of developing skills within the population of individuals diagnosed with ID and/or ASD. Some of these methods, in use in many special school classrooms today, are summarised.

Discrete trial teaching. Discrete Trial Teaching (DTT) is one of the most effective methods of teaching single new skills such as attending, imitating, following instructions and answering questions (Ghezzi, 2007) and for children diagnosed with ASD is perhaps the "only instructional method shown by empirical research to be effective for teaching many new forms of behaviour and new discriminations" (Smith, 2001, p.91).

DTT trials typically take place in a distraction free setting and begin with a cue, a discriminative stimulus, or SD, given by a teacher. A response is prompted and followed by a consequence to reinforce the response. Initially, verbal and/ or physical prompts are provided to ensure a target response and these are gradually faded until correct responses occur in the presence of relevant SDs. By creating a highly controlled learning environment with a systematic procedure for teaching new skills, opportunities for reinforcement of behaviour are contrived, resulting in a high percentage of success for the learner. This reinforcer-rich environment can in turn lead to decreases in disruptive or maladaptive behaviour such as stereotypy (Dib & Sturmey, 2007).

DTT does have inherent drawbacks in that passively sitting and waiting for instruction is reinforced (Carr, 1983). DTT procedures often rely on the use of prompts, and inevitably, whenever prompts are used, there is a risk that learners may become dependent on them (Green, 2001). When pupils become prompt dependent, target skills do not subsequently occur when teachers and prompting procedures are not present (Scott, Clark & Brady, 2000). This dependency has implications for skill acquisition in many areas, even within the area of play and leisure. As Smith points out: “During DTT, children are responding to cues from the teacher; consequently, they may not learn to initiate behaviour in the absence of clear cues. For example, they may use play skills only when asked to do so, not when they see toys” (p.89).

Within a school setting in the UK, Personal, Social and Health Education (PSHE), which encompasses the ability to work independently, is an area of the National Curriculum that pupils diagnosed with ID and/or ASD within the severe range, are typically slow or unable to achieve. DTT alone is not suitable for teaching the full range of cognitive, social, academic, leisure and functional living skills that individuals diagnosed with ASD need to develop and generalise into natural environments (Steege, Mace, Perry & Longenecker, 2007). For this reason, other instructional approaches are needed to transfer previously acquired skills into different settings within the presence of other individuals. One such approach is Incidental Teaching (IT).

Incidental teaching. IT takes advantage of a child's naturally occurring motivation for preferred items or activities (Hart & Risley, 1975, 1982). Rather than occurring in a structured, pre-prepared environment such as face-to-face learning across a table, it occurs in any area of a classroom or outdoor play space. A teacher will recognise a naturally occurring moment as a potential learning opportunity. These moments can be used to generalise skills learned in a more formal setting into a more natural environment. For example, a student may have been taught to discriminate between blue and red counters within a DTT session. When in an outdoor play environment, the student may be encouraged to throw a blue or a red ball when multiple coloured balls are available. When comparing DTT and IT to teach entirely new skills, research has shown that although DTT produces significantly faster results, IT produces greater generalisation and spontaneous use of skills (McGee, Krantz, Mason & McClannahan, 1985). Research suggests that while it takes pupils longer to learn via IT procedures, once the skill is acquired it has greater durability (Miranda-Linne & Melin, 1992).

Naturalistic teaching strategies. Several naturalistic procedures to teach language acquisition and other skills have grown out of the early procedures of DTT and IT, such as Multiple Incidental Teaching Sessions (Charlop-Christy & Carpenter, 2000), the use of Time Delay (Halle, Marshall & Spradlin, 1979) and Natural Language Paradigm (Koegel, O'Dell & Koegel, 1987). These procedures, known as Naturalistic Teaching Strategies (NaTS), combine the strategies known to facilitate acquisition, generalisation and maintenance of new behaviours (Charlop-Christy, LeBlanc & Carpenter, 1999).

Forward and backward chaining. The teaching strategies discussed can be used to teach individual, discrete skills in a range of learning environments, but none alone are suitable for teaching sequential or chained responses such as self-help, recreation-leisure, vocational skills and so forth. Task analysis, a process of reducing a complex chain of behaviour into smaller, more manageable tasks, can facilitate the teaching of sequential tasks. Forward and backward chaining combines task analysis with physical, gestural and/or verbal prompting procedures to teach sequential or chained responses, and together can prove to be a successful combination (Cooper, Heron & Heward, 2007). As with DTT and IT, forward and backward chaining techniques rely on physical and verbal prompting and it is these that acquire stimulus control over the target behaviour.

Task Analysis, Chaining and Multi-Component Teaching Programmes

A wide range of instructional prompts can be utilised within teaching procedures, either individually or in combination to provide multiple component packages of support. A description of how these procedures have been developed is given as a historical perspective from the 1960s.

Task analysis and chains of behaviour. In the 1960s and 1970s, a number of studies explored the use of training procedures when teaching vocational skills to individuals with mild ID (e.g. Horner & Keilitz, 1975; Cuvo, Leaf & Borakove, 1978). Task analysis was used to break down long chains of behaviour into smaller steps that could be taught separately. At the same time, prompting procedures used to teach new skills were considered and formalised. The subsequent combination of task analysis and formalised prompting procedures were used to aid skill acquisition. Horner and Keilitz (1975), for example, taught tooth brushing to adults diagnosed with mild ID via a step task analysis procedure. They used a least-to-most prompting procedure beginning with 1) no help, 2) verbal instruction, 3) demonstration and verbal instruction and finally 4) physical guidance and instruction. The procedure was successful in teaching the adults to brush their teeth independently: The combination of different forms of prompts proved to be effective for this group of individuals diagnosed with mild learning disabilities.

Cuvo, Leaf and Borakove (1978) extended the literature by teaching six adolescents with moderate ID to complete a sequence of cleaning tasks in a toilet. Task analysis was undertaken to provide a detailed description of 181 specific behavioural steps required to complete the sequence. As with Horner and Keilitz (1975), a series of four prompts was planned, ordered from less to more direct assistance and then faded as appropriate: verbal instruction and modelling, then verbal instructions and graduated physical guidance, followed by verbal instructions only and finally no help. The combined effectiveness of task analysis with prompting procedures replicated other studies and extended them by showing these methods could work for those with moderate ID (not just those with a mild diagnosis), that a longer chain of separate components could be taught and could be effective for younger individuals.

Multi-component packages. Studies using a combination of task analysis and multi component prompting procedures have been designed to develop independence skills. The main aim of these studies was to introduce and/or develop individual independent engagement in a range of different activities and settings.

Within vocational skill training, one of the main goals is to reduce or eliminate the need for teacher supervision (Frank, Wacker, Berg & Mahon, 1985), thereby promoting increased self-regulation and independent behaviour. To this end, many studies during the 1970s and 1980s focused on developing multiple component teaching packages that included verbal, physical and gestural prompting as well as visual cues. The introduction of visual cues could, in theory, remove the need for adult supervision; if stimulus control is transferred from physical and verbal prompting to some form of visual cue then adult supervision can potentially be withdrawn altogether. A wide range of studies has examined ways of developing skills using systems of visual cues (Connis, 1979; Wacker & Berg, 1983; Wacker, Berg & McMahon, 1985; Wacker, Berg, Berrie & Swatta, 1985; Sowers, Verdi, Bourbeau & Sheehan, 1985).

Connis (1979), for example, introduced pictorial cues to young adults with ID diagnoses, training in vocational skills within a food service environment. Prior to training, students depended on only verbal prompting to remain on task to complete between nine and 14 tasks performed in the same order every day. Without verbal prompting the students did not complete the tasks in sequence and would, for example, stand motionless for periods of time, continue the current task when unnecessary, begin a task that was not in the correct sequence or engage in inappropriate behaviour. During the intervention, the students were taught to look at photographs taped to a wall, showing a sequence of work required. Participants were given verbal instructions prior to and during the intervention, and learned to self-regulate by checking the photographs as the tasks were completed. The addition of visual cues, and the self-management procedure, resulted in independent task-change behaviour, which significantly reduced the need for adult supervision.

Sowers, Rusch, Connis and Cummings (1980) also used a multi component package by teaching three individuals to manage their time using verbal prompting and time cards as visual supports. This study amongst others (Johnson & Cuvo 1981; Martin, Rusch, James, Decker & Trtol 1982; Spellman, DeBriere, Jarboe, Campbell & Harris 1978, Thineson & Bryan 1981) indicated that the use of picture prompts was promising as a strategy for developing skills in those diagnosed with ID. Wacker and Berg (1983) continued this area of research by introducing visual supports, in the form of black and white pictures, to five high school pupils who subsequently learned to complete manual tasks such as creating a circuit board. Images of individual parts, and how they fitted together, supplemented the verbal prompts given to the individuals. Skill acquisition increased once visual cues were introduced to the pupils.

Following this, Wacker, Berg, Berrie and Swatta (1985) successfully used a picture prompt training package with teenagers diagnosed with learning disabilities. They were taught a variety of manual tasks such as cleaning windows, folding laundry and stuffing envelopes using a combination of verbal, physical and pictorial prompts. Again, the combination of visual and verbal prompting was successful, and reduced the need for adult supervision. While this study, and many other multi-component teaching programs were effective, they did have limitations.

Limitations of Multi-Component Teaching Programs

Some researchers began to question the specifics of each teaching programme, identify effective components and ask if improvements could be made.

Skill generalisation. Having established that individuals with intellectual disabilities could be taught to engage in chains of behaviour independently, in the 1980s and 1990s, some researchers asked if each successive chain needed to be taught separately. In Wacker and Berg's (1983) study, training time on a novel task was reduced once the use of picture prompts had been trained. This indicated that some generalisation of skills had occurred.

Sowers, Verdi, Bourbeau and Sheehan's study (1985) also showed that generalisation was possible. They taught four high school students to engage in a vocational training program. From a pool of 12 tasks within a cafeteria (e.g. sweeping floors and wiping tables), each student was assigned 6 tasks daily. During baseline procedures, only verbal instructions were given. The intervention consisted of a multiple cue system; students were taught to look at pictures, complete the task, tick it off and look at the next picture. Having learned to follow the picture cues, student skills generalised to novel materials; after an initial verbal instruction, students successfully completed novel routines by following picture cues alone.

Frank, Wacker, Berg and McMahon (1985) also considered the potential for skill generalisation using picture cues. Having taught 5 adolescents with mild ID to access a microcomputer program by using a picture prompt system, they showed that a combination of verbal prompting with a visual cue book was effective. Students learned to follow the books independently and furthermore, were able to generalise skills in varying degrees to a book that had not been directly taught. Frank et al. (1985) wondered "can students who are trained to use pictures on one task (e.g. Computer set up) generalise their use of pictures on a second, dissimilar task (e.g. Photocopying)?" (p.184). More research, they believed, was needed to determine if picture prompts could promote generalisation of specific skills or wider picture-following skills.

Separating individual components. While multiple component teaching programmes were effective, it was impossible to know which of the individual components were of most importance to the success of the package as a whole. As

Connis (1979) admitted following his intervention in a food service environment, "with the design used, the individual contributions of the pictorial cues, training procedures and reinforcement (praise) to the effectiveness of the training cannot be isolated. It can only be concluded that the combination of all components produced the improvement in performance" (p.360).

Sowers et al. (1985) were also aware that when multiple components are taught simultaneously, and not tested separately, the most effective component if any, is unknown. They acknowledged their lack of analysis regarding the role of each component of the training package stating "one or more of the components may, in fact, not be necessary for this population to learn to use the clock to time manage" (p. 127). Only by isolating the components, and systematically testing them, could these questions be answered.

Interested in the use of picture cues as a developing area of research, Martin et al. (1982) also identified the need to test individual components. They wondered if picture cues were a "mediating variable" (p 107). The purpose of their study was to "undertake a component analysis to examine the effects of picture cues as a means to establish self-control to complete complex tasks, and to train a skill heretofore not empirically validated" (p 108). To do this, they taught four adults to each complete five different meals by following 48-76 steps (depending on the meal). They started with a training baseline that consisted of only verbal instructions to complete the steps required to make the meal: the adults were then asked to make the meal. This was followed by a training package that combined the same initial verbal instructions with the addition of a photograph book that the participants were told to look at during meal preparation. In each condition, both verbal and physical prompts were given to complete the sequence as necessary. The book condition produced a higher rate of independence than baseline training. One participant had her book removed (in a reversal to baseline training) and her level of independence decreased only to increase again once the book was returned. It seemed therefore that the visual cues had indeed acquired stimulus control for this one participant.

Memorisation of components. Yet, it is possible that some degree of memorisation is likely to have occurred. Having stated that the percentage of picture cards turned independent of trainer assistance was "usually below the dependent measure", Martin et al. (1982) suggested the individuals "didn't always rely upon the pictures" and sometimes began the next step in the process without turning the page (p.116). They wondered if in future, as the participants became more familiar with the recipes, the book would be referred to only when the steps were more difficult or they needed to refresh their memories (much as recipe books are used by typically developed adults). Wacker and Berg (1983) cited this study, proposing that picture prompts had acquired stimulus control. They wondered if picture prompts functioned as permanent prompts or if they could be removed following training. However, while visual cues evidently facilitated the sequencing process, after some repetition of the procedure it seems the tasks were possibly memorised. The sequence of steps within each of the 5 different meals was the same every time. Therefore, the researchers could not be sure that visual cues alone were responsible for behaviour. Memorisation of the familiar routine could have been why the individuals successfully completed meal preparation tasks.

Furthermore, it is also not clear from this study if verbal instructions were a necessary component of skill acquisition. The introduction of a set of visual cues for a novel meal preparation task, with no provision of verbal cues, could have been an interesting additional component of the intervention. Potentially, it could have tested for generalisation and evidenced visual cues becoming discriminative stimuli for behaviour change.

The same question can be asked of Thineson and Bryan's (1981) study; when clients stopped paging through books following training, it is possible that the books were no longer necessary to occasion schedule following behaviour. As the books were not removed however, it is not known if the mere presence of the picture book continued to prompt performance. Removing the books could have tested this.

In Connis's study (1979), based in a food service environment, the observers noticed a decrease in participant’s use of pictures toward the end of the post-training phase as, rather than checking after each task, they began to mark several squares at once having already changed tasks correctly. On the last day of probe tests, the 4 participants checked the schedule far less or not at all (21%, 78%, 31% and 0% of the time respectively). As the assigned tasks were presented in the same order every day, it can be assumed that the participants had memorised the sequence to varying degrees. Only by changing the order of the visual cues, and by introducing new ones, could it be possible to be sure that the visual cues were the relevant SDs for occasioning schedule following behaviour.

MacDuff et al (1993) questioned the efficacy of using so many components in one intervention; to simplify matters, they opted for a procedure that utilised only physical prompting and decided to avoid verbal and gestural prompts. The subsequent teaching method they developed is described, and ways in which it differed from teaching procedures that preceded it are outlined in the next section.

Introducing the Activity Schedule

MacDuff, Krantz and McClannahan (1993), at the Princeton Child Development Institute (PCDI) in the US, had noted that in some studies (Connis, 1979; Thineson & Bryan, 1981) participants followed schedules by rote and stopped checking the pictorial schedule altogether. They acknowledged the importance of isolating separate components, because although interventions that used visual cues as part of a package had been successful, researchers had "not yet clarified which components of treatment packages are responsible for the reported results or whether entire treatment packages are essential" (p.90).

Minimising components. MacDuff et al. (1993) noted that "many intervention packages rely heavily on verbal instructions, modelling and gestures (p.89)" and furthermore, "because these prompts are often associated with reinforcement during teaching, they may acquire stimulus control over target responses, with the result that learners may not display target skills in the absence of teachers prompting procedures" (p.89). On this basis, they designed a two-component teaching package combining photographs as visual cues with graduated physical guidance; they named this the Activity Schedule.

MacDuff et al. (1993) used the activity schedule to teach individuals to engage in chains of behaviour through teaching appropriate self-care, work and leisure skills. Their schedules consisted of ring binders containing photographs of leisure or other activities. Individuals were taught via manual guidance procedures to open the book, attend to the photograph, locate the corresponding materials, complete the activity, put the materials away and return to the book to turn the page for the next activity.

Minimising and fading prompts. They chose not to include verbal prompts within their intervention. During the teaching procedure, the physical prompts were faded. To avoid the occurrence of errors becoming embedded within the chain of behaviour, MacDuff et al. (1993) opted for a physical prompting procedure; physical prompts were gradually reduced to spatial fading, then shadowing. By following these procedures, the discriminative stimulus was reduced to a visual cue alone. Visual cues and corresponding materials were varied in order, and novel materials were added to the schedule. When schedule following continued in the absence of physical prompting, it was evident that the visual cues alone were responsible for schedule following behaviour. It seems that MacDuff et al. (1993) had perhaps developed the most effective and efficient procedure for teaching independence skills via a chaining procedure. Aspects that contribute to the efficacy of interventions are considered.

Effectiveness and Efficiency

For any practitioner planning an intervention to teach new skills, selecting a procedure that leads to acquisition of the target skill with the fewest number of errors, in the most efficient amount of time, is a prime consideration. As Libby et al. (2008) stated “effectiveness and efficiency of teaching are often cited as critical factors in evaluating chaining procedures” (p.37). Being efficient and effective involves minimising errors while increasing the success of the learner.

Minimizing errors. Minimising learner errors within training sessions is a factor when considering efficiency, as the presence of any learner error results in the need for additional training trials. This results in training being more complex and time consuming. Errors also produce a lower rate of reinforcement, which may impair learning while increasing the likelihood of problematic behaviour occurring during training (Libby et al., 2001). Another measure of efficiency is the use of prompting procedures and how quickly they can be faded.

Prompting procedures. Prompts are described by McClannahan and Krantz (2010) as “instructional gestures, demonstrations, touches or other things that we arrange or do to increase the likelihood that children will make correct responses" (p.33). Instructional prompts are often categorised as verbal prompts, modelling, manual prompts, gestural prompts and visual prompts such as line drawings, photographs and textual cues. While prompts are initially useful in helping individuals to acquire desirable behaviour, new skills are only mastered independently if the prompt can be removed and the target skill subsequently continues to occur (MacDuff, Krantz & McClannahan, 2010).

Reducing prompt dependency. Whenever prompts are used there is a risk of prompt dependence (Green, 2001; Scott, Clark & Brady, 2000). If responding only occurs under the control of prompts then successful fading of these environmental stimuli can be problematic. As prompts, particularly verbal ones, can be difficult to fade, some stimulus control research has "focused on techniques that either fade adult-delivered prompts very rapidly after they are introduced or never introduce them in the first place" (p. 80, Green, 2001). Blum-Dimaya, Reeve, Reeve and Hoch (2010) also noted the importance of avoiding prompt dependency, commenting that "activity schedules reduce the need of the instructor to directly prompt completion of the activity, thus decreasing the possibility that the learner may become dependent on instructor-delivered prompts. Once the skill is acquired, the instructor's presence can be faded as quickly as possible to promote independent behaviour" (p.352)

The desire to identify the most effective and efficient teaching procedures has led some researchers to analyse and compare prompting procedures such as most-to-least (MTL) and least-to-most (LTM) strategies for particular individuals.

A Comparison of Prompting Procedures

Different prompting procedures are described and compared. The most effective and efficient forms of prompting for different skills and populations are considered.

Most-to-least and least-to-most prompting. MTL is defined by Libby et al. (2008) as the instructor placing their hands over the learners hands to guide learning and then "a less intrusive prompt such as guiding the learner at the wrist is used on subsequent training trials", which continues to be faded "as long as the learner is demonstrating success during training trials" (p.37). Conversely, LTM is described by Libby et al. (2008) as the teacher "allowing the learner a brief opportunity to respond independently on each training trial and then delivers the least intrusive prompt if needed. Increasingly more intrusive prompts are then delivered as necessary for the learner to complete each training trial" (p.37).

There are advantages and disadvantages of each method. As Fentress and Lerman (2008) point out "MTL prompting reduces the likelihood of errors but also restricts the learner's opportunities to respond without prompts. Alternatively, learners have more opportunities to respond independently under the LTM procedure, but they have more opportunities to make errors" (p.1084).

A comparison of MTL with LTM. Libby et al. (2008) compared MTL with LTM strategies when teaching 5 children with ASD diagnoses to build Lego structures. They found that both strategies were successful in inducing accurate building. There were some differences however; MTL was the only strategy that was successful for 2 of the children and for all children it produced fewer errors overall. However, for 3 children, LTM produced faster results and could therefore be seen as more efficient. Cengher, Shamoun, Moss, Roll, Feliciano and Fienup (2016) considered other studies (McConville et al., 1998; Walls, 1981) to have compared both MTL and LTM procedures and although both have been effective, concluded that efficiency outcomes were variable across participants and measurements. Different forms of prompting were more or less effective for each individual.

Individualising prompting strategies. Having recognised the variability of results across participants in Libby et al.'s (2008) study, Cengher et al. (2016) subsequently developed an assessment for the identification of optimal prompting strategies on an individual basis. They designed a 2-part intervention. Firstly, they assessed different prompt topographies in their participants (e.g. verbal, gestural, modelling and physical) and established an efficiency ranking scale. Secondly they compared MTL and LTM prompt fading with only prompt topographies that had resulted in correct responding. Prompts were therefore individualised for each participant. This procedure revealed that of the prompts used within the individualised procedures, MTL prompting was more effective and efficient than LTM for all three participants. Target responses were mastered using MTL procedures but not mastered with the LTM hierarchy even with 20% additional sessions being provided.

Using a time delay. MTL or LTM strategies can also incorporate a time delay (MTLD and LTMD respectively), either with progressive time delay prompts (PTD), which increase the delay across sessions or with a constant time delay (CTD) during which the delay remains the same but the prompt fades across sessions.

In a second Lego building study, Libby et al. (2008) compared MTLD and LTMD. For all 3 children who participated, skill acquisition was nearly as fast with MTLD as LTMD but it produced fewer errors. They considered their findings in terms of guidelines for best practice and concluded that “MTLD is likely the best default response prompting technique when a child’s learning history is unknown” (p.42) and that “MTL or MTLD is preferable if errors have been found to impede a child’s learning or to increase problem behaviour“ (p.42), while “LTM may be preferable for students who have already shown rapid acquisition with this prompting technique” (p.43).

Flexible prompt fading. When teaching receptive skills to children with ASD diagnoses, Soluaga, Leaf, Taubman, McEachin and Leaf (2008) compared a constant time delay procedure (CTD) with flexible prompt fading (FPF). While FPF is similar to MTL, it differs in that levels of prompting are not fixed, but are based on teacher judgment in keeping the learner at high levels of success (e.g. above 80% correct). The teacher can vary the prompt by decreasing the intensity and/or frequency of the prompts and/or changing the position of the prompts while also doing test trials to assess ability to respond to the target stimulus alone. Their results showed that FPF may be as effective and efficient as CTD, and conclude that teachers may choose to implement FPF over a CTD system as “the CTD system requires the earner to wait for a prompt” and “waiting can be a challenge for some children” (p.763). Additionally, as discussed, errors can occur during delays, and the extra time included with the delays could make CTD less efficient. The results were promising, which led Soluaga et al. (2008) to suggest that future research should consider the effectiveness of FPF on chained responses.

No-no prompting (NNP). A variation of the LTM procedure sees a longer pause before prompting. To give the learner more opportunities for independent responding, than LTM prompting, no-no prompting (NNP) is a procedure in which the learner is told “no” for two incorrect responses and then prompted on the third trial (Newsom, 1998; Leaf & McEachin, 1999). This procedure is recommended for skills that the learner has already mastered. Fentress and Lerman (2012) compared the NNP procedure with the MTL prompting method. Results showed that although the NNP method resulted in faster skill acquisition, MTL prompting resulted in fewer errors for all participants and better performance during maintenance probes for 3 of the 4 participants.

Using verbal prompts. Some researchers have investigated the effect of using verbal prompts with a physical LTM prompting procedure. West and Billingsley (2005) compared a traditional LTM procedure that included verbal prompts with a revised LTM procedure (RLM) that did not include verbal prompts. Their participants with ASD diagnoses acquired new skills within the classroom with both procedures, however RLM generated fewer errors and required fewer training sessions for the pupils to reach criterion. Therefore, when comparing time and effort to transfer stimulus control, the RLM procedure was more efficient. They found that verbal prompts, for this cohort of pupils, hindered progress.

Summary and Conclusion

This chapter has described some commonly used teaching strategies for those diagnosed with developmental and/or intellectual disabilities; teaching procedures such as discrete trial teaching, incidental teaching and naturalistic teaching strategies were summarised. A history of task analysis, chaining and multi-component teaching programmes were provided, and the limitations of multi component programs were identified. This background information provided a historical context to the activity schedule, designed by MacDuff, Krantz and McClannahan (1993). A description of their procedure and a brief rationale behind its design was given. Questions were asked regarding the efficacy and efficiency of individual elements within teaching strategies. This led to a comparison of prompting procedures with regards to their efficiency and effectiveness.

In summary, when comparing procedural variation in teaching behaviour chains, research indicates that manual guidance, rather than modelling and/or verbal prompting, can be the best strategy to use with learners who tolerate physical prompting as skill acquisition has been shown to be more rapid with this method (Bancroft, Weiss, Libby & Ahearn, 2011). Research also suggests that verbal prompts can hinder progress (West & Billingsley, 2005).

When analysing physical prompting, LTM has been compared with MTL prompting; results suggested that LTM can be a more efficient teaching procedure than MTL for those individuals who acquire skills rapidly. However, MTL leads to fewer errors occurring within training sessions, can be more effective (Libby, Weiss, Bancroft & Ahearn, 2008; Fentress & Lerman, 2012; Cengher, Shamoun, Moss, Roll, Feliciano & Fienup, 2015) and is associated with better performance during maintenance probes (Fentress & Lerman, 2012).

While not conclusive, results have shown that a delay can be effective for individuals for whom MTL or LTM is effective (Gadby, Gast & Wolery, 1987; Libby et al. 2008). The possibility of errors occurring during the delay however could mean this procedure would be inefficient for those who acquire skills at a slower rate. Errors that occur and become embedded within an individual's repertoire would then require correcting; this could result in more extensive training and a longer time frame. MTL could therefore be considered as preferable for those who acquire skills at a slower rate as errors require additional training to correct, and produce a lower rate of reinforcement which may impede learning, or result in problematic behaviour (Libby, Weiss, Bancroft & Ahearn, 2008).

As MacDuff et al. (1993) found out, their MTL procedure was "effective in preventing errors that might otherwise have become embedded in schedule-following response chains" (p.96-97). They described using graduated guidance, which was "faded in frequency and intensity as rapidly as possible" (p.92). More specifically, "Fading began by moving from graduated guidance to spatial fading (i.e., the teacher changed the location of manual prompts). Subsequently, the teacher moved to shadowing – he followed the youth's movements with his hands near the boy but without making physical contact" (p.92). It seems they used a MTL prompting procedure using flexible prompting with time delays, as appropriate as "if a boy engaged in inappropriate behaviour, or if he paused for an extended period of time, prompts were reinstated" (p.92).

To conclude, for those with more severe diagnoses, who acquire skills at a slower rate, a procedure without verbal prompts is likely to be more effective, as verbal prompts can hinder progress furthermore MTL is likely to be the most effective procedure as it reduces the likelihood of errors becoming embedded within individual repertoires, and is associated with better performance during maintenance probes. Research suggests, therefore, that for those individuals with a severe ASD or ID diagnosis, the MacDuff et al. (1993) procedure, which utilises a MTL method without verbal prompting, is likely to be more effective than a LTM procedure that incorporates verbal cues. However, in the absence of a comparative study, there is no evidence to suggest their procedure is more efficacious than one incorporating verbal or gestural prompts, or employing a LTM procedure. Since 1993, other researchers have used activity schedule procedures to teach independent schedule following. The following chapter presents a systematic review of activity schedules; the procedure is described in detail and its applications and subsequent uses are explored.

Chapter 4

Activity Schedules for Individuals diagnosed with Intellectual Disabilities, Autism and/or Other Developmental Disorders: A Systematic Review

Overview

Background. An activity schedule consists of a sequence of photographs, images or text, designed to prompt individuals to engage in a range of different activities independently. MacDuff, Krantz and McClannahan (1993) devised the activity schedule as a 2-component programme combining visual cues with MTL graduated guidance. Physical prompts were faded until schedule following occurred under control of visual stimuli alone. Their method is referred to within this thesis as the PCDI-AS. Due to the inclusion of additional prompts, not all subsequent activity schedule studies implemented the same procedure; these studies are known here as AS using other methods. AS in general have been used to teach a variety of skills including independent play and leisure skills to individuals with intellectual disabilities (ID) and/or autism spectrum disorder (ASD). Six reviews of studies have explored the use and efficacy of activity schedules, however, while some have examined and compared the formats of activity schedules, none has compared the methods used to teach them with regards to prompting procedures. It is not known therefore whether PCDI-ASs or other ASs are more effective for teaching independent play skills, or if one or the other is more efficacious for those diagnosed with different severity levels of ID and/or ASD.

Objectives. This systematic review sought to summarise AS literature via a synthesis of existing studies, with a focus on those including participants with ID, ASD or other developmental disorders. Aims included measuring quality and efficacy of activity schedules for developing independent play skills, and comparing PCDI-AS to AS using other methods.

Methods. The eligibility criteria were studies using a set of pictures or words to cues a sequence of activities, that were peer reviewed. A systematic electronic search was conducted using specified search terms (*activity schedule, visual schedule, picture schedule, photographic schedule*) used in combination with descriptors of the population of interest; individuals diagnosed with ID, ASD or

other developmental disorders. Studies not meeting the definition were excluded, as were theoretical articles and studies that did not include empirical data. The 49 studies identified were quality appraised using the Single-Case Experimental Design (SCED) Scale (Tate, McDonald, Perdices, Togher, Schultz & Savage, 2008), and examined for effectiveness using the percentage of non-overlapping data (PND) method (Scruggs, Mastropieri & Casto, 1987).

Results. A data extraction table including the 49 studies (*n*=117) provides results of quality appraisal and effectiveness measures. Comparison made between quality and effectiveness of the 11 studies identified as PCDI-AS studies, and the 38 AS studies, indicated that AS was *moderately effective* for individuals and *moderately effective* for developing independent play skills. However, studies using the PCDI-AS approach were *highly effective,* demonstrating greater generalisation and higher quality than those using other AS methods. The PCDI-AS approach was *highly effective* for developing independent plays skills. For those with a more severe ASD or ID diagnosis, results indicated the PCDI-AS approach was more effective than AS. A narrative synthesis of research provides an overview of settings, formats used and purpose of interventions, and focuses on studies that sought to develop independent play and leisure skills. It incorporates findings from the quality appraisal and effectiveness measures.

Limitations. Limitations include the nature of single case designs, which are considered less valid in demonstrating causal effects than other research methods. Further limitations include methods used to measure effectiveness and quality of study design; alternative methods may have produced different results and conclusions. No risk of bias was assessed regarding affect of cumulative evidence, or publication bias, nor has the issue of selective reporting within studies been assessed.

Conclusion and implications. Results suggest that while ASs were moderately effective for developing skills in individuals diagnosed with ID and/or ASD, PCDI-ASs were highly effective and evidenced greater generalisation. Practitioners planning an AS intervention to develop independence skills in individuals with ID and/or ASD diagnoses should consider the PCDI-AS approach, as although results are limited, they suggest this method is likely to be more effective than teaching AS via other methods.

Introduction

The first activity schedules. In 1993, three papers were published within the same periodical on the use of activity schedules as a teaching tool.

The first paper – introducing the procedure. In the first of the papers, MacDuff, Krantz and McClannahan (1993) described teaching four individuals with autism diagnoses, aged 9-14 years, to independently follow activity schedules within their group home. The schedules consisted of ring binders containing photographs of leisure and homework activities such as handwriting worksheets, Lego blocks and puzzles. Individuals were taught via manual guidance procedures to follow a complex chain of behaviour: open the book, attend to the photograph, locate the corresponding materials, complete the activity, put the materials away and return to the book to turn the page for the next activity. This complex chain was divided into separate components, and a component completion data collection procedure was designed to measure independent schedule following. No verbal or gestural prompts were used during the procedure. The physical prompts were delivered from behind the individual (to avoid coming between the learner and the materials) and systematically faded until lengthy chains of behaviour were followed in the absence of physical guidance. A most-to-least prompting procedure was used to avoid errors becoming part of the schedule following response chains.

Identifying the discriminative stimuli. An important aspect of their activity schedule was the decision to vary the order of activities and to add in novel photographs. By the end of the study each individual could complete their schedule without the need for adult supervision, and skills were generalised to novel activities. Having taught individuals to follow a pictorial schedule independently, MacDuff et al. (1993) had reduced the discriminative stimuli to a single visual cue negating the need to fade verbal prompts (as no verbal prompts were used). By re-sequencing photographs and adding in novel ones, MacDuff et al. (1993) established that the photographs were relevant discriminative stimuli and their participants were not merely following a familiar routine. The two other studies published in 1993, provided further evidence of the activity schedule's efficacy as a versatile teaching method that could be used to decrease levels of challenging behaviour and/or promote skill acquisition.

A second paper – generalising skills. In a study by Krantz and McClannahan (1993), activity schedules were used with three boys with autism, aged 6-8 years, all of whom had previously been taught to follow a schedule. The parents of these individuals were shown how to teach activity schedule following in their own homes, and to collect data on levels of engagement, interaction and disruptive behaviour. Each boy could, by the end of the study, independently follow a schedule lasting four hours. Levels of engagement increased dramatically while levels of disruptive behaviour significantly reduced. Effects were maintained 10 months later. In doing so, Krantz and McClannahan (1993) had evidenced that these procedures could be used to generalise skills across individuals, materials and settings.

A third paper – teaching more advanced skills. In a third study, Krantz, MacDuff and McClannahan (1993) worked with four individuals, aged 9-12 years, who had also already acquired schedule-following skills. In a school setting, they taught the children to follow a schedule that involved initiating verbal interactions with peers, thereby introducing new skills to individual repertoires. Individuals were taught to read from a script initially and then visual prompts were faded until they initiated verbal comments independently. All of the children learned to socially interact with each other via this teaching procedure. MacDuff et al. (1993) were unique in that having excluded verbal prompts from the procedure and having systematically faded the physical prompts, they reduced the discriminative stimuli to visual cues alone. Furthermore, when participants continued to follow these schedules after the introduction of novel visual cues, they established that skills generalised across materials. They had demonstrated that visual prompts alone occasioned the independent schedule following behaviour.

Further evidence from the Princeton Child Development Institute.

MacDuff, McClannahan and Krantz are executive directors at the PCDI, in 2016. McClannahan and Krantz (2006) describe the PCDI's mission as "to provide effective, evidenced-based education and treatment" (p.143). They achieve this by incorporating what they consider are the most effective behaviour analytic interventions designed, managed and revised on the basis of data analyses; these include empirically based procedures such as discrete trial teaching, stimulus shaping and fading and incidental teaching. The activity schedule, which incorporated stimulus shaping and fading, proved to be an effective teaching strategy. At the time of their writing (1996), 26 children attended their programme and all of them used activity schedules throughout the school day, while 17 used written rather than photographic schedules. While all children attending the programme have a diagnosis of autism spectrum disorder, IQ and verbal skills do not form part of the admission criteria. If one assumes that individuals with diagnoses from both ends of the autism spectrum attend the school, each presenting with a wide range of diagnosed intellectual deficits and capabilities, it would appear that the activity schedule could be suitable for all individuals diagnosed with ASD and ID. McClannahan and Krantz (2010) have since produced a book aimed at instructing parents and practitioners on how to implement AS procedures.

MacDuff et al.'s (1993) studies have positive findings, however, it must be acknowledged that the authors may have a vested interest in the design of their own teaching procedure. Those employed at the PCDI or collaborating with their employees (e.g. McClannahan, Krantz, MacDuff, Fenske, Hall, McGee & Mason) have authored several of the papers regarding activity schedules and therefore have a preference for this procedure over others. Nevertheless, the three 1993 PCDI studies have inspired further research into the teaching procedure. Other researchers have used activity schedules for developing skills in those diagnosed with ASD or intellectual disabilities, research suggests than in general it is an evidence based strategy to increase independence and reduce reliance on adult prompting (Milley & Machalicek, 2012; Crosland & Dunlap, 2012). However, although many have implemented activity schedules, they did not all follow the exact procedures recommended by MacDuff et al. (1993). Some studies, while using a visual schedule to depict a range of activities, also included augmentative cues such as gestural or verbal cues. In contrast, MacDuff et al.'s (1993) activity schedule is a sequence of visual cues that occasions behaviour change via physical prompts that are faded, and in the *absence of* other forms of prompting. Therefore, while all activity schedules are schedules that use visual cues, they do not all conform to procedures designed by MacDuff et al. (1993).

Defining 'activity schedules'. What is commonly referred to as an 'activity schedule' includes but is not confined to, activity schedules as designed by MacDuff, Krantz and McClannahan (1993). From this point, activity schedules in general will be referred to in the text as *activity schedules* or *AS*. However only those taught via the specific procedures developed by MacDuff et al. (1993) will be referred to as *Princeton Child Development Institute Activity Schedules*, or *PCDI-AS*.

All activity schedules are based on visual cues, which can be photographic, text or line drawings (or a combination), however other procedural elements differ. PCDI-AS and AS are summarised:

Summary of PCDI-AS activity schedules. A PCDI-AS procedure has the following characteristics:

- Two-component procedure
- Only visual cues and physical prompts are used; verbal and gestural prompts are not included in the procedure.
- Visual cues are presented one at a time.
- The order of visual cues is varied.
- Physical prompts are delivered from behind the learner using graduated guidance.
- Physical prompts are faded until the learner follows the schedule independently.

Summary of other AS methods. Studies not adhering to the above protocol are considered AS procedures. They include at least one of the following characteristics:

- Multiple component procedure
- Verbal and/or gestural prompts are included with physical prompting and visual cues
- Multiple cues are presented concurrently
- The order of visual cues remains the same, and not varied
- Physical prompts are delivered from the side, behind or in front of the learner
- One or more forms of physical, verbal and gestural prompting are embedded within the procedure and not faded

Summary of main reviews of activity schedules. Six reviews (2004-2015) focused on studies deploying activity schedules. (Bopp, Brown & Mirenda, 2004; Zitelli, 2007; Banda & Grimmett, 2008; Koyama & Wang, 2011; Lequia, Machalicek & Rispoli, 2012 and Knight, Sartini & Spriggs, 2015).

Although they each considered activity schedules, they had a different list of resulting studies. This is primarily due to the variety of reasons for conducting reviews as different aspects of activity schedule studies were applicable to each review (the reduction of challenging behaviour or developing independence skills for example). Discrepancies of results may also be in part due to the different search engines, and various key words or terms that were searched; using the terms "activity schedule", "visual schedule", "picture schedule", "visual cues", "visual supports", "picture prompts", and/or "photographic schedule" obtained a variety of results (see Appendix B for a comparison of search criteria). Inevitably, there has been some overlap in the studies that were included. A total of 42 studies published between 1993 and 2013 were referenced in these reviews. A list of all studies has been compiled (see Appendix C).

Bopp, Brown and Mirenda (2004) examined the role of speech and language therapists in delivering positive behaviour support (PBS) for individuals diagnosed with intellectual disabilities. They conducted an overview of PBS strategies, one of them being the use of visual schedules, including activity schedules. Eleven studies (from 1993 to 2000) that used a visual schedule as a means to aid comprehension in individuals diagnosed with autism or other developmental disabilities were considered. All studies reported positive outcomes and across the majority, behaviour improvements were both rapid and substantial. They concluded that speech and language therapists, who are increasingly involved in providing school based services, should recommend the use of visual schedules and furthermore, should be encouraged to provide leadership regarding the application of visual schedules to parents and classroom staff. They promote the use of activity schedules for use between and within activities, and acknowledge their role in helping individuals predict or understand up coming events.

Zitelli (2007) reviewed the success of activity schedule procedures in promoting independence, decreasing problematic behaviour and promoting skill acquisition in individuals diagnosed with autism. Having considered 15 studies published 1993 to 2007, she concluded that activity schedules have proven to be successful for a range of objectives, but stated that more experimental research is needed into the more advanced uses of activity schedules. Specifically, she proposed that further empirical evidence was necessary to "examine the components of the transition from a photographical activity schedule to a written activity schedule investigating the need for pre-requisite skills as well as effective procedures for stimulus fading from photographs with text to text alone" (p.6).

Banda and Grimmett (2008) reviewed 13 studies (from 1993-2004) that examined the effects of activity schedules on the social and transition behaviour of individuals diagnosed with autism. They concluded there are significant benefits of using activity schedules for people diagnosed with autism, within an age range of 3-40 years. It was assessed as an excellent strategy for supporting both social and transition behaviours. They reported that often, while developing on-task behaviour, disruptive behaviours decreased.

Koyama and Wang (2011) reviewed 20 studies (from 1993 to 2008) that investigated the effects of teaching an activity schedule on levels of independence in individuals diagnosed with autism and other intellectual disabilities. In all of the studies included in their review, participant tasks were comprised of activities already within their repertoires. The focus therefore was transitioning and sequencing, rather than new skill acquisition. The outcome of an increase in engagement and on-task behaviour was noted within studies. They concluded that the activity schedule can be a valuable tool in promoting independence, claiming that it "does not limit its use to a specific age range, diagnosis or intellectual functioning, but can be adapted to accommodate a variety of types of individuals" (p.2239).

Lequia, Machalicek and Rispoli (2012) reviewed the effects of activity schedules on challenging behaviour in children with autism spectrum disorders. They reviewed 18 studies (from 1990 to 2010) that used different forms of activity schedules (line drawings, photos, videos) and categorised them into self-regulation, independence, transition and play as their main foci. They concluded that "regardless of the intended purpose of activity schedule interventions, including activity schedules were effective in reducing challenging behaviour; there were no trends in assessing the effectiveness of various purposes (e.g. Self- regulation, transitions) of activity schedules" (p.489).

Finally, the most recent review was from Knight, Sartini and Spriggs (2015), who examined articles (published 1993-2013) to evaluate the quality of the visual activity schedules (VAS) for individuals with autism diagnoses. They examined the literature using current evidence-based practice (EBP) criteria developed by Horner et al. (2005). To be considered evidenced based, there had to be 5 studies meeting acceptable quality, across three research teams in three geographical locations and with a total of 20 participants. Of the 31 studies examined, 16 met their criteria for acceptable quality, to prove that VAS are "fairly to highly effective for the majority of dependent variables evaluated across the studies" (p.172).

Activity schedules for those with severe diagnoses. The main reviews find that an AS can be an effective teaching procedure. It has been described as "a very powerful and flexible technology for promoting independent performances in learners with autism" (Green, 2001, p.80). While the reviews validate an AS as an effective teaching strategy for individuals with a mild to moderate diagnosis, there have been no systematic evaluations of AS for the population of individuals diagnosed with severe autism and/or severe intellectual disabilities.

Indeed, there are some who doubt the AS's efficacy for those with a more severe diagnosis. Rehfeldt (2002), in a review of McClannahan and Krantz's (2000) book suggests that " it may be overly optimistic to expect that parents or teachers who work with children with more severe autism and mental retardation will be able to successfully implement the procedures" (p.107) and also that many children diagnosed with autism "are likely to demonstrate challenging behaviours that will undoubtedly interfere with activity schedule teaching" (p.107). Rehfeldt (2002) indicates that activity schedules may not be an appropriate teaching strategy for individuals diagnosed with severe intellectual disabilities.

To establish further information regarding the effectiveness of activity schedules for those with severe ID or ASD diagnoses, relevant information from the main reviews were considered and summarised. As discussed in Chapter 1, under the DSM-5 (2013) having a diagnosis of intellectual disabilities is separate from being diagnosed with autism. Therefore, severity of ASD and severity of intellectual disability are assessed separately and diagnosed individually.

Severity of diagnosed ASD. While there is a substantial body of literature that reports on the use of AS for those diagnosed with autism, there is a paucity of information regarding the severity of the condition in those individuals. Individual diagnoses are largely dependent on the diagnostic assessment being used, the descriptors and the criteria for severity levels. Earlier versions of the DSM-5 (2013) such as the DSM-III-R (1987), DSM-IV (1994) and DSM-IV-TR (2000) had varying terminology and criteria for diagnoses than later versions. The DSM-V (2013) provides detailed information regarding severity levels that are not present in earlier publications. This variation may account for the reported lack of information regarding participant diagnoses and severity levels.

All of the studies reviewed by Banda and Grimmett (2008) had participants with autism diagnoses, yet they did not discuss the severity of ASD or consider the efficacy of activity schedules for those with a mild, moderate or severe ASD diagnosis. While Koyama and Wang (2011) reported that over half of their participants had autism disorder, they decided that scores from autism rating scales would not be considered; severity of diagnosis was not an element of their review.

Lequia, Machalicek and Rispoli (2012) did consider severity of ASD but noted there was a deficit in reporting this within the studies. In fact, of the 18 studies considered, severity of ASD was only specified in 43% of participants within their review, and of these, only 4 studies reported participants with a severe ASD diagnosis (Cihak &Ayres, 2010; Machalicek et al., 2009; O'Reilly et al. 2005; Pierce & Schreibman, 1994). They found that due to deficits in reporting severity, it was difficult to detect a trend in effectiveness for different populations of individuals, stating that while studies reported positive results, "more research still needs to be conducted to examine the effectiveness of activity schedules for children who have more different ASD severities" (p.489).

Knight et al. (2015) also acknowledged the lack of reporting of severity by stating that of the 16 studies reviewed, 12 of them did not specify an ASD severity level for at least 1 participant. They identified 2 studies that included individuals with a severe ASD diagnosis (Cihak 2011; Hume and Odom, 2007). From the main reviews therefore, there is either a lack of interest in severity of diagnosis, or where there is an interest, the paucity of evidence prevents any clear conclusions being reached.

Severity of diagnosed intellectual disabilities. Koyama and Wang (2011) considered the IQ measurements of participants in their reviews by reviewing scores classified from the DSM-IV (the most current DSM at the time of their study), and of the 23 studies reviewed by them, only 41% of participants intellectual functioning were reported, and of those only two studies reported on individuals diagnosed with severe intellectual disabilities (Anderson et al., 1997; Wheeler & Carter, 1998), representing 2.9% of participants. According to Koyama and Wang (2011) "the implication is that activity schedules can be a useful tool in promoting independence and possibly self- determination of individuals with significant cognitive challenges". While this suggestion is encouraging, the number reported with severe intellectual disabilities is very small and does not therefore provide convincing evidence that an activity schedule is appropriate for all populations.

Knight et al. (2015) also considered general intellectual functioning but found that 10 of the 16 studies reviewed did not specify IQ scores, and of those that did, 5 reported on those with a mild to moderate diagnosis, while only 1 had "significant" deficits (Morrison et al., 2002).

Lequia, Machalicek and Rispoli (2012) also did not consider general intellectual functioning, due to a lack of information with published studies. They proposed "more detailed description of participant characteristics such as cognitive and communication abilities, severity of diagnosis, co-morbid diagnoses, topographies and functions of challenging behaviour" should be included in future studies (p.489).

PCDI-AS versus AS Prompting Procedures. While the reviews have validated the ASs as effective teaching procedures, none have compared differences within teaching methods and prompting systems used in individual studies. To date, there have been no comparative studies comparing the effectiveness of the PCDI-AS with AS using other methods. For those with more severe diagnoses, the literature suggests that a MTL prompting procedure with graduated guidance is likely to be more effective than a least-to-most procedure. Errors are less likely to occur under

MTL instruction than LTM, therefore skills are more likely to be acquired more rapidly. As the PCDI-AS is a MTL procedure, perhaps it is more effective than an AS procedure for those with severe ID or ASD. With only physical prompts to be faded, perhaps individuals would acquire skills more effectively, and in less amount of time than if further prompts were part of the procedure. However, in the absence of any comparison, the efficacy of the PCDI-AS versus AS using other methods, is not known. Knight et al. (2015) noted that the prompting procedures varied across studies; they reference studies that used verbal, gestural and physical prompting, graduated guidance, least to most prompting, time delay, modelling and fading. However, the outcomes for each procedure were not directly compared. As Banda and Grimmett (2012) noted, of the studies they examined, the majority “used some form of teaching through modelling and/or prompting” and therefore “it is unknown whether activity schedules alone in the absence of supplementary instruction or prompts are helpful in acquiring necessary behaviours” (p.331). For this reason, they suggest “future research should explore the role of instruction when using activity schedules to teach various behaviours to person with autism” (p.331).

Activity Schedules to Promote Independent Play. Although none of the studies focused solely on the use of activity schedules designed to develop independent play behaviour, there is some evidence to suggest it is appropriate for this purpose, and can have positive side effects. Lequia et al. (2012) for example, examined 4 studies to have developed play skills, and noted that challenging behaviour decreased for 93% of participants. Zitelli (2007) noted that AS have been used to develop play skills in classroom settings and discussed formats used; photographic, video modelling and use of computer programmes. Of the 16 studies examined by Knight et al. (2014), seven employed AS during play activities.

Generalisation and Maintenance of skills. The reviews suggest the AS is effective in promoting independence and self-management skills for a wide range of individuals. However, as Koyama and Wang (2011) note, only a small number of studies reported on maintenance or generalisation of skills; of the 23 studies, only six examined maintenance of skills and eight examined generalisation of skills. Results from this “small number of studies indicates that individuals who learn to use an activity schedule may apply it in different situations” (p.2240). In the review by

Banda & Grimmett (2008), six studies considered generalisation of skills across settings, one across materials and one across participants. Maintenance of skills was discussed in one study. More evidence is required therefore on the longevity of activity schedule skills, and on generalisation of skills across settings, individuals and/or materials. This view is shared by Banda and Grimmett (2012), who noted that only less than half of the studies reported data on generalisation. They suggest “more research is necessary in this area. Specifically, future research should be focused on generalisation effects of activity schedules to new behaviours” (p.331). Again, in the absence of any comparative study, it is not known if any particular method of activity schedule instruction is more effective for promoting generalisation and maintenance than another.

Aims of Systematic Review. The reviews suggested that the AS is an effective teaching strategy for those diagnosed with autism and/or intellectual disabilities. It has been endorsed by speech and language practitioners, teachers and parents. However, there is little evidence to suggest it is effective for those with a more severe ASD or ID diagnosis, or that it would be suitable to develop independent play skills in this population. Furthermore, it is unknown if there are any differences in either quality or effectiveness of PCDI-AS and other AS.

To reduce the risk of bias, this review seeks to measure the quality of activity schedules in general, through use of a quality rating scale that incorporated an indicator of generalisation. The quality of PCDI-AS will be compared with the quality of AS using other methods. A further aim of this review is to establish how effective activity schedules are, by measuring outcomes and effect sizes, and to compare the effectiveness of AS to PCDI-AS studies.

This systematic review aims to provide a narrative synthesis of activity schedule studies via a broad summary of existing research, giving an overview of purpose, formats, settings and populations. More specifically, it aims to summarise studies that used AS to develop independent play skills.

A final aim of this systematic review is to establish the efficacy of activity schedules for those with severe ID and/or severe ASD diagnoses. A comparison of outcomes for this population will be made between the PCDI-AS approach and AS using other methods.

The aims of this systematic review are:

1. To assess the overall quality of AS studies and compare the quality of PCDI-AS with other ASs.
2. To assess the effectiveness of AS studies and compare the outcomes and effect sizes of PCDI-AS studies with other ASs.
3. To provide a narrative synthesis of studies using AS with individuals diagnosed with intellectual disabilities and/or autism or other developmental disorders.
4. To summarise the methods and outcomes of AS interventions specifically designed to develop play or leisure skills.
5. To measure the effectiveness of activity schedule studies for participants with severe ID and/or ASD and compare outcomes for PCDI-AS to other AS methods.

Methods

To conduct a thorough search of the AS literature, precise search definitions, eligibility criteria and search procedures were required.

Eligibility criteria. According to McClannahan and Krantz (2010), an AS is "a set of pictures or words that cues someone to engage in a sequence of activities" (p.3). This is the definition used for this review. Studies meeting this definition, which used an AS to reduce undesirable behaviour, or introduce or increase a desirable behaviour, published between 1993 and 2015, that were peer-reviewed and published in English were included within this systematic review. Studies that did not meet the definition were excluded. Theoretical articles reviewing activity schedule studies, or discussing the method as a teaching procedure, that did not include an empirical study with intervention data were also excluded.

Search procedures. An electronic search was conducted using EBSCOhost of the following databases: PsycINFO, ERIC, PsycARTICLES and Child Development and Adolescent Studies. A list of search terms (*activity schedule, visual schedule, picture schedule, photographic schedule*) was used in combination with descriptors of the population of interest (*autis*, disabilit*, difficult*, ASD, ASC*). The various terms were combined with descriptors as a Boolean search: [(activity schedule or visual schedule or picture schedule or photographic schedule) and (autis* or disabilit* or difficult* or ASD or ASC)]. Studies published in English between 1993 (when MacDuff et al., 1993 designed the activity schedule) and 2015 (the year of the search) were located. To locate further articles cited in key texts, EBSCOhost and Google Scholar was used. When necessary, a hand search was completed from a range of academic journals. One study was located via contact with the study authors. The electronic and hand search of literature produced 205 studies after duplicates had been removed, as shown in Figure 4.1. After excluding 148 records on the basis that they were relating to other subject matter, 57 full-text articles were assessed for eligibility. Of these, 49 met the eligibility criteria.

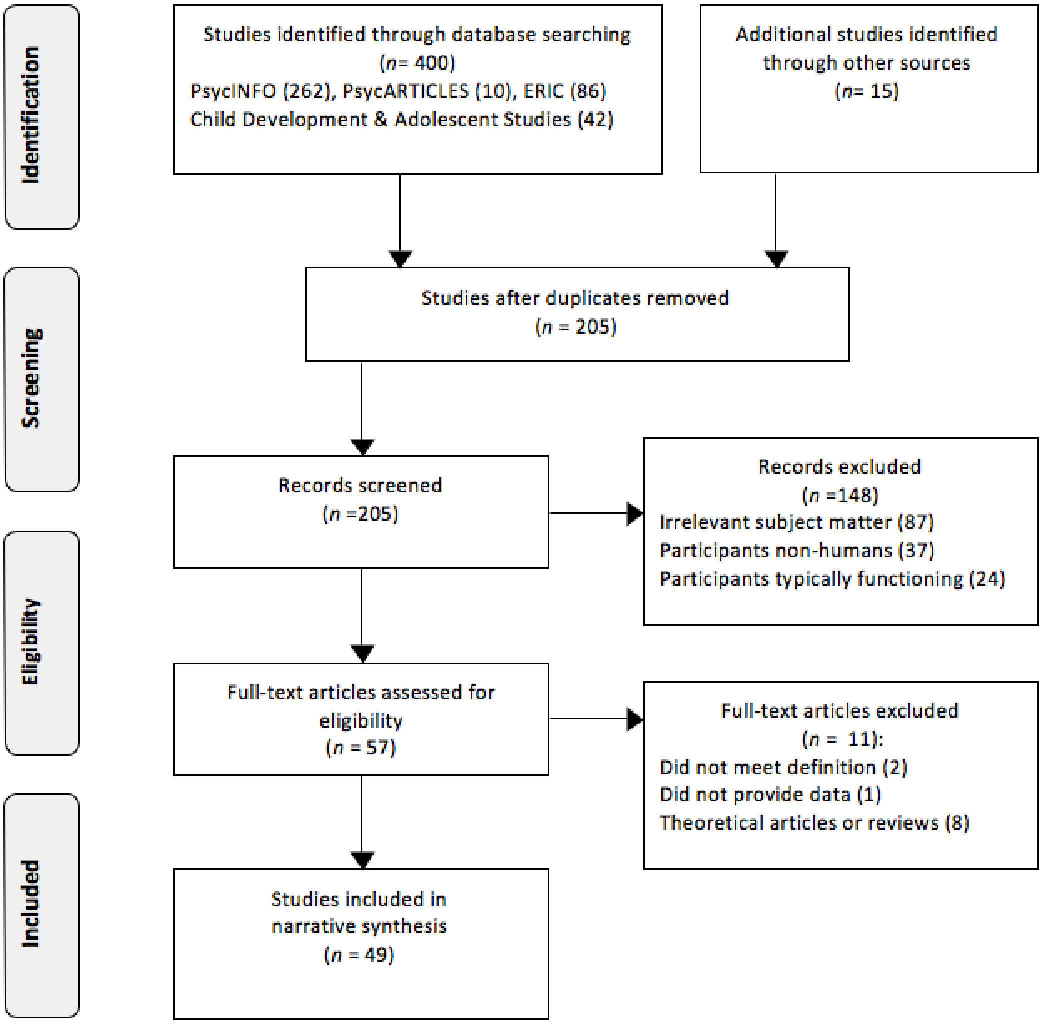


Figure 4.1. Flowchart to indicate numbers of papers identified for systematic review, based on the PRISMA Group diagram, Moher D, Liberati A, Tetzlaff J, Altman DG, (2009).

Quality rating. To reduce risk of bias regarding quality of studies, a quality appraisal of included studies was conducted. Although appraisal scales are "arbitrarily subjective in the relative values assigned for different items" (Wright, Brand, Dunn & Spindler, 2007), they provide a measure of quality that can be compared across studies. The quality of each study included in this systematic review was measured using the Single-Case Experimental Design (SCED) Scale (Tate, McDonald, Perdices, Togher, Schultz & Savage, 2008); this was chosen as a suitable scale for the current study as it was designed to assess single-subject designs. As such it provides a "brief and valid evaluation of methodological quality of single-subject designs, with the total score demonstrating excellent inter-rater reliability using both individual and consensus ratings" (Tate et al., 2008, p. 386). The SCED scale consists of 11 indicators of quality as shown in Table 4.1; the first assesses if clinical history was specified and the remaining 10 indicators contribute to a method quality score (for complete rating scale see Appendix D, SCED rating scale).

Table 4.1

Quality indicators from the Single Case Experimental Design (SCED), Scale Tate, McDonald, Perdices, Togher, Schultz & Savage (2008)

Item	Quality indicators
1	Clinical history was specified. *Must include Age, Sex, Aetiology and Severity*
2	Target behaviours. Precise and repeatable measures that are operationally defined. *Specify measure of target behaviour*
3	Design1: 3 phases. Study must be either A-B-A or multiple baseline
4	Design 2: Baseline (pre-treatment phase). Sufficient sampling was conducted
5	Design 3: Treatment phase. Sufficient sampling was conducted
6	Design 4: Data record, Raw data points were reported
7	Observer bias: Inter-rater reliability was established for at least one measure of target behaviour
8	Independence of assessors
9	Statistical analysis
10	Replication: either across subjects, therapists or settings
11	Evidence for generalisation

A dichotomous response format was used, as designed by Tate et al. (2008): "with 1 point awarded for each item where there is explicit evidence in the report that the criterion has been met. The method quality score thus ranges from 0 to

10, with higher scores indicating better methodological quality" (p. 389). Each of the studies was assessed individually using the SCED scale by the researcher.

Inter-rater agreement. To provide inter-rater agreement, a second, independent reviewer used the SCED scale to assess 14 of the 49 studies (29% of the studies), which were selected at random. Initial agreement was 72%. Differences were discussed and reconciled by mutual agreement (as suggested by Wright et al., 2007). The raters discussed the criteria for meeting the 11-item rating scale and the parameters for each indicator was agreed upon. The differences were predominantly around indicators 1, 4, 8, 9 and 11. It was decided that to score yes for indicator 1 (clinical history), the gender of each participant must be stated and/or each participant referred to as he or she, in accordance with the SCED methodology. Referring to participants by name, and assuming knowledge of gender based on this was not explicit enough. For indicator 4 (baseline), a minimum of 3 data points was required. For indicator 8 (independence of assessors), the independent assessor had to be independent of the study i.e. not a member of staff or member of the research team. For indicator 9 (statistical analyses), calculation of percentages did not qualify as statistical analyses. For indicator 11 (generalisation), evidence that the participants had independently generalised skills to novel materials and/or to a novel setting under baseline conditions was required. Having agreed on an approach, each of the papers where there was disagreement was discussed and differences were resolved, resulting in 100% agreement. The remaining studies were assessed using these same criteria.

Measures of effectiveness. To reduce any risk of bias regarding the outcomes, the effectiveness of individual activity schedule studies was assessed using the percentage of non-overlapping data (PND) method (Scruggs, Mastropieri & Casto, 1987). PND is considered to "deliver coherent, valid summaries of relevant research, in a wide variety of subject areas" and is the "most versatile and meaningful of the various methods" (Scruggs & Mastropieri, 2013). It has been used by researchers (e.g. Knight et al., 2015) to measure behaviour change or skill acquisition in single-subject designs. PND is a relatively simple procedure: "hand calculation is straightforward on uncrowded data sets with help from a transparent ruler" (Parker, Vannest & Davis, 2011, p. 310) and, as Schlosser, Lee and Wendt

(2008) suggest, “PND can be calculated in a reliable manner” (p.184, 2008). In the current study, as recommended by Scruggs et al. (1987), a paper, ruler and pencil method was used to calculate PND. The single highest data point in Phase A (Hi) was identified. The number of data points above Hi in Phase B was counted. This number was divided by the total number of data points in Phase B and multiplied by 100. This produced a percentage of non-overlapping data, providing the PND score. The percentage could then be interpreted as evidence the intervention was not effective (below 50%), minimally effective (50%-70%), moderately effective (71%-90%) or highly effective (91%-100%) according to general guidelines (Banda & Therrien, 2008).

Variation in design. Although calculating PND is relatively straightforward, as noted by Schlosser et al. (2008), a variety of conventions used by researchers exist when calculating PND in ABAB designs and in other phase comparative designs (p.170). To maintain consistency of approach within the current study, as recommended by Schlosser et al. (p.184, 2008) a protocol was designed prior to calculating PND:

Effects of AS were measured using only intervention phases, as maintenance and generalisation phases were not included in all studies. Where multiple behaviours were measured in a multiple baseline design (MBD), the one of most interest to this study, i.e. AS following, was used for the calculation. As some studies taught a variety of skills as part of multiple component packages (e.g. Browder & Minarovic, 2000), only the schedule-following data was used to calculate PND.

MBDs created further challenges when calculating PND. In MBDs across settings where the behaviour of interest was applied to each tier (e.g. Schmit et al, 2000; Pierce & Schreibman, 1994), PND was calculated for each tier and a mean was then calculated as an overall score. Where multiple sets of materials were used (e.g. Miguel et al., 2009) PND was calculated for the first set used. Where a hierarchical intervention was used for example as in a correspondence training package (e.g. Bevill et al.) the intervention phase that first used a visual schedule was compared with baseline conditions.

Where a withdrawal design was used (e.g. Carson et al, 2008) e.g. BABA, the first withdrawal was used as the baseline for comparison. For ABAB designs, as suggested by Scruggs et al. (1987), PND was calculated for each AB pair and then the mean was calculated.

PND was calculated for all studies that included a baseline. A potential drawback of PND is that single outliers can distort the magnitude of effect size. Equally, baselines with scores of 0 or 100 can impact upon PND outcomes. Manolov and Solanas (2009) point out that in single-case studies the applied researcher “possesses a thorough knowledge of the client and is able to identify which measurement is an extreme and potentially anomalous one and interpret it (e.g., seek for its reason) from a clinical, educational, social and so on, point of view” and accordingly “such a theoretical interpretation may be more meaningful than an arbitrary statistical treatment of the unexpected datum” (p. 1263). However, in the current study, the researcher does not have knowledge of individual participants and therefore cannot interpret anomalies. It was decided to include studies with outliers but be aware of potential ceiling and floor affects on the PND score.

Where there was no baseline, or no raw data was provided, PND could not be calculated (e.g. Dauphin et al, 2004; Liu & Breslin, 2013). Where any participant left the study before the intervention was complete, data for this participant was not included (e.g.Browder & Minarovic, 2000).

Aggregation of PND scores. For studies that included multiple participants, scores were aggregated using the mean of PND scores. The percentage PND scores for each participant were combined and divided by the number of participants to provide a mean PND score.

Inter rater agreement. The first rater used the PND scale to calculate a PND score for each of the 49 studies. The method of calculating PND was discussed with a second rater. The rationale for PND measurements was discussed as were variations in design in relation to which phases to compare, when to calculate a mean score and when PND was not an appropriate measurement. The second rater calculated a PND score for 14 of the studies, selected at random, providing an initial inter-rater agreement for 29% of the studies. Initial inter-rater agreement was 87%. There were disagreements over PND data in two studies (Lalli et al., 1994; Hall et al., 1985). The two disagreements were a result of a calculation error. After discussion, agreement was 100%.

Identifying participants with severe diagnoses. Terminology describing participant characteristics was examined. It is acknowledged that participant diagnoses are likely to vary according to when they received their diagnoses as different rating scales were in use, and criteria and/or descriptors may vary over time (if using the DSM-IV(1994), DSM-IV-TR (2000) or DSM-5 (2013) for example). To ensure a consistent approach, participants of AS studies were noted as having a severe ASD diagnosis if it explicitly stated “severe ASD”, “severe ASC” or “severe autism'”, either in a narrative description or under any autism rating scale. Participants were noted as having a diagnosis of severe intellectual disabilities if they had a reported IQ of 39 or below estimated using the Weschler Scales, or 35 or below estimated using the Stanford-Binet test or any other intelligence test, or if it explicitly stated “severe intellectual disabilities”, "severe cognitive disabilities” “severe developmental disabilities” or “severe mental retardation”.

Identifying location of studies. Each individual study was examined for information about where it was published and took place. In the absence of any explicit information that specified the country where the study took place, an assumption was made that the study occurred in the country the authors affiliated universities.

Identifying activity schedule studies that focused on play and leisure skills. Any study with one or more participant whose activity schedule focused on the development of play or leisure skills was identified. Play or leisure skills were defined as any indoor or outdoor activity that involved the use of play materials or involved leisure activities.

Distinguishing PCDI-AS from other AS. The methods used to teach AS in each study were examined. A study was considered to be a PCDI-AS intervention if the PCDI-AS procedures (as already described) had been followed, and this was clearly reported. If alternative methods were used, a study was considered to have made use of other AS procedures.

Results

A total of 49 articles that met eligibility criteria, with a combined total of 171 participants. Information pertaining to these studies was compiled in a data extraction table, Table 4.1. All of the 49 studies discussed in the systematic review are listed, and the number of participants noted. The geographical location of the study, the number of participants, the severity of ASD or ID, and the setting in which the intervention took place was identified. Intervention foci are included as is information about whether the study aimed to develop independent play skills and if PCDI-AS procedures were followed. If PCDI-AS procedures were not followed, additional notes about the variation was included. Results of the SCED scale and whether generalisation occurred were included. Finally, the PND score was included as an indication of the effectiveness of the intervention.

Table 4.2

Systematic review data extraction table

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
1993	MacDuff, G., Krantz, P. & McClannahan, L.	4 children	USA Teaching-family model home	Y - 4	N	+ Engagement in home activities	Y	Y	Y	8	Highly effective 100%
1993	Krantz, P. & McClannahan, L.	4 children	USA Classroom	N	Y-4	+ Verbal initiations	N	Y	Y	8	Highly effective 97% (range 89-100)
1993	Krantz, P., MacDuff, G. & McClannahan, L.	3 children	USA Family home	N	N	+ Engagement in home living skills + Parent skills	Y	N– focus on parents who gave verbal prompts	N	8	Highly effective 100%
1994	Dunlap, G., DePerczel. M., Clarke, S., Wilson, D., Wright, S. White, R. & Gomez, A.	2 children	USA Classroom	N	N	+ Engagement - Disruptive behaviour	N	N - verbal prompts provided	N	6	Moderately effective (engagement) 89% (range 67-100)
1994	Flannery, K. & Horner, R.	2 students	USA Classroom & work site	Y – 1	N	- Problematic behaviour	N	N - multi-element procedure used	N	6	Not effective 44% (range 36-52)
1994	Lalli, J., Casey, S., Goh, H. & Merlino, J.	2 adults	USA Hospital room	N	N	+ Engagement in daily routines - Problematic behaviour	N	N - verbal prompts given	N	7	Highly effective (engagement) 93% (range 90-100)

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
1994	Pierce, K. & Schreibman, L.	3 children	USA Training clinic	Y –1	N	+ Engagement in daily living skills	N	N - verbal praise, gestural and physical prompts given	Y	8	Highly effective 100%
1995	Hall, L., McClannahan, L. & Krantz, P.	3 children	Australia School	N	N	+ Child engagement - Aide prompt reduction	N	N – focus on aides who gave verbal prompts initially	N	9	Highly effective (engagement) 96% (range 88-100)|
1995	Newman, B., Buffington, D., O'Grady, M., McDonald, M., Poulson, C. & Hemmes, N.	3 children	USA After school program	N	N	+ Transitions	N	N – multiple prompts	N	7	Moderately effective 78% (range 50-97)
1997	Anderson, M., Sherman, J., Sheldon, J & McAdam, D.	3 adults	USA Group home	Y - 2	N	+ Engagement in daily activities	Y -	N - gestural and verbal prompts given	N	7	Highly effective 96% (range 89-100)
1998	Krantz, P. & McClannahan, L.	3 children	USA Classroom	N	N	+ Social initiations	N	Y – but verbal modelling provided to read script	Y	8	Highly effective 100%

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
1998	Wheeler, J. & Carter, S.	1 child	USA Pre-school	Y - 1	N	+ Task engagement - Problematic behaviour	N	N - no clear procedure given	N	5	Highly effective (engagement) 100%
1999	Clarke, S., Dunlap, G. & Vaughn, B.	I child	USA Family home	N	N	+ Engagement - Problematic behaviour	N	N - verbal prompts given	N	8	Highly effective (engagement) 100%
1999	Dunlap, G. & Fox, L.	6 children	USA Family home	N	N	- Problematic behaviour	Y	N- multiple strategies and prompts used	N	5	Highly effective 99% (range 95-100)
2000	Browder, D. & Minarovik, T.	3 adults	USA Work setting	N	N	+ Initiation of job tasks	N	N – multiple cues	N	7	Highly effective 100%
2000	Bryan, L & Gast, D.	4 children	USA Classroom	N	N	+ Engagement in academic tasks	N	Y	Y	7	Highly effective 100%
2000	Dettmer, S., Simpson, R., Smith Myles, B. & Ganz	2 children	USA Community settings	N	N	+ Transitions	N	N – gestural and verbal prompts given	N	8	Highly effective 100%

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
2000	Massey, N & Wheeler, J	1 child	USA Pre-school	N	N	+ Engagement in preschool	Y	N – verbal and gestural prompts given	Y	7	Highly effective 100%
2000	Schmit, J., Alper, S., Raschke, D. & Ryndak, D.	1 child	USA Classroom	N	N	- Tantrums during transitions	N	N – verbal cues given	N	7	Minimally effective 65%
2001	Bevill, A., Gast, D., Maguire, A. & Vail, C.	4 children	USA Pre-school	N	N	+ Engagement in indoor play activities	Y	N - prompts given to complete activities	N	7	Not effective 0%
2001	Dooley, P., Wilczenski, F., Torem, C.	1 child	USA Classroom	N	N	+ Transitions	N	N – multiple prompts given	N	2	Highly effective 100%
2002	Morrison, M., Sainato. D., Benchaaban, D. & Endo, S.	4 children	USA Pre-school	N	Y - 4	+ Engagement in indoor play	Y	N - gestural prompts given via modelling play behaviour	Y	9	Highly effective 100%
2003	Watanabe, M. & Sturmey, P.	3 adults	USA Adult service	N	N	+ Engagement in tasks	N	N – verbal prompts and praise given	N	8	Not effective 40%

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
2003	Kimball, J., Kinney, E., Taylor, B & Stromer, R.	2 children	USA Pre-school	N	N	+ Engagement in preschool tasks	Y	Y	N	1	N/A
2004	Dauphin, M., Kinney, E. and Stromer, R	1 child	USA Family home	N	N	+ Engagement in socio dramatic play	Y	N - verbal prompts given	Y	4	N/A
2004	Buschbacker, P., Fox, L. & Clarke, S.	1 child	USA Family home	N	N	+ Engagement in family routines - Problematic behaviour	Y	N - multiple component package	N	7	Minimally effective (engagement) 55%
2005	O'Reilly, M., Sigafoos, J., Lancioni, G., Edrishinha, C. & Andrews, A.	1 child	USA Classroom	N	Y - 1	+ Engagement - Self injury	N	N – multiple cues given	N	5	Minimally effective (engagement) 67%
2006	Wilson, P., Reid, D. & Green, C.	3 adults	USA Adult care home	Y-3	N	+ Engagement in leisure	Y	N –LTM prompts, modelling and verbal cues	N	5	Highly effective 100%
2007	Hume, K. & Odom, S.	1 adult, 2 children	USA University library	N	Y - 1	+ Engagement in school tasks	Y	N - Multiple forms of prompts used	N	9	Moderately effective 80%

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
2007	Spriggs, A., Gast, D. & Ayres, K.	4 children	USA Classroom	N	N	+ Engagement in school tasks	Y	N – multiple verbal prompts in second phase	Y	7	Highly effective 100%
2008	Carson, Gast, D. & Ayres, K.	3 adults	USA School & shop	N	N	+ Transitions	N	N – verbal prompts given	Y	7	Minimally effective 67% (range 0-100)
2008	Betz, A., Higbee, T. & Reagon, K.	6 children	USA Pre-school	N	N	+ Engagement in joint schedules	Y	Y	Y	7	Highly effective 97%
2008	Mechling, L. & Gustafson, M.	6 students	USA School kitchen	N	N	+ Completion of cooking tasks	N	N - praise statements delivered, LTM prompts given	N	7	Highly effective 100%
2009	Mechling, L., Gast, D. & Seid, N.	3 students	USA Kitchen	N	N	+ Engagement in meal preparation	N	N – verbal prompts and praise given	N	7	Highly effective 100%
2009	Miguel, C., Yang, H., Finn, H. & Ahearn, W.	2 children	USA Pre-school	N	N	+ Engagement with written schedule	N	Y	Y	6	Highly effective 100%

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
2009	Waters, M., Lerman, D. & Hovanetz, A.	2 children	USA Classroom	N	N	- Problematic behaviour	N	N -LTM prompts using verbal prompts and modelling	N	6	Highly effective 93% (range 86-100)
2010	Blum-Dimaya, A., Reeve, S. & Reeve, K. & Hoch, H.	4 children	USA Classroom	N	N	+ Engagement in video games	Y	Y	Y	7	Highly effective 100%
2010	Mechling, L. & Savidge, E.	3 students	USA Classroom	N	N	+ Completion of tasks + Transitions during tasks	N	N – multiple prompts used	N	7	Moderately effective (median) 85% (range 56-100)
2010	Van Laarhoven, T., Kraus, E., Karpman, K., Nizzi, R. & Valentino, J.	2 children	USA School	N	N	+ Engagement in daily living tasks	N	N - verbal prompts given, no prompts to complete tasks	Y	8	Highly effective 100%
2011	Cihak, D.	4 students	USA School	N	Y - 4	+ Transitions	N	N - verbal prompts and praise given	N	6	Highly effective 92% (range 84-100)

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
2011	Cuhadar, S. & Diken, A.	3 pre-schoolers	Turkey Asia Pre-school	N	N	+ Engagement in leisure activities	Y	N - verbal praise given plus error correction procedure	Y	8	Highly effective 100%
2011	White, E., Hoffman, B. Hoch, H. & Taylor, B.	6 students	USA Kitchen	N	N	+ Engagement in paired vocational tasks	N	Y	N	7	Minimally effective 70% (range 0-100)
2012	Duttlinger, C, Ayres, K. Bevill-Davis, A. & Douglas, K.	4 children	USA Classroom & food hall	N	N	+ Task completion	N	N – verbal and gestural prompts given	Y	7	Moderately effective 88%(range 75-100)
2013	Carlile, K., Reeve, S. Reeve, K. & DeBar, R.	4 children	USA School	N	N	+ Engagement in leisure activities	Y	Y	Y	7	Highly effective 100%
2013	Liu, T. & Breslin, C.	25 children	USA School gym	N	N	+ Motor skill performance	N	N - verbal prompts provided	N	3	N/A

Year	Study and Participants		Location and Setting	Participant Characteristics		Behaviour Change	Play Skills	PCDI-AS Procedures	SCED		PND Effect Size
				Severe ID	Severe ASD				Gen.	Quality Rating	
2013	Pierce, J., Spriggs, A., Gast, D. & Luscre, D	4 children	USA Classroom	N	N	+ Transitions	N	N – verbal prompts and praise given	Y	7	Highly effective 99% (range 95-100)
2013	Raver, S. Hester, P., Michalek, A., Cho, D. & Anthony, N.	4 children	USA Classroom	N	N	- Inattention	N	N – verbal prompts given	N	7	Not effective 12% (range 0-29)|
2014	Brodhead, M., Higbee, T., Pollard, J., Akers, J. & Gerencser, K.	6 children	USA Classroom	N	N	+ Engagement in paired schedules	Y	Y	Y	8	Highly effective 100%
	Total participants	171									
	Total number of Y			9	11		18	11	19		

Note. Effectiveness data was obtained by using the Percentage of Non-Overlapping Data (PND) method (Scruggs & Mastropieri, 2013). The quality data was obtained by using the Single Case Experimental Design (SCED) Scale (Tate, McDonald, Perdices, Togher, Schultz & Savage, 2008).

The following sections address each of the five aims of this systematic review:

1: Quality of Activity Schedules

Quality rating for all AS studies. To minimise risk of bias, the quality of activity schedule studies was assessed using the Single Case Experimental Design (SCED) rating scale. For each individual study, a dichotomous scoring system allocated a single point for each of the 10 quality indicators that were evidenced. This provided a score out of 10 for each study, as shown in Appendix E. The total score for the 49 studies was 328 (*n*=171). To calculate a mean score, the total score was totalled and divided by 49. This produced a mean score of 6.7 (range 1-9). There were two main indicators that were frequently lacking in the studies: assessor independence and statistical analyses. Also note worthy was the lack of participant clinical history in some studies, specifically severity of diagnosis, and lack of reporting of generalisation in general.

Generalisation. The 11th indicator on the SCED scale concerns whether or not the study evidenced generalisation of skills to novel materials, settings or individuals. The total number of studies that evidenced generalisation was 19, accounting for only 39% of the activity schedule studies *(n*=66). Generalisation occurred in a minority of studies overall. Although the AS studies in general had a positive score with regards to quality, the lack of generalisation in the majority of studies has reduced the overall quality.

Quality rating for AS studies including play skills. The SCED quality rating scores indicating quality of 19 activity schedule studies designed to develop play skills were extracted from table 4.1 (*n*=65). These scores were totalled, divided by 19 and multiplied by 100 to give a mean. The mean score was 6.7 (range 1-9) with a median of 7. The same procedure was used with the remaining 29 studies, which attempted to develop a variety of other skills such as transitioning or engagement in academic tasks. The mean score was also 6.7 (range 3-9) with a median of 7. These scores are comparable with the overall score of AS studies in general. Therefore, when considering the first 10 indicators of quality, it can be interpreted that AS studies in general have been of equally high quality regardless of purpose.

Generalisation of play skills. Of the 19 play studies, 10 evidenced generalisation of skills (*n*=37), accounting for 52.6% of play studies. In comparison to the 29 other studies, only 9 evidenced generalisation of skills (*n*=28) accounting for 31% of the studies teaching other skills. Studies focusing on play skills evidenced more generalisation than studies focusing on developing other skills. When considering the 11th indicator of quality, it could be interpreted that those studies focusing on play skills are of higher quality than those focusing on other skills.

Quality of PCDI-AS studies versus AS studies. The quality of studies using the PCDI-AS approach was compared with the quality of AS using other methods. The 11 studies that used a PCDI-AS approach received an overall score of 74, which, when divided by 11 produced a mean of 6.7 (range 1-8). The median was 7. The total score for studies using other AS methods was 254. When divided by 38, this produced a mean score of 6.7. The median score was 7. The quality of studies using these 2 methods was therefore comparable. When considering the first 10 indicators, both PCDI-AS and AS using other methods are of equally high quality.

Generalisation via PCDI-AS methods versus AS methods. The number of studies that evidenced generalisation using the PCDI-AS method was compared with the number of studies using other AS methods. Of the 38 studies using other AS methods, 26% (10 studies) evidenced generalisation (*n*=126). In contrast, of the 11 studies that used PCDI-AS methods, 83% (9 studies) evidenced generalisation (*n*=45). These data suggest that those studies using the PCDI-AS approach evidenced substantially more generalisation of skills than the studies using other AS methods. Therefore, when taking the 11th indicator of quality into account, studies using the PCDI-AS approach evidenced higher quality than studies implementing AS using other methods. Compared with AS studies in general, studies using the PCDI-AS approach provided more evidence that skills generalised to novel stimuli that had not previously been taught, and that skills generalised to novel settings.

2: Effectiveness of Activity Schedules.

Effectiveness of all AS studies. The Percentage of Non-overlapping Data (PND) method was used to obtain a measure of effectiveness of activity schedules for those diagnosed with ASD and/or intellectual disabilities. Of the 49 studies, 3 did not provide raw data and were therefore ineligible, 46 were eligible for PND calculations (*n*=143). Firstly, a percentage of effectiveness was calculated for all activity schedule studies as shown in Appendix F. This was interpreted using the general guidelines for interpreting PND scores (Banda & Thierren, 2008) as not effective (below 50%), minimally effective (50%-70%), moderately effective (71%-90%) or highly effective (91%-100%). Effectiveness ranged from 0% to 100%. To obtain a mean percentage, the percentages were totalled, divided by 46 and multiplied by 100. This was calculated as 87% effective. As this score falls within the 71%-90% category, according to the guidelines for interpreting PND (Banda & Therrien, 2008), activity schedules can be considered to be *moderately effective* overall. PND scores are noted in Table 4.1.

Effectiveness of AS studies to develop play skills. To identify if activity schedules have shown to be effective for teaching play or leisure skills, the effectiveness rating scores for play skills studies, as noted in Table 4.1, were examined. Of the 19 studies that incorporated play or leisure skills into their activity schedules, 2 did not provide data and were therefore ineligible, however 17 were suitable for assessment *(n*=62). These scores were totalled, divided by 17 and multiplied by 100 to produce a mean. The mean score for play studies was 89.5% (range 0%-100%) with a median of 100%, indicating that studies implementing activity schedules using the PCDI-AS approach are *moderately effective* for teaching play skills. A comparison was made with the other remaining studies that did not teach play skills. One study was ineligible, as it did not include raw data. The scores for these remaining 29 studies (*n*=81) were totalled, divided by 29 and multiplied by 100 to provide a mean. The mean score was 85.3% (range 44%-100%) with a median of 93% indicating that studies using activity schedules are *moderately effective* when teaching skills other than play skills.

Effectiveness of AS studies versus PCDI-AS studies. The effectiveness of activity schedule studies using the PCDI-AS approach was compared with the studies using other AS methods.

Two studies using other AS methods were not included due to lack of data. Of the remaining 36 studies using other AS methods, results were mixed. Some were *minimally effective* (Schmit et al, 200; Buschbacker et al., 2004; O'Reilly et al, 2005;

Carson, Gast & Ayres, 2008) or not effective (Flannery & Horner, 1994; Bevill et al., 2001, Watanabe & Sturmey, 2003, Raver et al., 2013). However, other studies were *moderately effective* (e.g. Dunlap et al, 1994; Newman et al. 1995) and highly effective (e.g. Wheeler & Carter, 1998; Spriggs, Gast & Ayres, 2007). The PND scores of the 36 studies (*n*=102) using other AS methods were combined, divided by 36 and multiplied by 100 to produce a mean percentage. This was calculated as 84% (range 0%-100%); activity schedule studies using other AS methods can therefore be considered as *moderately effective*.

One study using PCDI-AS methods was not included due to lack of data. Of the remaining 10 PCDI-AS studies, while one study was found to be *minimally effective* (White et al., 2011), the remaining 9 studies were assessed as being *highly effective*. The PND scores of the 10 studies (*n*=43) were combined, divided by 10 and multiplied by 100 to produce a mean percentage. This was calculated as 96% (range 70%-100%). As this score is within the 91%-100% category, activity schedule studies using PCDI-AS methods can be considered as *highly effective* according to the general guidelines for interpreting a PND.

3: A Narrative Synthesis of Activity Schedule Research

This section provides an overview of the 49 studies that have used AS from 1993 to 2015. The participants are broadly described, and the settings and locations where activity schedules have been used are considered. Studies that have used the procedure to teach new skills (including daily living skills, work and vocational skills, and academic and social skills) are reviewed, as are studies that sought to reduce problematic behaviour and ease transitions. Results of measures of effectiveness and quality are taken into account when assessing the different studies. Social validity of studies is also considered.

Participants. AS have been used with a wide range of people; preschool aged children (Morrison, Sainato, Benchaaban & Endo, 2002; Dooley, Wilczenski & Torem, 2001) and school-aged children (Pierce & Schreibman, 1994; Krantz & McClannahan, 1998; Dettmer, Simpson, Myles & Ganz, 2000), teenagers (Lalli, Casey, Goh & Merlino, 1994; Spriggs, Gast & Ayres, 2007; White, Hoffman, Hoch & Taylor, 2011), college students (Carson, Gast & Ayres, 2008), adults diagnosed with learning disabilities (Lalli, Casey, Goh & Merlino, 1994; Anderson, Sherman, Sheldon & McAdam, 1997; Watanabe & Sturmey, 2003) and residents in homes for the elderly (Anderson, Sherman, Sheldon & McAdam, 1997).

A total of 171 individuals were included across all 49 studies, with a mean age of 11 years (combined age of 1,609). When categorising individuals by age, while 4 studies included participants with mixed ages, 14 included infants aged 5 or under, 25 included school aged participants aged 6 to 17 and 9 studies included adults aged 18 or over. In the youngest category, there were 38 participants aged 5 or under with a mean age of 4 years (range 2-5 years, combined age 155 years), there were 20 adults age 18 or older with a mean age of 25 years (range 18-40 years, combined age of 501 years). A total of 87 individuals were of school age between 6 and 17 years inclusively, with a mean age of 11 years (combined age of 953 years). Twenty-five individuals in one study (Liu & Breslin, 2013) were not included within these calculations as they were described as aged 3-16 and crossed 2 categories.

Individuals with complex diagnoses. Most studies have involved the teaching of AS to individuals diagnosed with mild to moderate ASD or Asperger Syndrome, and/or to individuals with varying degrees of diagnosed intellectual disabilities. Very few participants have been described as having other syndromes or genetic disorders. One study included two individuals with Down's syndrome (Irvine, Singer, Erickson and Stahlberg, 1992), one taught an individual with Williams's syndrome (Spriggs et al., 2007) and one with Landau-Kleffner syndrome (Buschbacher, Fox and Clarke, 2004). In their chapter about genetic intellectual disability syndromes, Simon, Haas-Givler and Finucane (2014) note the benefits of considering behavioural phenotypes when planning interventions, stating "this type of research can elucidate patterns of learning style that are more characteristic of some syndromes than others and have implications for the best approach in teaching an individual to acquire new skills and behaviour" (p. 26). However, the activity schedule has not been systematically examined as a potential teaching method for individuals with complex diagnoses.

Settings and locations. The vast majority of activity schedule studies took place across different states in the USA (n=47**)**. One took place in Australia (Hall, McClannahan & Krantz, 1995), and one in Turkey (Cuhadar & Diken, 20110|).

AS have been used in a variety of educational settings: in nurseries and schools (Wheeler & Carter, 1998; Morrison et al. 2002; Raver, Hester, Michalek, Cho & Anthony, 2013) and outdoors in school playgrounds (Machalicek, Shogren, Lang, Rispoli, O'Reilly, Helinger & Sigafoos, 2009). They have been implemented in residential group homes (Lalli et al., 1994; Anderson et al., 1997) and private family homes (Clarke, Dunlap & Vaughn, 1999). They have also been used in the wider community in places such as shopping centres (Duttlinger, Ayres, Bevill-Davis & Douglas, 2012), cafeterias and retail outlets (Carson, Gast & Ayres, 2008), offices and commercial kitchens (White, Hoffman, Hoch and Taylor, 2011). Some activity schedules have been static, designed for use in one location and placed on walls (Lalli et al., 1994). Many however are portable, designed to be picked up and used within one room or building, taken out into other environments (Dettmer, Simpson, Myles & Ganz, 2000), put on clipboards (Morrison, Sainato, Benchaaban & Endo, 2002) or even placed on a car dash board (Dettmer et al., 2000). Some have been embedded into computers or devices such as iPods and tablet computers (Carlile, Reeve, Reeve & DeBar, 2013; Dauphin, Kinney & Stromer, 2004) and others have incorporated games consoles (Blum-Dimaya, Reeve, Reeve & Hoch 2010).

Teaching new skills. Many practitioners have used an AS to teach new skills or further develop existing ones. Skills can be categorised as work and vocational skills, academic skills and social skills. Evidence suggests that once individuals can follow a visual AS, the schedule can then be used to introduce and develop other important skills in an individual's repertoire (e.g. Higbee & Reagon, 2008; Krantz & McClannahan, 1998; Carlile, Reeve, Reeve & Debar, 2013). Skills in each category have been developed through the use of AS:

Daily living skills. Sequences of daily living skills such as cleaning windows, getting dressed, folding laundry, setting a table, preparing food and making a drink have all been taught through AS (Pierce and Shreibman, 1994; Clarke, Dunlap & Vaughn, 1999). Pierce and Shreibman (1994) for example, taught daily living skills at home to young children diagnosed with autism. They learned age-appropriate skills that were not previously within their repertoires, such as setting a table, making a drink and getting dressed. Similar methods were used by Clarke et al. (1999) who taught a child to complete an early morning routine; getting out of bed, going to the bathroom, getting dressed, brushing hair and going to the breakfast table. Both of these studies followed other AS methods and were assessed as highly effective on the self-management skills of the children involved which benefitted wider family life. An AS can provide a valuable, early intervention strategy to teach children diagnosed with intellectual disabilities the functional daily living skills they will need to be successful adults (Carothers and Taylor, 2004).

Work and vocational skills. Vocational or work skills required in offices, cafeterias and factories such as sweeping floors, dusting, wiping tables, stuffing envelopes, building circuits, following instructions on a computer program and replenishing resources have also been taught using AS (Carson, Gast & Ayres, 2008; White, Hoffman, Hoch and Taylor, 2011). For example, Carson et al. (2008) used photographic activity schedule books in a community based vocational training program in a retail outlet. Although this study, using AS following other methods, was assessed as minimally effective, the students were taught to use the schedule to help them switch tasks such as stacking shelves, sorting cutlery and folding towels, and skills generalised across environments. The authors extended the use of AS by introducing them to individuals in job sites. Following this, White et al. (2011) used schedules to teach pairs of adolescents diagnosed with autism to complete a set of tasks co-operatively. Each pair worked together to complete tasks with multiple steps, for example an 18-step procedure to clean a kitchen was achieved with a member of the pair each completing half of the tasks. They alternated tasks and referred to the schedule to see what came next.

Academic and social skills. Academic and social skills have been taught and developed in schools via AS (Spriggs, Gast & Ayres, 2007; Krantz and McClannahan, 1998; Miguel, Yang, Finn & Ahearn, 2009; Dauphin, Kinney & Stromer 2004; Kimball, Kinney, Taylor & Stromer, 2003). Spriggs et al. (2007), for example, increased the on-task behaviours of school students through use of an AS. Once a schedule was introduced, students followed the sequence of school activities as indicated in the notebook. Pictures represented areas of the classroom where specific academic tasks took place such as spelling, computer work and maths. The schedules were not used to teach discrete academic skills but to teach schedule following and on-task behaviour. Having learned to use them independently, when removed during a no-book condition, students requested the books indicating that the books were socially acceptable to the students. This AS study was assessed as highly effective in developing independence skills.

In the study by Spriggs et al. (2007), being able to follow an AS was the skill to be learned. Containing tasks that only require skills that are already in a person's repertoire is a typical feature of activity schedule studies, as recommended by Krantz and McClannahan (1999). However, once schedule following skills have been acquired, the AS procedure can then be used to develop new skills, as demonstrated by various studies (e.g.Carlile, Reeve, Reeve & Debar, 2013; Betz, Higbee & Reagon, 2008).

Developing reading skills. Miguel et al. (2009) worked with children who had previously learned to follow a picture schedule; they then combined a match to sample (MTS) procedure with an activity schedule, to teach children to read specific words. Through MTS training (Sidman, 1994), Miguel et al. (2009) used pictures of school activities such as a puzzle or a drawing tool, and taught the children to match dictated word to picture (AB) and then dictated words to printed word (AC), resulting in matching printed word to picture (BC) occurring with no training. Following this PCDI-AS procedure, the children followed a printed word activity schedule independently. The authors established that conditional discrimination training could serve to transfer the control from pictures to printed words, thereby teaching their participants to read an AS consisting of words only. This PCDI-AS was highly effective and evidenced generalisation.

Developing vocalisation skills. Also working with children who had previously been taught to follow a schedule, Krantz and McClannahan (1998) developed vocalisation skills in children diagnosed with autism. The pupils did not converse with the teacher during baseline however during the intervention they were taught to read words "watch me" and "look" placed above or below the photographs. They were prompted to approach an adult and say the appropriate word to initiate conversation. The adult responded with a statement relevant to the activity in the photograph; this PCDI-AS was assessed as highly effective; vocalisation skills generalised across teachers and continued once scripts were faded.

Developing physical skills. Activity schedules have also been used to support physical education in school children diagnosed with ASD. Liu and Breslin (2013) designed a picture activity schedule as an instructional aid when assessing physical skills such as catching and throwing a ball. They proposed that as those with ASD diagnoses can experience particular difficulties in processing auditory information, the provision of visual cues would be beneficial. Individual data was not provided therefore measuring effectiveness was not possible, and the study scored low in terms of quality (3/10). However, the authors report that the children who followed visual cues as well as short verbal commands performed significantly higher than those who received auditory cues alone.

AS and problematic behaviour. The reduction of self-injurious behaviour and other problematic behaviour such as noncompliance, aggression, tantrums, property destruction and off-task behaviour has occurred following the introduction of AS (Lalli, Casey, Goh & Merlino, 1994; Dunlap & Fox, 1999; O'Reilly, Lancioni, Edrishinha & Andrews, 2005). They have frequently formed part of a multi-component treatment package and Lequia et al. (2012), having reviewed studies that aimed to reduce problematic behaviour, found that "regardless of the intended purpose of the activity schedule interventions, including activity schedules was effective in reducing challenging behaviour; there were no trends in assessing the effectiveness of various purposes (e.g. self regulation, transitions) of activity schedules" (p.488). So, although there was no clear trend on the purpose or topography of the challenging behaviour to be addressed, there was a general positive effect in the reduction of less desirable behaviour.

Lalli, Casey, Goh and Merlino (1994), for example, used a combination of escape extinction with an AS to reduce the escape-maintained aberrant behaviour rates of two individuals. They also compared the effects of a photographic schedule with a printed schedule. Results suggested that the printed schedule was more effective in producing lower rates of problematic behaviour than the photographic one. They hypothesised that the different formats may have functioned as discriminative stimuli for different response classes. While the photographs may have correlated with situations that previously produced escape behaviour in the participants, and became SDs for escape behaviour, in contrast the printed words may have functioned as SDs for compliant behaviour due to their use in teaching sessions that produced high rates of reinforcement. This study following other AS methods was assessed as highly effective, although the authors did not evidence generalisation.

Reduction of challenging behaviour as a desirable side effect. While some studies focused on the reduction of problematic behaviour as a main intervention goal, in other studies it has been a desirable side effect of an entirely different goal (Zitelli, 2007). Even when not targeted, problematic behaviour has been observed to decrease when AS are introduced (Krantz, MacDuff & McClannahan, 1993; Pierce & Schreibman, 1994; Lalli et al., 1994; Massey & Wheeler, 2000), resulting in a secondary positive effect. This desirable by-product can be a result of a response being required that is not compatible with the problem behaviour. As Koyama and Wang (2011) point out "a decrease in self-injurious and disruptive behaviour may be a collateral effect of activity schedule" and "one could conclude that the more time spent on on-task behaviour is likely to lead to less time engaging in maladaptive behaviour" (p.2240).

Activity schedules eliciting challenging behaviour. There is some suggestion that when activity schedules are used in some specific situations, they can themselves elicit challenging behaviour. An example of this is in Massey and Wheeler's (2000) highly effective AS study when higher rates of challenging behaviour were observed during leisure activities when an activity schedule was implemented. This can suggest that, as AS are often antecedents to demands, or are considered demanding themselves, they may be associated with challenging behaviour. This can be especially true if they are used as a prompt for a student to transition from a desired activity to a non-preferred activity (Lequia et al., 2012). Dettmer et al. (2000) reported displays of physically aggressive behaviour from a participant when an AS was withdrawn, while another tried to grab the trainer's arm as well as preferred materials in the schedule. The reinforcing properties of the schedule activities and materials affected the schedule following behaviour. Therefore, a more judicious use of reinforcing materials could be advisable in future studies. Nevertheless, this AS study proved to be highly effective.

Activity schedules to ease transitions. Since transitioning between and within activities can be challenging for those diagnosed with autism, AS can serve as antecedent support strategies; if done effectively, this can reduce the need for staff supervision and increase independence (Pierce, Spriggs, Gast & Luscre, 2013). AS have been used to aid self-regulation and facilitate transitions (Schmit, Alper, Raschke & Ryndak, 2000; Bryan & Gast, 2000; O'Reilly, Sigafoos, Lancioni, Edrishinha & Andrews, 2005; Dettmer, Simpson, Myles & Ganz, 2000; Dooley, Wilczenski & Torem, 2001; Waters, Lerman & Hovanetz, 2009; Cihak, 2011). An example of this is Schmit et al. (2000), who were highly effective in increasing the levels of compliance and decreased the tantrum behaviour in a child during transition times. This was occasioned by use of single photographs with individually printed words, and verbal prompts, to signal a transition.

Some researchers have used the Picture Exchange Communication System ([PECS]; Frost & Bondy, 2002) as part of visual schedules. Dooley et al. (2001) used PECS symbols to help a young child to transition with less problematic behaviours such as screaming, biting and kicking. They did this by introducing a schedule board with symbols that represented activities across the school day. Dettmer et al. (2000) also used symbolic visual supports to facilitate transitions in two individuals using a variety of activity schedule formats. The aim for both individuals was to decrease transitioning time. One participant used a portable album as well as corresponding line drawings being placed sequentially onto a car dashboard; the combined use of schedules saw a reduction in latency during transitions. The second participant also had two schedules; a main symbolic schedule which corresponded with the entire day, with a second schedule consisting of written note cards which depicted learning activities and a "finished box". Again, there was a decreased latency during transition times and for both participants the package of procedures was successful. In both cases, although both procedures were highly effective, as more than one visual technique was used, it is difficult to identify which was more responsible for the behaviour change.

In contrast, Bryan and Gast (2000) sought to replicate MacDuff et al.'s (1993) study by using only graduated guidance with visual cues to affect behaviour change. They used PCDI-AS to develop skills in students with autism diagnoses who were all dependent on adult verbal prompting and supervision to complete academic tasks. Picture books, and graduated physical prompts, were provided to aid transitions between 4 classroom centres where academic tasks were undertaken. The procedure was highly effective and students eventually followed the schedule in the absence of supervision. It was clear, from their procedure, that the photographs alone were responsible for behaviour occurring. Schedule following dramatically reduced however when books were not available; participants requested the books when they were unavailable, indicating a preference for them. This study was inspirational to Pierce, Spriggs, Gast & Luscre (2013). They taught four students to transition between activities within a self-contained classroom, using books that contained symbols that represented activities, as well as more abstract symbols such as a green rectangle for cutting and gluing and a yellow star for computer. Students learned to follow schedules within and between activities, which proved to be highly effective. Verbal prompts were provided, which were faded along with gestural and physical prompting until schedule following occurred independently.

Waters et al. (2009) sought to reduce problematic behaviour that occurred during transitions particularly from preferred to non-preferred activities. Photographs of activities were used and the participants were physically prompted to remove them from the binder or desk and carry them to the new location; this procedure was designed to increase the saliency of the visual cues. A differential reinforcement of other behaviour procedure (DRO) was used, as well as extinction, which together were highly effective. Separate and combined effects of these procedures were evaluated. Results indicated that visual cues alone might not reduce some forms of problem behaviour unless extinction is also used.

Self-management and choice. In some AS studies, with the introduction of a choice element, independent task engagement increased (Watanabe & Sturmey, 2003; Wilson, Reid & Green, 2006). In Wilson, Reid and Green's (2006) study, in which adults diagnosed with severe disabilities were offered preferred choices during leisure times, levels of engagement increased substantially. This study had a relatively low score for quality (5/10) but was highly effective. Although it is unclear as to which of the controlling variables within their approach was responsible for the behaviour change, the combination of adult prompting, access to preferred activities and being provided with a choice was successful. Research suggests that allowing some degree of self-scheduling could promote independence and self-management skills; two major behaviour change goals within any special education classroom. Indeed, as Koyama and Wang (2011) point out, "merely following a schedule made by another person is a form of behavioural compliance whereas true independence is achieved when individuals with intellectual disabilities can plan and follow activities on their own" (p. 2240). A commonly observed issue in classroom-based studies involves children rearranging the order of activities on their schedules to either avoid demanding tasks or to gain access to preferred ones (Machalicek et al., 2009). In fact, offering some degree of choice may help with this. An interesting comparison for future research could be compliance in child-chosen and adult-chosen schedules (Banda & Grimmett, 2008).

An AS, when executed independently is, in itself, a form of self-management. Other forms can also be embedded within the activity schedule. Pierce and Schreibman (1994) for example, used self-delivery of tokens as part of a self-management technique. Their activity schedule procedure may owe its effectiveness to this form of reinforcement, as well as to the visual cues.

Formats. AS have been designed in differing formats appropriate to the purpose and setting of the intervention, as well as the needs of the individuals. There has been some suggestion that a functional assessment can help to establish the format and type of visual schedule that is needed (Bopp et al. 2004). Photographs, line drawings and videos for example have been used to positive effect.

Using text or photographs. Schedules have consisted of printed words or sentences (Watanabe & Sturmey; Krantz & McClannahan, 1998), black and white symbols or pictures (Bryan & Gast; Dettmer, Simpson, Myles & Ganz, 2000; Dooley, Wilczenski & Torem, 2001) or a combination of the above. Photographs have been the most commonly used element of activity schedules (Banda and Grimmett, 2008), which usually consist of books or ring binders that contain one image per page. For some, these have been the most effective schedule format (Banda and Grimmett, 2008). Others found that printed words were more effective than photographs (Lalli et al., 1994). However, when analysing the effectiveness of different formats, no clear trends emerged (Lequia et al., 2012).

Objects of reference. Wheeler and Carter (1998) proposed that a schedule can take the form of objects to represent activities for the child at the early symbolic stage, and that forms of schedule are graduated on a continuum from concrete to abstract (Schopler, Mesibov & Hearsey, 1994). However, to date, no published study has been identified that has reported on using objects in this way and therefore there is no evidence that this method is effective. Koyama and Wang (2011) also commented on the lack of objects to represent activities within schedules. They propose that this could be explained in respect of a hierarchy of symbols (Mirenda & Locke, 1989). They assert, "written words have the weakest association with their referents - an object or idea to which a symbol, such as a written word, refers - among two-dimensional symbols (i.e. photographs, line drawings and written words". They suggest that a hierarchy of symbols implies that objects of reference are the easiest to understand, for example that the symbol for shoes represents *going outside*. The reason no study used objects, they say, is "due to researchers' presumption that mastery of activity schedules requires a minimum level of symbol understanding. In other words, individuals may need to have cognitive ability to understand the association between a (two-dimensional) symbol and its referent in order to learn activity schedule" (p. 2239). Indeed, McClannahan and Krantz (2010) describe three pre-requisite skills necessary for any learner to have in their repertoires prior to learning to follow a schedule; these include picture-object correspondence (as described in Chapter 6). The assumption is, if a learner cannot match picture to object then they will not be able to follow a visual schedule independently. However, it seems that no studies have systematically tested this theory.

High-tech versus low-tech schedules. Some schedules have incorporated audio and video components on the computer (Dauphin, Kinney & Stromer, 2004; Kimball, Kinney, Taylor & Stromer, 2003), although they did not provide individual data and could not be assessed for efficacy, and they scored low in terms of quality (1/10 and 4/10 respectively). Three studies compared the effectiveness of photographs with videos (Cihak & Ayres, 2010; Mechling & Gustafson, 2008; Van Laarhoven, Kraus, Karman, Nizzi & Valentino, 2010) and all demonstrated that both types were effective. In Cihak’s (2010) study, pictures were more efficient for one individual, while video was more efficient for two and a fourth participant responded equally to both. The author concluded that different students need different types of schedule and suggested flexibility; this flexible approach was highly effective for these participants.

Both Mechling and Gustafson (2008) and Van Laarhoven et al. (2010) demonstrated that videos were more effective than photographs. Both of these highly effective AS studies used portable devices with the supposition that with computers and other mobile devices becoming more widely available in schools, they will likely take the place of more traditional book-based formats. In Mechling and Gustafson's (2008) study, students' skill maintenance varied when video and static picture prompts were removed, and only verbal prompts were given. Three of the six students maintained their skills when the static picture cues were removed, while for the other three, performance decreased. In contrast, following the removal of the video prompts, only one student maintained her level of performance. To complete the tasks, students were more reliant on the video cues than the picture cues.

Interestingly, while in Van Laarhoven et al.'s (2010) study, staff agreed that the videos were more effective; they preferred the pictures because they were more familiar and easy to transport.

Mechling and Savidge (2011) sought to extend previous research through the use of photographs, video and auditory prompts combined on a portable digital assistant (PDA). One reason they chose this combination format was to increase skill generalisation, proposing that to do this with visual cues alone required gestural prompting: "use of novel tasks, with only a picture-based system, may require demonstration of new tasks by the teacher in order for students to understand how to approach the task" (p. 688). They wanted to investigate the effect of a PDA on completion of novel tasks. However, as MacDuff et al. (1993) had already demonstrated, generalisation of skills to novel visual cues can be achieved via their procedures using static images alone. The use of gestural prompts is not necessary.

Following Mechling and Savidge's (2010) intervention, all 3 students completed task boxes when the PDA was unavailable and the visual cues on a task strip were provided; their combined approach was moderately effective. Each student showed a preference for watching the videos; when given a choice, they opted to view the video prompt before completing the tasks and two of the three students did not self-adjust to a less intrusive form of prompting. So, although the use of video and auditory prompts can be effective, they may in fact hinder independence if use of them is chosen even when unnecessary.

Another consideration is which format is more conducive to generalisation into other environments; often community environments are more noisy and full of visual stimulation and distractions than a contrived classroom environment. With a video-based schedule, there is a danger that those diagnosed with autism may miss aspects due to distractions, and static photographs therefore, may be easier to rely on as visual cues (Cihak, 2010). Practical issues clearly warrant consideration as if the schedules are not easy to manage by either the individuals who use them, or the support staff who oversee them, then they will not be fully utilised.

Socially acceptable formats. There is some suggestion that mobile devices are more novel and less stigmatising than a binder with Velcro and pictures (Knight et al., 2015). Social acceptability is also considered by Zitelli (2007) who asserts that a low-tech variation of the activity schedule such as written to-do lists may be much more acceptable that traditional photographic schedules. Typically developed adults use a variety of devices that can be considered to be AS. These consist of either paper based, low-tech items such as Post-it notes, diaries, calendars or written to do-lists, or high-tech variations such as computer, mobile phone or tablet-based applications that facilitate note taking and diary entries. Many people refer to their activity schedules periodically, to remain on task, to keep appointments on time, and so forth. As Anderson et al. (1997) point out "people with mental retardation, along with some well-paid executives, are among the few people with personal assistants who will continually remind them of what to do next" (p.233); having a personal assistant is seen as a luxury, however for those diagnosed with intellectual disabilities, constant supervision is often a necessity. Any format or schedule that can increase independence and reduce the need for supervision of those with a diagnosed disability, whether it is high-tech or low-tech, must surely be viewed as a positive intervention.

Social validity. Most studies employed the use of activity schedules did not report on social validity (Banda & Grimmett, 2008; Koyama & Yang, 2011;

Knight et al., 2015). It seems that more needs to be done in this area. Given the significance of user acceptance in determining the effectiveness of an intervention, a measure of social validity that included feasibility and acceptability measures would seem to be essential (Koyama & Yang, 2011). Indeed, Knight et al. (2015) rejected many studies from their review due to failure to address social validity. Those studies that did report on social validity however, reported favourably. Findings reported by Bryan and Gast (2000) represent typical responses from use of paper based schedules with an education setting: "social validity findings indicate that the students' regular education teachers, paraprofessionals, and speech teachers reported that using picture schedules would be a useful management tool, would be feasible to implement in their classrooms, and could be used to benefit all children" (p.14). All stakeholders, including parents, reported that AS were effective (Knight et al., 2015). Ongoing evaluation of intervention outcomes is an important aspect of any classroom project in order to inform future studies and ensure the most effective strategies are being employed.

4: Activity Schedule to Develop Independent Play or Leisure Skills

Since MacDuff et al. (1993) taught children to engage in a sequence of leisure and homework tasks using a photographic activity schedule, other researchers have also used variations on this procedure to occasion independent play behaviour (Bevill, Gast, Maguire & Vail, 2001; Morrison, Sainato, Benchaaban & Endo, 2002; Hume & Odom, 2007; Machalicek, Shogren, Lang, Rispoli, O'Reilly, Franco and Sigafoos, 2009; Carlile, Reeve, Reeve and Debar, 2013; Dauphin, Kinney & Stromer, 2004; Betz, Higbee and Reagon, 2008; Cuhadar and Diken, 2011). The AS studies that sought to develop independent play or leisure skills are examined in more detail. Consideration is given to effectiveness and quality of individual studies.

Firstly, studies that used a combination of AS with task correspondence training to teach independent play in both indoor and outdoor settings are reviewed. This is followed by a review of the various activity schedule formats used to develop independent play; the advantages and disadvantages of using both high-tech and low-tech schedules are considered. Schedules designed to develop more advanced independent play skills are examined, for example to develop co-operative or reciprocal play or to teach entirely new play skills within a schedule. Finally, response definitions for independent 'play' or 'engagement' used across studies are considered.

Teaching play and task correspondence. Bevill, Gast, Maguire and Vail (2001) sought to increase engagement of preschoolers diagnosed with intellectual disabilities and/or developmental delay who spent much of their time in child-initiated sessions wandering around “without meaningfully engaging in play activities” (Bevill et al., 2001, p.131). They did this via correspondence training, described as a “say-do” sequence in which participants are “prompted to verbalize a plan to engage in the target behaviour and are reinforced contingent on verbal-nonverbal correspondence between their play (the verbal or ‘say’ component) and subsequent actions (the nonverbal or ‘do’ component)” (p.130). In a first phase of correspondence training, individuals are typically provided with reinforcing items for ‘saying’ what they will do (without the content of their actions necessarily matching). In a second phase, reinforcement is contingent on the ‘doing’; it is only provided if the actions correspond with what was said. Bevill et al. (2001) employed a least-to-most hierarchical prompting strategy that included verbal prompts, and correspondence training (as described) with photographs that represented a variety of play activities. Children were prompted to select 3 photographs representing play areas of the classroom. Each child was then verbally prompted to engage in three different activities. In the first condition, the adult reviewed the photographs selected by the child and reinforcers were provided for the ‘saying’. In a subsequent condition, reinforcers were provided at the end of the session, contingent on play corresponding with the pictures. However, a limitation of the study was a lack of a ‘Picture Display Only’ condition, and “failure to introduce reinforcement of content and picture display as two separate conditions” made it “impossible to determine whether picture display alone would have impacted children’s behaviour” (Bevill et al., 2001, p.141). A single controlling variable responsible for behaviour change was not evident. Measures of effectiveness indicated that this AS study was not effective.

Morrison et al. (2002) also combined activity schedule training with correspondence training, using similar procedures. During playtime in a preschool classroom setting, children were taught to make a selection from four photographs of different play areas, and place three onto a clipboard. When necessary, physical prompts were used to guide the children to the appropriate areas and then gestural prompts were provided to model play behaviour with materials within the area. During correspondence training, at the end of each session, trainers verbalised where the children had played and reinforced correct schedule following behaviour through praise and conditioned reinforcers. Visual cues were used to make play selections, remain on task and follow the sequence of play activities. The children "in the absence of extensive verbal language could use photographs to accurately represent play preferences and correspond their play behaviour to their verbal behaviour" (p.70). While this study was highly effective, the use of gestural prompts precluded it from being a PCDI-AS; it is possible that this additional prompting acquired stimulus control and the need to fade it from the procedure could have delayed skill acquisition. Another limiting factor was the broad interpretation of what each photograph signified; each one occasioned going to an appropriate area and engaging with any of the materials within that environment.

A third study in developing play skills also combined AS training with correspondence training; Machalicek et al. (2009) utilised these two strategies to increase engagement while decreasing challenging behaviour in three pupils diagnosed with moderate to severe autism. Pupils were taught to follow a sequence of four photographs on a clipboard in an outdoor setting. Photographs corresponded with four of eight play areas that contained different activities such as sand play, swing or slide. Graduated physical guidance was provided to go to the correct area of the playground, match photograph to corresponding photograph in the play area, and engage in the appropriate play activity. Verbal prompts were given at the end of each 2-minute play period to "check your schedule". Each participant learned to follow the schedules and while challenging behaviour decreased, engagement increased, however they continued to require a verbal prompt to check their activity schedule between activities. Verbal prompting, it seems, had become embedded within each individual's schedule following behaviour. While the intervention was highly effective, schedule following skills did not generalise to novel materials.

Perhaps if, as MacDuff et al. (1993) suggested, verbal prompts had been omitted from the procedure, only a visual cue would have been required to occasion schedule following behaviour. Another area of note was during the intervention each child attempted to alter planned play activities by removing or changing the order of photographs from the schedule. This may have indicated a preference for another activity, or the discriminative stimulus "show me what you will play today" may have signalled a choice of play activities to the pupil. Perhaps, if an element of choice had been incorporated into the procedure, as in Morrison et al.'s (2002) study, verbal prompts could have been avoided.

Increasing the variety of play materials engaged with. Hume and Odom (2007) measured pupil engagement with play materials during baseline free-play sessions when a range of toys were readily available. They compared engagement with a similar range of materials and tasks within a structured session, using a visual activity schedule referred to as an 'individual work system' (IWS). Both conditions allowed for adult prompting, including physical, verbal and gestural cues. The number of play materials engaged with was totalled for each session. On-task behaviour was measured with adult prompting, in each condition.

The IWS produced a higher rate of engagement than the free-play session; pupils were more engaged during the structured condition. A higher rate of engagement in the IWS condition coincided with a decrease in adult prompts when the visual cues were available. Furthermore, the number of play materials engaged with was greater in the IWS than during free play sessions.

However, a return to baseline produced a drop in engagement and number of play materials engaged with, evidencing that visual cues within the IWS were in part responsible for the behaviour change. However, this was not a PCDI procedure as verbal and gestural prompts were used in all conditions. It is not known, therefore, to what extent the additional prompts were responsible for behaviour change. This intervention was moderately effective, however skills acquired during IWS conditions did not generalised to free-play sessions in the absence of a visual schedule.

Teaching play via a high-tech approach. A variety of high-tech approaches have been employed to develop play skills.

Using an iPod. Carlile, Reeve, Reeve and Debar (2013) used a high-tech approach when working with four boys diagnosed with autism who had already been taught to follow a picture schedule in a book format. Having decided that presenting AS to learners in book form could be "cumbersome and socially stigmatizing" (p.34), they opted to use an iPod touch to teach leisure skills. They claimed that this provided a more socially acceptable format, especially if all adult prompts were faded and eventually removed. To teach individuals to follow a schedule of activities such as playing with a ball, a slinky or toy cars, a strict graduated guidance procedure was used. Highly structured protocols were put in place; delayed reinforcer procedures faded delivery from a FR-2 ratio to a FR-22 ratio and finally to no reinforcement over nine separate stages. Manual guidance was provided with a time delay of 2-seconds, 4-seconds and then no delay, while adult proximity was faded from 0.3 meters, to 2.1 meters and finally until the adult was in a different room with only intermittent supervision. This detailed PCDI-AS procedure provided strict guidelines for the supervising adults and ensured successful outcomes for the learners. However, while the results were highly effective, it is noted the pupils had prior histories with both iPod touch technology as well as book-based schedules. On this basis, they cannot predict if children with no prior experience of one, or the other, could learn to follow this procedure.

A multi-media approach. A high-tech approach was used by Kimball et al. (2003), who designed individualised multimedia AS for preschool children diagnosed with autism, however effect size could not be measured due to lack on individual data. Photographs and film clips of the children engaging in leisure activities such as colouring in, or playing with a ball, were embedded within computer-based schedules. They assert that for children with autism diagnoses "the use of activity schedules can yield functional skills that are seldom achieved by more traditional teaching procedures such as discrete trial instruction" (p.41). If the reinforcing variables are in place, skills can be acquired via discrete-trial-teaching, however as previously discussed (in Chapter 3), during these procedures children often become prompt dependent and passively wait for reinforcement. Kimball et al. (2003) capitalised on the children's preference for learning from the computer, and used the PCDI-AS procedure recommended by McClannahan and Krantz (1999) to teach independent schedule following. While a benefit of using computer-based schedules is that multiple supports such as video modelling can be combined in one device, there are, according to the authors, advantages of using a simpler, notebook-type format. Notebooks are simple, inexpensive, easy to construct, portable and adaptable, and moreover "particularly to promote generalisation, it makes sense to transfer computer-cued schedules to notebook-type format" (p.42). Given that audio cues were embedded within their procedure however, generalisation to notebook schedules would be difficult without verbal instruction, and this would then need to be faded, as Krantz and McClannahan (1998) did when developing social interaction skills using a script reading procedure.

Activity schedules and computer games. Blum-Dimaya, Reeve, Reeve and Hoch (2010) demonstrated it is possible to use a low-tech photographic schedule alongside video modelling to great effect. They implemented an AS procedure to teach individuals to play a guitar-based video game. Their PCDI-AS procedure was highly effective in teaching the individuals practical skills required such as setting up, turning on and tuning off the game and system as well as how to play the guitar game. As they noted, “little research has been conducted to identify effective methods to teach leisure skills to children and adults with autism and related disabilities” (p.351). They successfully taught the individuals, via a graduated guidance procedure and photographic schedule, to play notes in the correct sequence as the game. They selected this procedure having noted that AS “reduce the need of the instructor to directly prompt completion of the activity, thus decreasing the possibility that the learner may become dependent on instructor-delivered prompts. Once the skills is acquired the instructor’s presence can be faded as quickly as possible to promote independent behaviour”(p.352). Their procedure was highly effective and skills generalised to novel songs and settings not used during training. Of further interest is the fact that when the schedules were removed, the individuals continued to play the guitar-based game. This suggests a maximum functionality of skills; having faded the schedule and other forms of guidance, the participants had demonstrated skills required to perhaps in future, play the game with siblings or friends without requiring a schedule.

High-tech to low-tech or low-tech to high-tech. While Kimball et al. (2003) suggest introducing a computer-based schedule first, and then later replacing it with a notebook style schedule, Dauphin Kinney & Stromer (2004) suggest the opposite; a notebook schedule could lead to a more high-tech format. Dauphin et al. (2004) combined video-enhanced AS with matrix training to teach socio-dramatic play to a child diagnosed with autism. In a 3-phase intervention, he learned to a) follow the computer procedures by saying the script and doing the actions modelled in the videos, b) follow a notebook schedule and c) combine the two strategies. This study could not be measured for efficacy, however the authors found that this combination was successful in teaching socio-dramatic skills, evidenced by the fact that skills generalised to novel, untrained activities. In doing so, the authors contributed a new set of procedures to teach socio-dramatic play. Dauphin et al. (2004) acknowledge that the use of computers and/or videos may require adult training to use such technologies in the classroom, and also that it may be too complex for some individual learners. One option would be to "forego (or postpone) the use of such high-tech tools in favour of notebook activity schedules" (p.1247). This low-tech format, therefore, may be the most effective for some children, especially those with a more severe diagnosis.

Teaching co-operative play. A low-tech schedule was used by Betz, Higbee and Reagon (2008), who extended the AS literature by teaching pairs of children to engage with play materials co-operatively. They worked with fluent AS followers who had already learned to select activities from a choice board and embed them into their schedules. They subsequently learned to follow joint schedules; photographs representing two games were placed into a schedule followed by two blank pages. Each child was taught to make a selection from other games and place a corresponding photograph onto one of the two blank pages. Scripts accompanied each of the choices, for example, "Lets play Hungry Hippos", and the children were taught to verbalise the script to each other. Printed words were faded by removing one at a time, until no words were present, and children continued to initiate play verbally. This PCDI-AS procedure was highly effective and skills generalised to novel activities.

All three pairs of children were successful in learning to engage in a series of four games and skills generalised to novel activities. For one pair however, levels of engagement deteriorated during the re-sequencing phase, which necessitated the reintroduction of graduated guidance. Rather that being part of the procedure from the beginning, re-sequencing occurred only after the maintenance phase. Perhaps the deterioration in engagement would not have occurred had re-sequencing been incorporated earlier within the teaching sessions, as suggested by MacDuff et al. (1993). Re-sequencing across the training sessions could therefore be advisable. Also of interest is the fact that there was no programmed reinforcement by an instructor during the procedure; because of this the authors questioned the behavioural mechanisms responsible for the effectiveness of their teaching strategy. They wondered if the game playing itself became a reinforcing event. A suggestion by Betz, Higbee an Reagon (2008) for future research was to isolate the behavioural mechanisms.

Inspired by Betz et al. (2008), Brodhead, Higbee, Pollard, Akers and Gerenscer (2014) also developed co-operative play in children with autism diagnoses. They taught children who were already fluent activity schedule followers to play a reciprocal game of hide-and-seek. A PCDI-AS procedure was used with each pair; two linked activity schedules were provided with pages sequenced for one child to play the hider and one the seeker. In doing so they demonstrated that activity schedules can control social interactions during a less structured play activity. The schedules were instrumental in producing the social behaviour change, and proved to be highly effective. However, when the schedules were removed, the children did not play the game. There was no evidence, therefore, that the game itself was a reinforcing event, as suggested in the study by Betz et al. (2008). An attempt to fade the schedules could perhaps have resulted in a transfer of stimulus control to the natural environment. This could potentially have provided evidence that the game playing activity was a reinforcing event.

Teaching new play skills via a schedule. Cuhadar and Diken (2011) taught three boys diagnosed with autism to engage in play by following schedules. They differed from previous research as rather than using skills already in individual repertoires, and ensure that schedule following itself was the new skill to be acquired, they taught completely new skills within the schedule. Although the children had the pre-requisite skills suggested by McClannahan and Krantz (1999), they had not previously been taught to follow an AS.

Each individual learned to play Mr Potato Head, knock down bowling pins and to build with Lego. However, their procedure differed from McClannahan et al.'s (1993) in that the materials did not vary (no novel ones were used) and they were laid out across a counter in the same order each time. There was no evidence therefore that the visual cues acquired stimulus control. Another dissimilarity was the use of verbal praise paired with edible reinforcers after each activity was completed. It is not known what affect this had on task completion. Also of note is the fact that the same edible reinforcers were used for each child across all training sessions; one was used as an in-schedule reinforcer and the other was placed on the last page of the schedule as a terminal reinforcer. As a preference assessment was not conducted prior to each session, it is not known how reinforcing these items were across time. Nevertheless, the intervention was highly successful and the children learned to follow their schedules.

Response definitions for play and stereotypy within activity schedule studies. As discussed in Chapter 2, researchers focusing on the development of play skills have used a variety of terminology to define play. Similarly, a review of studies using AS to develop play skills reveals that the parameters of what is *play* or *engagement with play materials* varies considerably.

When Betz et al. (2008) assessed the use of joint schedules to promote peer engagement. Children were considered as "engaged" if "both participants were taking turns using the game materials in the way in which they were designed, clearing up game materials, setting up game materials, or obtaining or putting the game on the shelf" (p.238).

In Morrison et al.'s (2002) study, when aiming to increase play skills, response definitions were *on-task* and *off-task* behaviour with play materials. The definition of on-task behaviour was however broad; as well as “purposeful interaction or manipulation of the materials involved in the play activity”, also included within the on-task category was focused visual attention on play materials, on another child engaged in the activity or the experimenter, as well as verbal or non-verbal interaction with anyone present (p.61). Off-task behaviour included self-stimulatory behaviour, repetitive manipulations of play materials or engagement in disruptive behaviour. Therefore, while watching another child engage with play materials was classified as on-task, repetitive manipulation of toys was classified as off-task. Therefore, at times a child not even touching a toy could be considered as on-task next to a child involved in self-stimulatory behaviour with a toy, which could be considered as off-task behaviour. These definitions could perhaps be confusing and present misleading results.

In Machalicek et al.'s (2009) study, definitions were more specific. Play was defined as "engaging in behaviour appropriate to the play activity (e.g. sliding on the slide, swinging on the monkey bars) with eyes open and focused on materials or people in the activity area" (p.550). The behavioural definition of positive play to be recorded and measured was consistent across all pupil participants. However, definitions of challenging behaviour varied across individuals. A list of challenging behaviour was made for each participant. Jeffrey, for example, frequently lined up rocks and dropped them into crevices. While this may be considered as a form of play to some, within this study it was considered to be a form of stereotypic manipulation and therefore not play.

5: Activity Schedules for those with Severe Diagnoses

Information regarding participant diagnoses was obtained from individual studies and compiled (see Appendix G) using procedures set out in the Methods section. This information was added to Table 4.1. Analysis of the table reveals that a total of 171 individuals, aged from 29 months to 40 years, participated in the 49 studies. Those diagnosed with severe diagnoses in ID or ASD were identified.

Participants with a severe diagnosis. Twelve studies included at least one participant with severe diagnoses in ASD or ID. The total number of participants with a severe diagnosis is 27, accounting for 15.7% of participants in AS studies. No studies reported participants with a dual diagnosis of severe ASD and severe intellectual disabilities.

Participants diagnosed with severe ASD. Six studies included participants with an ASD diagnosis within the severe range: Three studies had four participants diagnosed with moderate to severe autism (Krantz & McClannahan, 1993; Morrison et al., 2002; Cihak, 2011) and three studies had one participant with severe autism (O'Reilly et al., 2005; Hume & Odom, 2007; Machalicek et al. 2009), totalling 15 participants with a severe ASD diagnosis. Those 15 participants account for 8.7% of the 171 participants in the AS studies included in this study.

Participants diagnosed with severe ID. Six studies included participants diagnosed with a severe intellectual disability: Three studies had one participant diagnosed with severe ID (Pierce & Schreibman, 1994; Wheeler & Carter, 1998; Flannery & Horner, 1994), one study had two participants with severe ID (Anderson et al., 1997) one study had three participants with severe ID (Wilson et al. 2006), and one study had four participants with a severe ID (MacDuff et al., 1993), totalling 12 participants with a diagnosis of severe ID. Those 12 participants account for 7% of the 171 participants in AS studies.

Effectiveness of activity schedules for those with severe diagnoses. The effectiveness of activity schedules for those with ASD diagnoses and/or ID diagnoses in general was compared with the effectiveness of activity schedules for those with severe ASD and/or severe ID. The PND scores for the 27 individuals with severe diagnoses were examined (see Appendix G). Their scores were combined, divided by 27 and multiplied by 100 to produce a mean score of 92% (range 36-100%). According to the general guidelines for interpreting PND scores (Banda & Therrien, 2008), this indicates that activity schedules in general are *highly effective* for those individuals with severe ASD or ID diagnoses.

Effectiveness of PCDI-AS versus AS for those with severe diagnoses. The scores of those taught by PCDI methods were compared with those taught by other AS methods. A total of 19 individuals with ASD or ID diagnoses within the severe range were taught to follow activity schedules using other AS methods within 12 studies. Their scores were combined, divided by 19 and multiplied by 100 to produce a mean PND score of 90% (range 36-100%).

A total of eight individuals were taught to follow activity schedules using PCDI-AS methods in two studies. Their PND scores were totalled, divided by 8 and multiplied by 100 to produce a mean PND score of 99% (range 89-100%). Results therefore, according to Banda & Thierren (2008) suggest that for those with severe ASD or ID diagnoses, AS methods are *moderately effective* for teaching activity schedule following, whereas PCDI-AS methods are *highly effective*.

Further Analysis

To establish which studies used the PCDI-AS approach to develop play skills in those with more severe diagnoses, the following information has been extracted from Table 4.1:

a) AS studies with a participant with a severe diagnosis. Of the 49 studies, 12 studies used AS with participants who had a severe diagnosis of either ASD or ID (MacDuff et al. (1993), Krantz & McClannahan, 1993; Morrison et al., 2002; O'Reilly et al., 2005; Hume & Odom, 2007; Machalicek et al., 2009; Cihak, 2011; Pierce & Schreibman, 1994; Flannery & Horner; Wheeler & Carter, 1998; Anderson et al., 1997; Wilson et al., 2006).

b) AS studies that developed independent play and leisure skills. Of the 49 AS studies, 19 included development of independent play skills (MacDuff et al., 1993; Krantz & McClannahan, 1993; Anderson et al., 1997; Dunlap & Fox et al., 1999; Massey & Wheeler, 2000; Bevill et al., 2001; Morrison et al., 2002; Kimball et al., 2003; Dauphin et al., 2004; Buschbacker et al., 2004; Wilson et al., 2006; Hume & Odom, 2007, Spriggs et al., 2007; Betz et al., 2008; Machalicek et al., 2009; Blum-Dimaya et al., 2010; Cuhadar & Diken, 2011; Carlile et al., 2012; Brodhead et al., 2014).

c) AS studies that followed PCDI-AS procedures. Studies that followed the PCDI-AS procedures were noted. A total of 11 studies followed PCDI-AS procedures (MacDuff et al., 1993, Krantz & McClannahan, 1993; Krantz & McClannahan, 1998; Bryan & Gast, 2000; Kimball et al., 2003; Betz et al., 2008; Miguel et al., 2009; Blum-Dimaya et al., 2010, White et al., 2011; Brodhead et al., 2014 and Carlile et al., 2013).

These three variables have been cross-correlated to provide further information. Key information is summarised in Figure 4.2 in a Venn diagram. Of the 49 studies, the number that had participants with a severe diagnosis (total=12) is shown in Circle A. The number of studies designed to develop independent play (total=19) is shown in Circle B, and the number of studies that followed PCDI-AS procedures (total=11) is shown in Circle C.

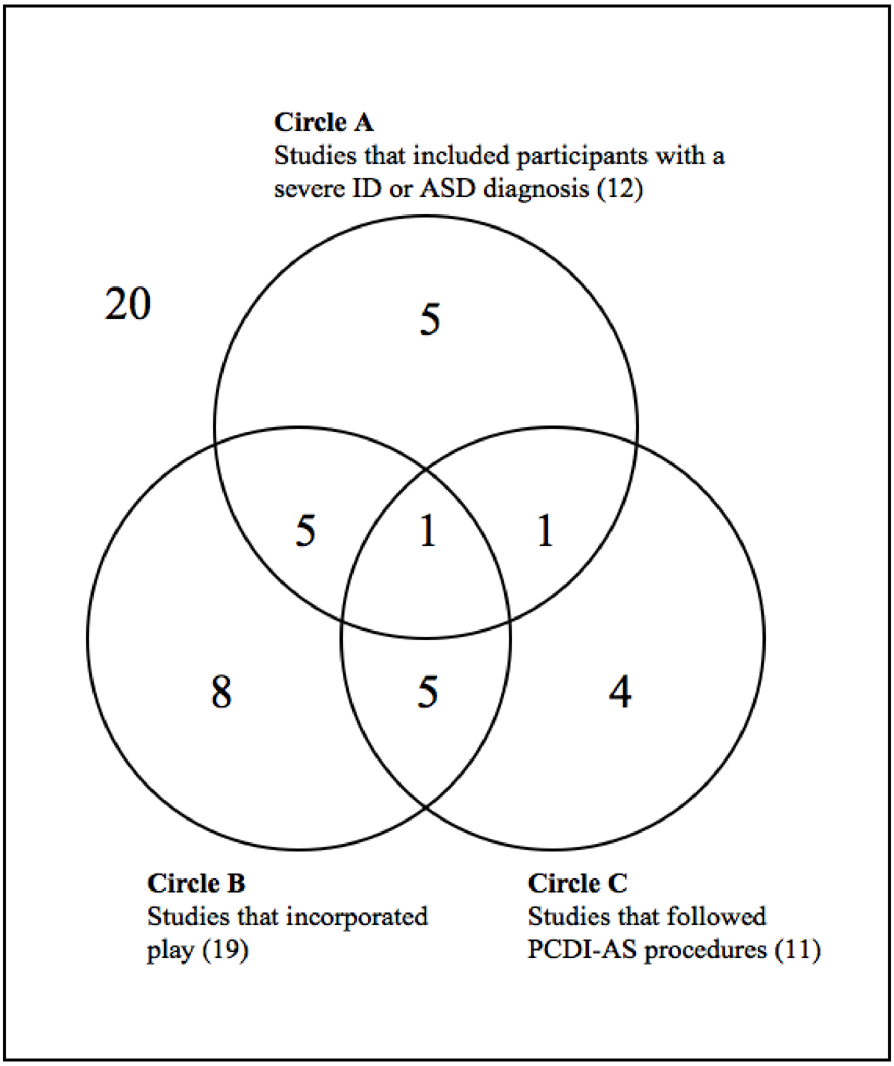


Figure 4.2. The 49 AS studies and number of studies under three variables: studies with participants with a severe diagnosis, studies that developed independent play and studies that followed PCDI-AS procedures.

Cross-correlation of three variables.

Correlation of A (Severe Diagnosis) + B (Play Skills). Studies that included a participant with a severe diagnosis, and studies that developed play have been cross-correlated. There are six studies that aimed to develop play skills in those with a severe diagnosis (MacDuff et al., 1993; Anderson et al., 1997; Morrison et al., 2002; Hume & Odom, 2007; Machalicek et al., 2009; Wilson et al., 2006).

Cross-correlation of B (Play Skills) + C (PCDI Procedures). Studies that sought to develop independent play skills using PCDI procedures have been correlated. There are six studies that combined these two variables (MacDuff et al., 1993; Kimball et al., 2003; Betz et al., 2008; Blum-Dimaya et al., 2010, Carlile et al., 2013; Brodhead et al.2014).

Cross-correlation of A (Severe Diagnosis) + C (PCDI Procedures). Studies that included a participant with a severe diagnosis and studies that followed PCDI procedures have been correlated. Two studies met these criteria (MacDuff et al., 1993; Krantz & McClannahan, 1993)

Cross-correlation of A (Severe Diagnosis) + B (Play Skills) + C (PCDI procedures). All three variables have been cross-correlated; studies that sought to develop independent play skills, had participants with a severe diagnosis and used PCDI-AS procedures. Only one study met these three criteria: MacDuff, Krantz and McClannahan (1993).

Discussion

Activity schedules in general have been shown to be successful for a range of age groups, to develop a variety of skills in individuals with ID and/or ASD; both PCDI-AS and AS using other methods have been effective. The use of a quality appraisal tool and a formal measure of effectiveness minimised bias and produced some comparative results. The results of the quality assessment, measures of effectiveness and narrative synthesis of studies are summarised and discussed:

Summary of quality measures. When considering individual studies, the quality rating score ranged from 1 to 9; there were both high and low scores for studies following AS or PCDI-AS procedures. The mean scores from quality measures using the dichotomous scoring systems indicates that activity schedule studies using both PCDI-AS and other AS methods had the same quality outcomes. Both scored 6.7 using the SCED scale.

Differences were seen however with regards to generalisation. Only 39% of all studies reported generalisation of skills. Of those, most reported across settings only, with a minority reporting on generalisation across activities (Betz et al., 2008; Dooley et al., 2001) and across settings as well as tasks (Pierce & Schreibman, 1994; Spriggs et al., 2007). Two of the main reviews noted that quality measures were lacking in studies; less than half of the studies examined by Banda and Grimmett

(2008) or by Koyama and Wang (2011) examined generalisation. The current study concurs with this finding. However, when comparing generalisation of skills reported in PCDI-AS studies and studies using other AS methods, there was a wide discrepancy. A minority of 26% of studies following AS methods reported generalisation, in contrast, 82% of PCDI-AS studies reported generalisation. When these results are taken into account, according to the SCED scale, it would seem that studies following the PCDI-AS approach were of higher quality than those AS using other methods. A major goal of behaviour interventions is to effect change that is long-lasting and occurs in other settings, across individuals and to novel materials. As studies using the PCDI-AS approach evidenced substantially more generalisation, it could be considered as preferable to other AS approaches for both practitioners and participants of studies.

Summary of effectiveness measures. It must be acknowledged that there have been PCDI-AS studies as well as studies using other methods that have been highly effective. However, there has been only one PCDI-AS study that was minimally effective (White, Hoffman, Hoch & Taylor, 2011), and one that could not be measured (Kimball, Kinney, Taylor & Stromer); the other 11 PCDI-AS studies were highly effective. Of the studies using other methods, three were not effective (Flannery & Horner, 1994; Bevill, Gast, Maguire & Vail; Raver, Hester, Michalek, Cho & Anthony, 2013) four were minimally effective (Schmit, Alper. Raschke & Ryndak, 2000; Buschbacker, Fox & Clarke, 2004; O’Reilly, Sigafoos, Lancioni, Edrishinha & Andrews, 2005; Carson, Cast & Ayres, 2008), and three could not be assessed (Kimball, Kinney, Taylor & Stromer, 2003; Dauphin, Kinney & Stromer, 2004; Liu & Breslin, 2013). The other AS studies were either moderately or highly effective.

With an overall PND score of 87%, measures of effectiveness indicate that activity schedules in general are moderately effective. The PND effect size ranged from 0% to 100%. When considering studies on an individual basis, there were studies using other AS methods that were highly effective (e.g. Pierce & Schreibman, 1994; Anderson et al., 1997) and AS studies that were not effective (e.g. Flannery & Horner, 1994). There were also PCDI-AS studies that were highly effective (e.g. Bryan & Gast, 2000; Betz et al., 2008) and minimally effective (e.g.

White et al., 2001). However, mean results showed variation; when comparing measures for the PCDI-AS approach (mean 96%) with other AS (mean 84%), the PCDI-AS approach appears to be more effective. Therefore, according to the PND scores AS are moderately effective, PCDI-AS are highly effective.

This trend continues when comparing PND scores for those participants with severe diagnoses. Although it seems that at a combined 92%, all activity schedules are highly effective for those with severe ASD or ID diagnoses, when the two approaches are compared there are differences in effectiveness. With a mean score of 90%, the AS studies scored within the moderately effective range whereas with a mean score of 99%, the PCDI-AS approach was highly effective. It seems therefore, that while activity schedules in general are effective, those following the PCDI-AS approach result in a greater effect size for all individuals, including those with severe diagnoses.

Summary of narrative synthesis. The narrative synthesis of activity schedules provided salient information regarding the teaching procedure, and aspects to consider when planning an intervention.

It is likely that learners need to acquire picture-object correspondence skills prior to learning to follow an activity schedule (Koyama & Wang, 2011, Krantz & McClannahan, 1999). Furthermore, with regards to the content of schedule folders, it seems that for those who have not learned to follow an activity schedule, it is preferable to teach activity schedule following as a skill in itself, rather than to try to teach new skills within the schedule (Spriggs et al., 2007; Krantz & McClannahan, 1999). However, once an individual has acquired schedule following, the procedure can be used to introduce or develop a wide variety of further skills. Paired schedules in particular would be valuable for developing social skills as well as play skills (White et al., 2011).

Schedule formats need to be easy to manage for both learners and teachers to ensure success (Van Laarhoven et al., 2010). The type of visual cue should be carefully considered for each cohort of individuals, as some forms could be associated with challenging behaviour (Lalli et al., 1994). Even when not targeted, the use of an activity schedule is likely to reduce any occurrence of problematic behaviour (Krantz et al., 1993; Pierce & Schreibman, 1994; Lalli et al., 1994;

Massey & Wheeler, 2000). As it can in itself occasion challenging behaviour, it is advisable to plan the timing of activity schedule training to avoid it being associated with the termination of a preferred activity (Lequia et al., 2010).

During training, careful consideration of the reinforcing properties of specific resources is advisable (Dettmer et al., 2000), as the use of any preferred materials during the planned activities may be distracting. Preferred items can be used to reinforce schedule following behaviour, however these need to be planned for each individual. Providing an element of participant choice within activity schedules can be beneficial (Watanabe & Sturmey, 2003, Koyama & Wang, 2011).When presenting results, social validity measures add further significance to studies (Koyama & Wang, 2011; Knight et al., 2015).

Summary of play AS findings. More specific consideration of studies seeking to develop play skills yielded further information. In summary, they have been used in outdoor and indoor settings, and have consisted of both high-tech and low-tech formats. Basic skills as well as more advanced, co-operative skills have been taught via AS procedures. When planning an activity schedule to develop play skills, it is advisable not to incorporate verbal or gestural prompts into the procedure as these would need to be faded, which would likely impede or delay skill acquisition (Morrison et al. 2002; Machalicek et al. 2009).

Whether using a high-tech or low-tech format, a visual cue needs to clearly represent a specific play activity to be completed independently (Morrison et al. 2002). A low-tech format is a practical option as it is inexpensive, easy to make, portable and adaptable (Kimball et al. 2003). Additionally, a low-tech format may be more suitable for those with a severe diagnosis (Dauphin et al.2004).

Having a range of preferred items and conducting a preference assessment prior to each session is advisable (Cuhadar & Diken, 2011). Re-sequencing visual cues early in the procedure is advisable to promote generalisation of skills (Betz et al., 2008; Cuhadar & Diken, 2011). If no novel materials are added it is not known if the visual cue is responsible for the behaviour change (Cuhadar & Diken, 2011).

Co-operative play could be taught to those who have already mastered individual schedule following (Betz et al. 2008). Which ever aspects of play are being developed, in order for measurement to be accurate and consistent, the parameters of what is considered independent play and what is not needs to be clearly defined (Betz et al., 2008; Morrison et al. 2002; Machalicek et al., 2009).

Correlation of variables. From the evidence presented, it seems that the most effective way to teach individuals to develop independent play skills using an activity schedule, is via a PCDI-AS approach. The systematic review suggests that the PCDI-AS approach is more effective and leads to greater generalisation of skills than other AS methods. When cross-correlating these three variables, it appears that only one study used the PCDI-AS approach to develop independent play skills in individuals with severe ID: MacDuff, Krantz and McClannahan (1993). MacDuff et al.'s (1993) study achieved a quality rating score of 8/10, demonstrated generalisation and was 100% effective.

The difference in the PCDI-AS approach and the approach using other AS methods centres on prompting procedures. As discussed, the PCDI-AS approach utilised only physical prompting and visual cues. Physical prompting was gradually faded until visual cues alone were responsible for schedule following behaviour. In contrast, AS using other approaches incorporated other prompts within their procedures. Often, both gestural and verbal prompts were used alongside physical prompts and visual cues. Without fading these it is not known which prompts were responsible for behaviour change; it can only be concluded that the behaviour change was a result of multiple components. It seems that as the PCDI-AS appears to be more effective and promotes more generalisation, their prompting procedure is more efficient. It is likely that the absence of verbal or gestural cues is responsible for the increased quality and effectiveness.

Limitations

There are several limitations to this systematic review that require acknowledgement.

Limitations of multiple baseline designs. One such limitation is that evidence for the activity schedule being effective is predominantly via a series of multiple baseline (MBD) single case designs. Some researchers consider that an advantage of the MBD is it does not require withdrawal of an effective treatment in a return to baseline (Cooper, Heron & Heward, 1997). This makes it an acceptable method of testing the effects of an intervention within a school setting. Due to its “inherent flexibility in the timing of interventions and the ability to conduct analyses in a multi-probe or non-concurrent fashion” this approach is “easily adapted to applied settings” (Kennedy, 2005, p.162). However, as Kennedy (2005) points out “this strength is also the primary weakness of the design. Because of it structure, it is difficult to conduct comparative, component or parametric analyses of independent variables using the multiple baseline designs” (p. 162).

In single case designs, the high degree of direct contact researchers maintain with their participants is positive in that it allows the researcher to respond to the participant, and amend processes as necessary. However, this does lead to questions regarding researcher subjectivity. According to Yin (2013), there are some who consider the multiple baseline design (MBD) method a “ last resort”. This is due to a lack of credibility of procedures, which do not always protect against such biases as a researcher seeming to find what she or he had set out to find (Yin, 2013), and is perhaps weaker than other designs in demonstrating causal effect.

Nevertheless, when conducted within certain parameters the MBD can meet evidence standards as an acceptable experimental design according to the Single-Case Design Technical Documentation (Kratochwill et al., 2010). There are stringent guideless within which researchers can ensure they apply the independent variable consistently across participants and conditions. With a minimum of six phases (which could be 3 participants with an AB design), with at least five data points per phase, the single case MBD design can meet evidence standards. This systematic review did not include an analysis of studies with regard to meeting the established standards by Kratochwill et al. (2010), therefore it is not known what proportion of studies met acceptable standards.

Limitations of quality measurement. Further limitations include the measurement system selected to examine quality. The single case experimental design (SCED) scale (Tate et al., 2008) was chosen, however, the authors acknowledge that some items on the scale may be controversial and possibly “some criteria are insufficiently stringent” (p.396). An example being the requirement of 3 points being sufficient to meet the criterion or stability of baseline; some consider that to be insufficient whereas for others there are some conditions during which a person may pose a threat to the safety of themselves or others, and therefore it may not be possible to baseline the target behaviour. Other scales such as the risk of bias in N-of-1 trials (RoBiNT) by Tate, Perdices, Rosenkoetter, Wakim, Godbee & Togher (2013), with different criteria may have resulted in different conclusions regarding the quality of studies. Measures of effectiveness were limited to those on the SCED scale. There are elements within activity schedule studies that impact on effectiveness that were not included on the SCED scale and therefore not examined in the current study. For example, schedules of reinforcement are known to affect rates of responding during interventions, but they were not examined. It is not known if or how the absence or presence of reinforcement affected individual studies or if these schedules of reinforcement were applied consistently.

Limitation of effect size measurement. A further limitation is the selection of the percentage of non-overlapping data (PND) designed by Scruggs et al. (1987) to measure effect size. As Schlosser et al. (208) point out, although they found that PND can be calculated in a reliable manner, the reporting practices related to PND application are not consistent across systematic reviews. Parker et al. (2011) evaluated nine non-overlap techniques; although they state that PND is the most widely published method of calculating effect size (Parker et al., 2011), they acknowledge limitations exist. For PND “is the only non-overlap method that emphasises a single score in Phase A. So, the usefulness is limited to those data series where Phase A has no positive outliers as a single high score dictates results” (Parker et al., 2011, p.301). Alternative methods of measuring non-overlap may have resulted in different conclusions.

Finally, it is acknowledged that the risk of bias that may have affected cumulative evidence was not assessed. Publication bias may have affected the number of activity schedule studies being included in publications. It is possible that some researchers and publishers have a vested interest in this particular intervention. Selective reporting may have biased the evidence by not reporting interventions that were unsuccessful, or by publishing but omitting particular participants data that would have skewed results. The possibility of publication bias is acknowledged but not been examined.

Conclusion

It was not known if there were any differences in quality or effectiveness between the PCDI-AS approach and AS using other methods. This systematic review sought to compare both the quality and effectiveness of PCDI-AS with other AS. It has examined in particular comparisons of the two approaches with regards to participant characteristics and for developing independent play skills.

In conclusion, the results of this systematic review suggest that activity schedules in general are *moderately effective* for developing skills in those with intellectual disabilities, autism and/or other developmental disorders. They are also *moderately effective* for teaching play skills in particular. When comparing teaching approaches however, it seems that the PCDI approach is more effective; it falls within the *highly effective* range for both the general population of individuals with ID and/or ASD as well as those with a more severe diagnosis. Furthermore, as it demonstrates greater generalisation, the PCDI-AS is of higher quality than the studies using other AS methods.

The implications for practitioners or parents planning interventions in a range of settings such as schools, home or residential settings or work places, the PCDI-AS approach is likely to be more effective than AS using other methods. It appears to be more effective for all individuals with ASD and/or ID diagnoses. It seems that the prompting procedure using only physical prompting with most-to-least graduated guidance in the absence of gestural or verbal cues, is more effective than methods that combine multiple components.

There have been 12 studies that have taught activity schedule following to individuals with severe diagnoses (MacDuff et al., 1993; Krantz & McClannahan, 1993; Flannery & Horner, Pierce & Schreibman, Anderson et al., 1997, Wheeler & Carter, 1998; Morisson et al., 2002; O'Reilly et al., 2005; Wilson et al., 2006; Hume & Odom, 2007, Machalicek et al. 2009 & Cihak, 2011). Although the evidence suggests that the PCDI-AS approach is more effective, only two of these studies used the PCDI-AS approach (MacDuff et al., 1993; Krantz & McClannahan, 1993), and both were highly effective. Of these two, only one study sought to develop play skills in individuals with severe diagnoses: MacDuff et al. (1993). The evidence is therefore limited.

No systematic review had previously focused on method of activity schedule delivery with regards to prompting procedures. None has compared the efficacy of the methods designed by MacDuff et al. (1993) and other methods of delivery. Results of this study suggest that the PCDI-AS approach is more effective and of higher quality than AS using different methods.

Results also indicate that since MacDuff et al.'s (1993) study, there have been no further studies that have used PCDI-AS procedures to develop play or leisure skills in individuals with either a severe ASD or severe ID diagnosis. While the evidence suggests that the PCDI-AS approach would be highly effective for teaching independent play skills to those with severe diagnoses, only one study to date has done this. There is a paucity of evidence therefore, that these procedures are effective in teaching independent play skills in particular to this minority population. Further research using the PCDI-AS approach with individuals with severe ASD or ID diagnoses would further validate this method of teaching independence skills to this particular population.

Chapter 5
Project Overview

Overview

The main study took place over 2 academic years, between September 2012 and July 2014. It was a complex intervention comprising different training procedures and observation sessions; pre-requisite skill training, activity schedule training and play observations.

This chapter provides a project overview, beginning with the research aims and questions, and a rationale for the design of the intervention. A description is given of adult and pupil participants. This is followed by an account of procedures followed to gain ethical approval for the study. Pre-requisite skill training, activity schedule training and play observations are fully described in three individual chapters of this thesis. However, to put these three components into context, this chapter gives a synopsis of procedures used and an outline of the subsequent chapters that describe follow up probe data, social validity and an overall discussion. A project timeline gives a timescale and presents the different components visually. This provides a framework of reference for the whole intervention. Finally, an account of how measures were taken to promote a consistent approach is given for each of the three components of the study.

Research Aims and Questions

Having considered the literature on activity schedules in general, evidence suggests that they are *moderately effective* for developing independence skills for learners with ID or ASD. They are also *moderately effective* for developing play skills. When comparing the PCDI-AS approach with AS using other methods, while the AS approach is moderately effective, the PCDI-AS is highly effective and leads to greater generalisation of skills. This trend continues with those who have severe ID or ASD diagnoses. While the data suggests that for those with severe diagnoses, the PCD-AS approach is likely to be effective for developing skills, the literature is lacking in evidence. Only two studies have used the PCDI-AS approach to develop skills in those with severe diagnoses (MacDuff et a., 1993; Krantz & McClannahan,

1993) and of these only one (MacDuff et al. 1993) has focused on independent play skills. Both of these studies were highly effective, of high quality and resulted in skill generalisation. With only one study demonstrating that the PCDI-AS approach is effective for teaching independent play skills in the population of individuals with severe diagnoses, evidence is lacking. More research in this area could provide further evidence. The main research questions to be asked were these:

Primary research question. Can PCDI-AS be used to teach children presenting with severe ID and/or severe ASD to engage with play materials independently of adult prompting?

Subordinate research question. If they can be taught to behave independently with traditional play materials, will these skills generalise across materials and to other child-initiated play sessions?

Rationale for Intervention Design

The literature review and background theory, as discussed in Chapters 1 to 4, informed the design of this project. This section provides an overview of decisions made regarding intervention design. Although it seems that the PCDI-AS is likely to be the most effective design for teaching independent play skills, other AS studies explored within the literature review were of interest. Many contained elements instrumental to the design of this project's main intervention.

Activity Schedule Procedure. Results of the systematic review suggest that the PCDI-AS, as designed by MacDuff, Krantz and McClannahan (1993) is more effective than AS using other methods. Further more, with other multi-component teaching programs it is not always clear which elements of the design are responsible for behaviour change. In contrast through their experimental studies, MacDuff et al. (1993) had proven that verbal and gestural prompts were not a necessary part of their teaching package and could in fact be superfluous to the design: including them could perhaps hinder progress. By removing verbal and gestural prompting entirely from the procedure, they negated the need to fade prompts. It seems that their procedure, using physical prompts, delivered via graduated guidance from behind, and faded until adult supervision was unnecessary, provided the optimum teaching strategy. Compared with AS using other methods the PCDI-AS studies were of higher quality in that they evidenced more generalisation, and were more effective. For these reasons, it was decided to follow the procedures developed by MacDuff et al. (1993), as described Krantz and McClannahan's (1999) guide for practitioners.

Data collection. The component completion data collection sheet, as provided by Krantz and McClannahan (1999), was straight forward in design and could be modified for the purpose of this study. It provided a paper-based recording method that adult participants could complete to create a measure of independence. A permanent product would be created during each training session, allowing for pupil progress to be continually tracked. It was decided to create a modified version of this component completion data collection sheet.

Format. Having decided on the teaching procedure, consideration was given to activity schedule format. A low-tech approach was selected over a high-tech one for several reasons. Firstly, some individuals within the study were computer competent with desktop computers and/or tablet devices, while others were not. However, a procedure applicable to all pupil participants was required. Secondly, all of the pupils, competent or not with high-tech devices had a learning history with computers and/or tablets; these prior experiences would inevitably affect their performances during training. In contrast, none of the pupils had a learning history with a ring binder format. Thirdly, there was a potential for distraction with computers or hand held devices, as for some pupils these had been previously used as preferred items during teaching sessions. Confusion regarding demands being placed via use of these objects could in turn have led to problematic behaviour in some pupils. In contrast, a ring binder itself was not a preferred item for any pupils. A variety of reinforcing items or activities could however be embedded into the design of each individual schedule.

In previous research, neither photographs nor video/computer-based schedules are proven to be more effective than the other. There is substantial evidence that photographs are effective and as they were commonly used within the classroom setting would not be socially stigmatizing. The use of photographs would approximate visual strategies already used within the classroom environment. By using similar materials there could be a reduction in material preparation time. Photographs were generally associated with preferred items, as these were used within the classroom on choice boards. It was decided that the low-tech format would be most appropriate as a first activity schedule for all of the pupils.

Resources. The format of the activity schedule binder was relatively straightforward and inexpensive to make. Photographs of resources could be created in advance, and could be duplicated and updated as required. The binder itself was portable so if appropriate could be used in multiple environments. The other materials necessary to the procedure (wallets, containers, resources for activities) could be readily obtained and organised in a way that could be managed, maintained and updated within a busy classroom environment. Once set up, the resources could be managed by the adult participants involved in the study.

Participants

All pupil participants in the main study attended a special school in the south east of England. The adult participants worked at the school with the pupil participants. A description of adult participants is given, followed by an overview of pupil participants. Individual pupil profiles provide more detailed information regarding individual pupil characteristics.

Adult participants. The trainers were neuro-typical adults, consisting of the researcher and thirteen teaching assistants (TAs) who had varying degrees of experience in working with pupils diagnosed with learning difficulties. The majority of TAs had no experience of Applied Behaviour Analysis (ABA) at the start of the study. All TAs were given training in ABA, as described within the section outlining measures to promote consistency. Some TAs worked full-time with the pupils while others worked on a part-time basis. On a typical school day, 10 adults supervised 10 pupils providing a staff: pupil ratio of 1:1. As well as being the school's specialist in ABA, the researcher was the class teacher and as such responsible for the educational provision of the pupils within the study. One of the TAs was a Higher Level Teaching Assistant (HLTA) as well as being a Lead Practitioner (LP) as she had completed a BSc in Intellectual Disabilities, which included a year of instruction in ABA.

Pupil participants. All 11 pupils who participated within the study had a statement of Special Educational Need (SEN) and attended a special school in the South East of England designated specifically for pupils with difficulties in *cognition and learning* that resulted in *profound, severe or complex needs*. To obtain a diagnosis of SEN, General Practitioners, Educational Psychologists, Consultant Paediatricians and/or other professionals had assessed them. Ten of the pupils had been diagnosed with SEN codes of Severe Learning Difficulties (SLD) and 1 with Profound Learning Difficulties (PLD), and with the effects of intellectual deficits on individual functioning, (see Chapter 1), these codes can be considered interchangeable with severe to profound intellectual disabilities.

Nine pupils had a diagnosis of Autism Spectrum Disorder (ASD) while one was described in her statement of special educational need as having "autism-type characteristics". It is acknowledged that there are dangers in relying on evaluations rather than official diagnoses. However, severity level of ASD was not part of official diagnoses for these individual students; therefore evaluating the category that each pupil best fits involved an element of diagnosing, and is a limiting factor of the study. Nevertheless, pupil characteristics were considered, by the researcher and the school Head of Education, and each pupil's behavioural repertoire was considered consistent with a level 3 ASD diagnosis as described in the DSM-5 (2013), and discussed in Chapter 1. Further details regarding individual pupil characteristics used to evaluate severity of ASD and ID are summarised in Table 5.1 (p.128) and described in more detail in individual pupil profiles (pp.130-135).

One pupil (pupil A) participated in a pilot study, which was conducted by the researcher during the academic year 2011-2012. This provided a means of developing fluency with the training procedures and of testing the design of materials and data collection procedures. Pupil A did not participate in the main study. The other 10 pupils formed a class within the school. Pupils for this class were selected from across different age ranges within the school following an internal assessment procedure. Assessment data for all pupils were analyzed jointly by the researcher and the Head of Education; those who had lowest achievements in basic learning skills within the National Curriculum subjects of Literacy, Numeracy and Personal, Social and Health Education (PSHE), and whose progress was slowest in these areas, were selected. They were grouped together to form this class based on their learning requirements, rather than by age. It was decided that this class would participate in the main study and receive an approach to education using the principles of Applied Behaviour Analysis (ABA). Pupil participants ranged from school year 3 to school year 8. Ages at the start of the main study, in September 2012, ranged from 7 years and 4 months to 12 years and 3 months.

Pupil identification. Pupils were assigned a letter for identification purposes. Letters provided a means of pupil confidentiality and were allocated to pupils in the order in which it was anticipated they would begin their activity schedule training. The order was decided on the basis of pupil attainment data, medical needs and other circumstances that could affect pupil progress. Pupil J, for example, was scheduled for a medical procedure early in the academic year, so it was decided that to give her maximum time for her condition to stabilise, she would be in the last pupil pair to be taught to follow an activity schedule. Pupil K had engaged in high levels of challenging behaviour in his last class placement, he was undergoing behavioural assessments and, therefore, also placed in the final pair. In contrast, pupils B and C were not taking medication, and they exhibited relatively little challenging behaviour so it was anticipated that they would be the first pupils to begin activity schedule training.

Activity schedule training was planned to start for each pupil once they had demonstrated mastery of the pre-requisite skills. How quickly each pupil would acquire the pre-requisite skills was unknown, therefore some flexibility was required. For this reason letters were chosen over numbers. If the order of training needed to change, letters of the alphabet would not be confused with numerical listings. One of the pupils (pupil I) began the study but moved to another class due to an increase in medical needs. The remaining nine pupils, pupils B, C, D, E, F, G, H, J and K, participated fully within the study.

Pupil participant summary.

Each pupil required support for all activities of daily living such as meal times, dressing and personal care, and required supervision at all times to remain safe. All pupils demonstrated severe to profound difficulties with adaptive behaviour. Further individual information regarding conceptual, social and practical capabilities is provided, as recommended for diagnostic purposes by the DSM-5 (2013).

While all pupils had a diagnosis of severe to profound learning difficulties, the diagnosis itself does not reflect the wide range of idiosyncrasies, abilities and characteristics within the group of pupils. Diagnoses such as ASD or SLD can be considered as summary labels that represent a whole range of possible behavioural repertoires. As noted in Chapter 4, Lequia et al. (2012) recommended that more detailed descriptions of participant characteristics should by included in future studies using activity schedules. A detailed and accurate account of individual pupil characteristics is, therefore, provided.

Pupil diagnoses, measurements of intelligence, diagnosed levels of learning difficulty, modes of communication and types of stereotypical behaviour are firstly summarised in Table 5.1. The age of pupil participants is given in years and months. Diagnostic information is taken from individual statements of special educational need. Further information on self-injurious behaviour and aggression, if they were present in individual behavioural repertoires is also provided. This is followed by a more detailed narrative description of each pupil participant. All details regarding diagnoses, communication, stereotypy, aggression and self-injurious behaviour was accurate for each participant in September 2012.

Table 5.1

Summary of Pupil Participants

Pupil	Gender and age	Diagnoses and Communication	Stereotypy	SIB/ Aggression
A	M 8.7	SLD, ASD, severe delay in speech and communication Speech in 3-4 word phrases	Spinning self around on one foot repeatedly	None observed
B	M 7.4	SLD, ASD, severe speech and language delay, On Griffiths Mental Developmental Scale (GMDS) at age 41 months scored as 24 months Speech in 2-3 word phrases, PECS phase IV	Repetitive vocalization e.g. “a-dee-a-dee”, Banging small item on table repeatedly, Lining up items on floor or tables	Punches tops of own legs, Hits table with force using palm of hand’ Hits others

C	F 11.10	SLD, Severe developmental delay, severe speech and language delay, undiagnosed chromosomal abnormality, ASD type characteristics, On GMDS at 48 months cognitive score was 18 months = GQ of 38 = severe delay PECS phase III	Mouths small toys repeatedly, Rocks whole body from side to side while seated on chair, Stands with feet wide apart stepping from one foot to another repeatedly	Bites back of own hand leaving teeth marks
D	M 9.7	SLD, ASD, delay in language development, general severe learning difficulties PECS phase II	Rubs spit on toys such as small world figures, Mouths small items repeatedly, Rocks small items from side to side on tabletop repeatedly, Makes repetitive, high pitched vocalizations	Takes adults hand and squeezes it forcibly with both of his hands
E	M 9.1	SLD, ASD, suspected Angelman Syndrome, On NHS/CAHMS paperwork, ICD codes: F72 – severe learning disability, Impairment of behaviour F84 – ASD PECS phase I	Opens/closes doors repeatedly either quietly or banging loudly, Walks around room and tips chairs over by pulling on chair backs, Throws small item in air over his head	Bangs own forehead on wall Bangs side of own head on corners of tables
F	M 11.3	PLD, ASD, severe to profound learning difficulties, level of functioning around 1-2 year level, even more profound delay in speech and language development PECS phase I	Paces back and forth across the room, Fiddles with ears repeatedly by flicking them with his fingers, Screams loudly and repetitively	Hits own forehead with palm of his hand, Bangs side of head with force against side of adult's arm, when adult next to him, Bangs head backwards with force against adult's chest with adult behind him
G	M 8.1	SLD, ASD, OCD, significant communication and interaction difficulties and severe cognitive delay, On GMDS at 27 months he had a mental age of 16 months indicating a severe delay PECS phase I	Moves hand in front of face repetitively, Licks all over his fingers repeatedly, Screams/makes loud vocalization	Grabs adults hand and rubs own chin on back of adults hand with force, Grabs adults forearm with both hands and twists with force, Pushes adults out of the way with palms of his hands, Uses side of his body to push adults away
H	M	SLD, ASD, Fragile X	Skips back and forth	Punches side of his

	9.2	Syndrome, global developmental delay PECS phase II	across the room, Swings item around head, Stretches rubbery toys as far as possible repeatedly	own head with fist, Bites the back of his own hand or first finger, Bangs own head against walls, floor and furniture, Punches or kicks others
J	F 12.3	SLD, ASD, tubular sclerosis, epilepsy, developmental delay, ADHD, On GMDS at 36 months scored 18 months = severe delay PECS phase I	Mouths small item repeatedly, Taps items on the side of her own face or against own ear, Flicks through pages of books repeatedly	None observed
K	M 8.1	SLD, ASD, overall developmental delay, learning difficulties, On GMDS at 43 months scored 24 months = severe delay Speech in 3-4 word phrases	Screams/shouts single words repetitively and out of context e.g. “help” or “mum”	Punches or kicks others, Lays on floor and kicks out at others passing

Note. All information was accurate in September 2012. Age is given in years and months. Diagnostic information was compiled from individual Statements of Educational Need, unless otherwise stated. M= male; F=female; SLD=severe learning difficulty; ASD=autism spectrum disorder; PLD=profound learning difficulty; GMDS=Griffiths Mental Developmental Scale (Griffiths, 1996); OCD=obsessive compulsive disorder; PECS=picture exchange communication system (Frost & Bondy, 2002); NHS=National Health Service; CAMHS=Child and Adolescent Mental Health Service

Individual pupil participant profiles. A detailed narrative description of pupil characteristics is provided. All pupils who participated in the main study exhibited some forms of problematic behaviours and therefore had personalised behaviour support plans. Information regarding pupil characteristics, communication skills and problematic behaviours observed at the start of the study are given. Typical behaviour observed during play sessions is summarised for each pupil.

Pupil A. Pupil A was a male in year 4 (aged 8 years and 7 months) who had a diagnosis of SLD and a diagnosis of ASD. He sometimes communicated verbally using 3-5 word phrases, though much of his utterances were echolaic and/or repetitive. He initiated interactions by manding and tacting, according to Skinner's (1957) definition of verbal behaviour.

During 1:1 learning opportunities, pupil A manipulated play materials when asked to imitate adult actions. However, these same actions were not repeated during child-initiated play sessions; he usually watched others or engaged in stereotypic behaviour in the form of spinning on one foot.

Pupil B. Pupil B was a male in year 3 (aged 7 years and 4 months), who had diagnoses of SLD and ASD. He sometimes communicated verbally using some single words and 2-3 word phrases such as "go to toilet" or "I want crisps". At the age of 41 months he was assessed using the Griffiths Mental Developmental Scale (GMDS); results indicated a developmental age of 24 months. Much of his utterances were echolaic and/or repetitive. Alongside speech, he used Picture Exchange Communication System (PECS) symbols (Frost and Bondy, 2002) as a form of communication. He discriminated between a range of symbols representing preferred items. He worked within PECS phase IV, using symbols/words.

During play sessions, he typically used the train set. If the train set was not available, his level of engagement with play materials was low. He sometimes exhibited aggressive behaviour towards peers by hitting them if they came close to him or tried to touch items he was using. He sometimes banged the table with fists or open palms, and stamped his feet. He occasionally exhibited self-injurious behaviour (SIB) by punching the top of his own legs. His stereotypic behaviour included repetitive vocalization and manipulation of objects, for example saying "a-dee a-dee a- dee" while banging a toy train up and down on the table. When asked to participate in a non-preferred activity, pupil B sometimes made loud crying noises.

Pupil C. Pupil C was a female in year 7 (aged 11 years and 10 months) who had a diagnosis of SLD and a severe delay in speech and communication. She had been assessed as having a chromosomal disorder and some characteristics consistent with a diagnosis of ASD. At the age of 48 months she was assessed using the GMDS, which indicated a developmental age of 18 months. Although she made some individual speech sounds, she did not articulate single words. She used Makaton sign language for "more" to indicate she wanted more food, however her main form of communication was with PECS. Discrimination between a range of symbols occurred and she used a sentence strip to request items, such as "I want crisps", communicating at PECS phase IV.

Pupil C sometimes engaged in SIB by biting the back of her hand, she also chewed the cuffs or top of her sweatshirt. During play sessions she typically engaged with the dolls house and small figure, often engaging in stereotypic behaviour in the form of mouthing objects and/or rocking from side to side repeatedly while standing or sitting on a chair. She sometimes made loud moaning noises when asked to do non-preferred activities. If the adult persisted with the request, she sometimes lay on the ground, moaning, refusing to get up. Pupil C could feed herself using her hands but needed supervision to avoid choking, as she tended to cram too much food into her mouth at one time.

Pupil D. Pupil D was a male in year 5 (aged 9 years and 7 months) who had a diagnosis of SLD and diagnosis of ASD. Although he could make some individual speech sounds, he did not articulate single words. He used some single PECS symbols representing highly preferred food items and was learning to discriminate between them, working at PECS phase III.

During play sessions he engaged in stereotypy involving small world plastic figures. This typically involved spitting on his fingers and rubbing the spit across the figures. He mouthed the figures and also rocked them repeatedly on different surfaced, making a rattling noise. He engaged in high-pitched repetitive speech sounds. He pulled at adults towards preferred objects that he wanted. He stamped up and down on the spot if denied a preferred item and grabbed at adults hands, squeezing them hard with both of his hands. Pupil D could feed himself using his hands but needed constant supervision to prevent overfilling his mouth.

Pupil E. Pupil E was a male in year 4 (aged 9 years and 1 month) who had a diagnosis of SLD, a diagnosis of ASD and suspected Angleman syndrome (he was undergoing diagnostic assessments for this). He walked with an awkward gait and had limited control over his limbs, often bumping in to furniture and sometimes dropping to the floor. He made some discernible speech sounds, though did not articulate whole words. He communicated with a large single symbol to exchange for a highly preferred food item working at PECS phase I.

Pupil E had limited fine motor skills; using his thumb and forefingers to pick up and release items was a challenge. He sometimes had a pronounced tremor when using his hands. His stereotypic behaviour involved repeatedly trying to open doors that were locked; if they were unlocked he opened and shut them repetitively. Sometimes, he tipped over chairs by pulling on the backs of them. He also picked up items and threw them up over his head. Pupil E often stood beneath strip lights on the classroom ceiling. He stared at them while repetitively clapping his hands. He sometimes banged his own head against a door, wall or piece of furniture. Pupil E was learning to feed himself with a spoon and required constant supervision while eating.

Pupil F. Pupil F was a male in year 7 (aged 11 years and 3 months) who had a diagnosis of PLD and a diagnosis of ASD. He made some individual speech sounds, though did not articulate any single words. He often laughed loudly for no apparent reason. He communicated with a single symbol to exchange for a highly preferred food item, and was learning to travel with his symbol, working at PECS phase II.

Pupil F had a very flexible body and engaged in back bends often dropping to the floor. During play sessions his stereotypic behaviour involved pacing back and forth across the room and fiddling with his ears repeatedly by flicking them with his fingers. He sometimes engaged in SIB in the form of hitting his own head with his hand. Aggressive behaviour included banging his head against an adult. He did this against an adult’s arm if the adult was next to him, or against the adult's chest if the adult was behind him. He sometimes lay on the floor refusing to get up, kicking out at adults who approached him. Pupil F grabbed at any food that was near him, including hot food. He was learning to feed himself with a spoon.

Pupil G. Pupil G was a male in year 3 (aged 8 years and 1 month) who had diagnoses of SLD, obsessive-compulsive disorder (OCD) and ASD. At the age of 27 months he was assessed using the GDMS, which indicated a developmental age of 16 months. He made some individual speech sounds, though did not say single words. He communicated with a single symbol to exchange for a highly preferred food item and was learning to discriminate between a symbol and a distracter, working at PECS phase III.

Pupil G’s stereotypic behaviour included lying on the floor or across several chairs. He engaged in repetitive vertical or horizontal hand movements in front of his own face. He sometimes licked his fingers repeatedly. He often engaged in repetitive speech sounds or high pitched screaming. Aggressive behaviour included grabbing and twisting adult forearms with both of his hands. He also grabbed the back of an adult's hand and rubbed his chin with force onto it. Sometimes he grabbed an adult's hand, put it to his own mouth and coughed on it repetitively. Pupil G sometimes pushed adults out of the way with the palms of his hands, or used the force of his body by pushing sideways onto an adult. Pupil G had an extremely limited diet, consisting of 2 types of food and 1 type of drink. He ate one particular brand of yogurt as well as one particular brand of baby biscuits. He ate the biscuits only if they were broken into 4 pieces. He drank apple juice but only if it was in a particular bottle that he sucked from. Pupil G attempted to elope when out of the classroom environment and needed the support of 2 adults when he left the building.

Pupil H. Pupil H was a male in year 4 (aged 9 years and 2 months), had diagnoses of SLD, ASD and Fragile X Syndrome. He made some speech sounds but did not articulate single words. He sometimes made loud repetitive sounds. He communicated using single PECS symbols and was being taught discriminations between a range of highly preferred PECS symbols and photographs at PECS phase III.

Stereotypic behaviour involved repeatedly skipping back and forth, sometimes while swinging a stretchy toy from one hand. He engaged in aggressive behaviour such as slapping or punching peers or adults. Pupil H also engaged in SIB; repeatedly punching the side of his head, banging his head on the table or floor, biting the back of his hand or biting his first finger. If presented with a plate of hot food, pupil H had a tendency to throw it. He preferred to eat small pieces of cold food such as cubes of raw vegetables or cheese.

Pupil J. Pupil J was a female in year 8 (aged 12 years and 3 months) who had diagnoses of SLD, attention deficit hyperactivity disorder (ADHD), ASD and Tubular Sclerosis. She was also diagnosed with epilepsy and during the first year of the study had a Vagus Nerve Stimulator fitted to control epileptic seizure activity. She made some speech sounds but did not articulate single words. She communicated by exchanging a single symbol for a highly preferred food item and was learning to travel with her symbol, working at PECS phase II.

Pupil J’s stereotypic behaviour included mouthing objects, flicking through the pages of a book repeatedly, tapping an item next to her ear or tapping an item on her face. Pupil J could feed herself cold food with her hands but needed constant supervision to avoid choking. She only ate hot food it she was spoon-fed.

Pupil K. Pupil K was a male in year 4 (aged 8 years and 1 month) who had diagnoses of SLD and ASD. At the age of 43 months he was assessed using the GDMS, which indicated a developmental age of 24 months. He communicated using speech, in short 3-5 word sentences, often repeating words from preferred films or television programs.

Pupil K sometimes engaged in aggressive behaviour towards adults and pupils, in the form of kicking and hitting. Stereotypic behaviour included repetitive vocalization that was out of context, such as loudly shouting "help" or "mum". If asked to participate in a non-preferred activity, pupil K sometimes lay on the ground and kicked out at anyone approaching. His preferred activity was the computer. When this activity was terminated, he sometimes picked up and threw the monitor or hit out at adults.

Ethical Opinion

A favourable ethical opinion was sought and gained for this study. Measures taken to maintain participant confidentiality and to protect and store data are described.

School approval. The study was carefully planned in conjunction with the school's Head of Education who was ultimately responsible for the welfare and educational provision of all pupils in the school. Professional decisions about teaching methods do not typically require ethical approval or child/parent consent, and the Head of Education was satisfied that the planned procedures were both ethically and educationally sound. As such, the teaching methods described were agreed as part of the educational curriculum for the pupils within the study.

Research approval. While teaching methods do not need a formal opinion from an ethics committee per se, these specific teaching methods formed part of a research project involving pupil participants and as such, in line with legislation of research projects involving human participants, a Research Governance Framework

(RGF) student project registration form was completed (see Appendix I). It was submitted with the Screening Form for Ethics Submission and the Ethical Review Checklist to the Tizard Ethics Committee in September 2012: The PhD project was subsequently approved in October 2012.

Parental approval. A meeting was held with the parents of pupil A prior to beginning the pilot study. The project was explained and the parents gave consent for their son to be taught via the proposed methods. The project plans were shared with the parents and carers of individual pupils in the main study in person at a meeting held at the school and in writing via a letter (see Appendix J). The rationale and procedure for teaching Activity Schedules to pupils was explained. As pupils within the study were assigned a letter, and not referred to by name, they remained anonymous. This measure to maintain confidentiality was explained to parents and carers who were given the opportunity to ask questions, and ultimately refuse permission for their children to be participants within the study. The response to the meeting was overwhelmingly positive and no parents or carers refused permission.

Data protection and storage. Three of the pupils in the main study were designated as Children in Care (CiC) as they lived with foster carers. A school policy stated that no photographic images or DVDs of CiC pupils could be shown outside of the school environment. DVDs were not taken of pupil participants who were designated as CiC.

Of the remaining pupils who lived with their parents, consent to take and share DVD footage internally and externally was given. In line with the school's usual procedures regarding consent and privacy, parents of pupils in the study had already given written consent for photographic and DVD images of their child to be used both internally and externally of the school. However, as DVDs were planned as part of a research project, parents were given the opportunity to refuse permission for any research DVD footage to be shared outside of the school. Parents of one pupil gave consent for DVD footage to be taken and reviewed within school, but refused permission for the footage to be shared outside of the school. DVD footage of this pupil has not been shared.

All data, including DVD footage, was kept on secure devices with password protection. DVD footage was taken and viewed primarily for the purpose of collecting some inter-observer agreement and for discussion purposes. Plans were made to share DVD footage with university students and staff whom had a professional interest in the procedures used. Permission was sought specifically for this purpose, and most parents gave consent for DVD footage to be shown in educational establishments. Only footage from parents who agreed to this in writing was shown.

Confidentiality. Details pertaining to pupil and adult participants within the study have been kept confidential. The assignment of letters to identify individual pupils ensured they remained anonymous. Adult participants are not named or described individually. The HLTA gave verbal permission for her additional qualifications to be described within the adult participant section.

On-going Approval. Parents and carers were given regular updates regarding pupil progress via notes in the daily home/school book, conversations at parents' meetings and through progress data shown via graphs that were sent home. All parents and carers were given opportunities to watch their child engage in an activity schedule in the classroom and/or to view DVD footage where applicable. Parents and carers were given the right to withdraw their child from the study at any time. Parents and carers of five of the participants viewed the procedure. No parents or carers withdrew their child.

Intervention Overview

The intervention comprised three main components; pre-requisite skill training, activity schedule training and play skill observation sessions. Additionally, probe data were taken at an 11-month follow up, when social validity measures were also taken. A brief synopsis of each of the components of the study is given, followed by a summary presented in tabular form, in Table 5.2.

Pre-requisite skill training. Three pre-requisite skills necessary to begin activity schedule training were identified; 1) attending to a picture on a page 2) matching identical objects and 3) matching object to picture. For activity schedule training to be successful, these skills were considered to be important within individual repertoires (Krantz & McClannahan, 1999). The 3 skills were tested in individual pupils and, where necessary, subsequently taught via specific teaching procedures. Methods used to teach these skills and results are described in Chapter 6.

Activity schedule training. Following pre-requisite skill training, pupils were introduced to activity schedule training two at a time. Pupils were taught individually using a most-to-least prompting procedure. Component completion data were taken to provide a percentage of independent schedule following. Methods used to teach activity schedules, and results are outlined in detail in Chapter 7. Follow up data were taken during activity schedule sessions 11 months following the end of the main study. This data is also presented in Chapter 7.

Independent play sessions. Throughout the study, pupils were observed in regular child-initiated, independent play sessions. These sessions occurred prior to and during the period when pre-requisite skill training, as well as activity schedule training, was delivered. Levels of engagement with play materials were measured and the type of play material engaged with was recorded. The impact of activity schedule training on pupil play skills was estimated. Methods used to measure independent play, and results are described in Chapter 8.

Social validity. A measure of the project's social validity was taken via questionnaires given to adult participants, parents and carers of pupil participants following the end of the intervention, a month prior to follow-up data being collected. Methods used to obtain social validity measures, and results are presented in Chapter 9.

A summary of the intervention is given in Table 5.2, which describes the purpose, procedure and measurement system of each aspect of the intervention.

Table 5.2

Summary of Study Components and Data Collection Procedures

Study Component	Purpose	Procedure	Measurement
Pre-requisite skill training	To teach specific skills: 1. To attend to a picture on a page, 2. To match identical objects, 3. To match objects to pictures	Discrete trial teaching procedure	Event recording to produce a percentage of accuracy
Activity schedule training	To teach engagement in a sequence of play activities by following a picture-based schedule	Multi-component teaching package comprising a pictorial schedule and a most-to-least prompting procedure	Component completion data to produce a percentage of independent schedule following
Play observation sessions	To measure engagement with play materials, and incidents of SIB and aggression during child-initiated play sessions	Observations of child-initiated play sessions	Interval recording to produce a percentage of time during which engagement with play materials, SIB and aggression occurred, Written notes to produce a list of types of material engaged with
Follow-up activity schedule observations	To measure independence with activity schedules and assess longevity of skills acquired during main study	Observations of activity schedule sessions	Component completion data to produce a percentage of independent schedule following
Social validity measures	To measure social validity of study by obtaining opinions of adults involved in study	Questionnaires given to patents/carers and school staff	Likert-type rating scale to produce mean responses to statements, Written comments to provide qualitative response.

Note. Likert-type rating scale is based on the measurement scale devised by Likert (1932).

Project timeline. Each pupil was taught and observed on an individual basis resulting in a wide variation in time taken to master the pre-requisite skills. Due to this disparity, some overlap in the different components of the study was inevitable; while some pupils continued with pre-requisite skill training, other had mastered these skills and had begun activity schedule training. Pupils were introduced to activity schedule training in pairs, and the timing of this was staggered. Play skill sessions, however, were observed throughout the study. Some aspects of the study, therefore, ran concurrently while other aspects were sequential. To provide a visual framework for the intervention, a project timeline is presented in Figure 5.1.

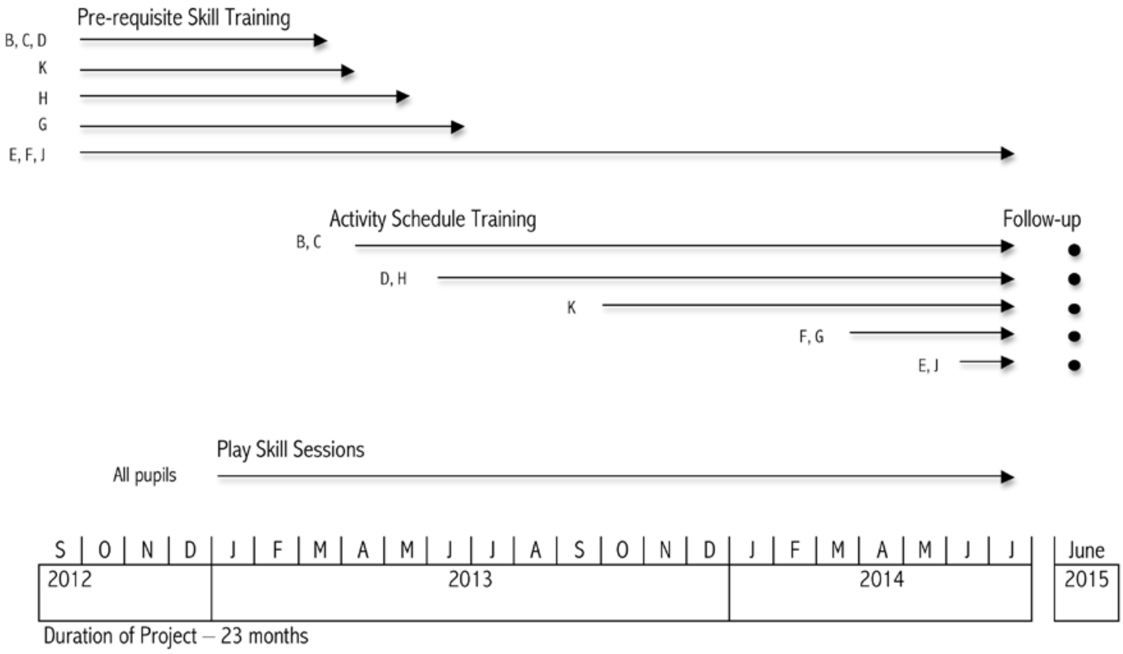


Figure 5.1. Project timeline

A timeframe of 2 academic years was allocated to the study, from September 2012 to July 2014. The time line represents months during this period, with pupils represented by letters B to K. The return visit to the school to collect 11-month follow-up data is shown, following a break in the timeline that extends to June 2015.

For all pupils, pre-requisite skill testing and subsequent training began in October 2012, followed by activity schedule training. Start and end dates of the different aspects of the project are broadly indicated for each pupil with arrows, showing variation in times taken to reach mastery. The first pair began activity schedule training in April 2013, with the final pair beginning training in June 2014. From January 2013, pupil engagement with play materials was measured in play skill sessions that occurred on a regular basis until July 2014. From April 2013 to July 2014, play sessions, pre-requisite skill training and activity schedule training ran concurrently.

Strategies to Promote Consistency and Measurement Quality

To avoid results being confounded by any inconsistencies in procedural application, ensuring the independent variable is applied as planned is important (Cooper, Heron & Heward, 2007). With this in mind, specific measures were taken to avoid confounding variables while promoting a consistent approach.

Definitions and protocols. To ensure that all procedures were administered properly and consistently, operational definitions used at different stages of the project were kept deliberately simple and precise. Protocols were written to explain exactly what should and should not be included within specific procedures, and scripts were written where necessary. These are presented where appropriate in the chapters that outline procedures for the study.

Staff training. At the start of the study, the majority of adult participants had limited knowledge or experience of using ABA procedures. Training was given on the basic principles of behaviour analysis such as the 3-term contingency and functional analysis of behaviour. Training was also given on behaviour analytic procedures such as errorless learning techniques, discrete trial teaching, the use of reinforcers and prompting procedures. Members of staff were taught to collect data accurately. Training was given via a series of workshops that incorporated DVDs to explain and demonstrate procedures, subsequent group discussions and practical experience.

Specific training was given to adult participants on discrete trial teaching, as this was the main method of teaching within the class. All adult participants were trained through verbal instruction, sharing of protocols and scripts and via modelling of procedures. Prior to working with the pupils, staff gained direct experience in discrete trial teaching via role-play exercises.

Following training, staff members were provided with written guidelines to follow. The first pre-requisite skill teaching sessions delivered by adult participants were directly supervised and further training was given as required until all procedures were applied consistently. Some sessions were recorded on DVD so that procedures could be reviewed and validated or amended as necessary. Regular staff meetings were held to discuss and review procedures. Further observations of adult participants were made throughout the study to promote consistency of approach across all procedures.

Inter-observer agreement. Quality of measures, obtained at various points of the intervention, was taken via inter-observer agreement (IOA). Two or more independent observers measured the same events then reported on the observed values. These measures served four main purposes (as advised by Cooper, Heron & Heward, 2007); for determining the competence of new observers, to identify any observer drift, to identify if the target behaviour was clear and with multiple observers collecting data, to increase confidence that any reported changes in behaviour were likely to reflect actual change (p.113). IOA was obtained and reported during activity schedule training (described in Chapter 7) and during play observations (described in Chapter 8).

While no experimental design can fully control all variables, efforts were made to identify, then reduce or eliminate any potentially confounding variables. Methods used throughout each phase of the study were validated by the main supervisor via direct observation, and by both the main and second supervisors of via analysis of DVD footage.

Summary and Conclusion

This chapter has provided an overview of the entire project. The main research aims and questions were specified. A rationale was given regarding the design on the intervention, based on salient information gleaned from the literature review and background information. Adult participants were described and pupil profiles described pupil characteristics in detail. Measures used to obtain ethical approval were given. A project overview presented a summary of the intervention chapters within this thesis. It described the 3 main components of the intervention, the subsequent chapters that outline follow-up data and social validity measures. A project timeline provided a visual reference for the project. Measures taken to promote a consistent approach during the delivery of interventions were outlined.

Methods used to train the 3 pre-requisite skills necessary for activity schedule training are presented in the following chapter. Results of the testing and training are given and discussed.

Chapter 6

Pre-Requisite Skills – Training Methods and Results

Overview

Many school curricula include strategies for teaching individuals diagnosed with autism to discriminate between types of stimuli and to match certain stimuli to each other; these skills are arguably components of all cognitive, communication, social, academic and self care skills (Green, 2001). Discrimination and matching skills are requirements prior to following an activity schedule.

According to McClannahan and Krantz (2010), while some skills can be acquired while engaging in activity schedule training, others are important to have in individual repertoires before training commences. There are three specific *pre-requisite skills*: The first (a discrimination skill) is being able to distinguish a picture from a background. This is because some children diagnosed with autism will attend to an aspect of the background rather than the image in the foreground; focusing on a small detail or the shine on the paper, for example. The child therefore needs to learn that it is the central image that has significance. The second and third skills (both matching skills) are to match an object to an identical sample, and to match an object to a photograph of the same object. Many children diagnosed with autism do not equate the 'sameness' between identical objects, and have not learned the relationship between objects and pictures, that a 2-dimensional image represents a 3-dimensional item. They therefore require instruction to acquire this understanding.

These three skills correspond with the skills required to follow a paper-based activity schedule, which is the intervention selected for this study. Attending to a photograph in a folder, then identifying the photograph with the object is essential for retrieval of the corresponding items necessary to complete the activity.

Each pupil in the study was tested for the three pre-requisite skills in October 2012; no pupil had these discrimination and matching skills within their repertoires. A training program was subsequently designed. This chapter outlines methods used to teach these three skills. Teaching procedures are described in detail, and results are presented.

Methods

Methods are based on those developed by MacDuff, Krantz and McClannahan (1993) and recommended by McClannahan and Krantz (2010).

Setting. Sessions took place within the natural environment of the classroom. Pupils worked on an individual basis with a trainer, at their usual learning stations. Up to five pupils and five trainers were in the same room at the same time. A learning station consisted of a table with a chair either side of it, facilitating face-to-face learning. Each station was situated at least two meters away from another. Pre-requisite skills were taught within each pupil's individual teaching session, conducted on a 1:1 basis as part of usual classroom routines. Teaching sessions comprised a series of learning tasks aimed at developing core skills in numeracy and literacy; the pre-requisite skill tasks were included within each pupils planned curriculum. They were preceded by, and followed by, other instructional tasks.

Materials. Two different sets of materials (a and b) were designed for each of the three skills; these were kept in transparent wallets and labelled 1a and 1b, 2a and 2b, 3a and 3b. Materials were selected on the basis that they were different from materials that would be used during activity schedule training. This was to prevent any skill acquisition with particular stimuli during pre-requisite skill training being a confounding variable during activity schedule training.

Each pupil was assigned one set of materials for initial training. Resources were selected on the basis that they were items commonly found within school classrooms and were readily available. Once mastery was achieved with one set, then another set was introduced. Two different sets of materials were used to ascertain whether or not skills would generalise across different materials. This would preclude the possibility of any pupil engaging with the materials due to personal preference for the images or objects. Pupil A had been taught the pre-requisite skills during the pilot study; this experience revealed that for practical reasons A5 sized paper resources were easier to manage than those of A4 size, so resources of A5 size were used for training purposes. Resources used for skill training are described.

Picture versus background materials – skills 1a and 1b. A book was designed for picture versus background skill training. This consisted of five A5 laminated pages held together by a metal ring. The pages in each book were plain and of the same colour, although different colours were used for different books (yellow, beige, green, blue). A sticker between approximately 1cm and 3cm in diameter was placed on each page. The stickers were placed randomly at different locations on each page. Two sets of five books were made for pupil use (10 books in total). The first set of five books had stickers that were circular and plain in colour. The other set of five books contained a variety of images such as vehicles, household items and flowers. For example, one set had stickers of a spanner, hat, boat, dice and a jam jar. Figure 6.1 shows some sample books.

Figure 6.1. Sample 1b training materials.

Matching identical objects materials – skills 2a and 2b. A further pre-requisite skill was matching object to identical object. Materials in each set consisted of five pairs of identical items. Ten different wallets were made, each one containing five pairs of objects that were distinctive due to shape and colour. For example, one set included two each of glue sticks, plastic yellow peppers, mini green baskets, red cogs, stickle bricks. Another set included yellow cogs, red cotton reels, blue stickle bricks, wooden giraffes and plastic plums, as shown in Figure 6.2. None of the materials were used during activity schedule training.

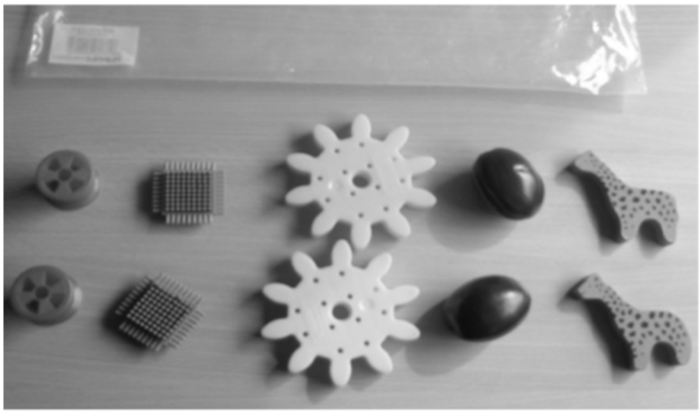


Figure 6.2. Sample 2b training materials.

Picture-object correspondence materials – skills 3a and 3b. The third skill was matching objects to corresponding photographs of the objects. Materials in each set consisted of five objects and five corresponding photographs on A5 laminated pages. Two different sets of five wallets were made. The first set of five wallets contained a plastic plum, a pink Unifix cube, a purple pen, a blue wooden block, a red stickle brick and five pages each with a corresponding photo of one item. The second set of five wallets contained a piece of train track, a paint brush, a white Unifix cube, a soft toy bird, a blue stickle brick and five pages with corresponding photographs of each item, as shown in Figure 6.3. None of these materials were used during activity schedule training.

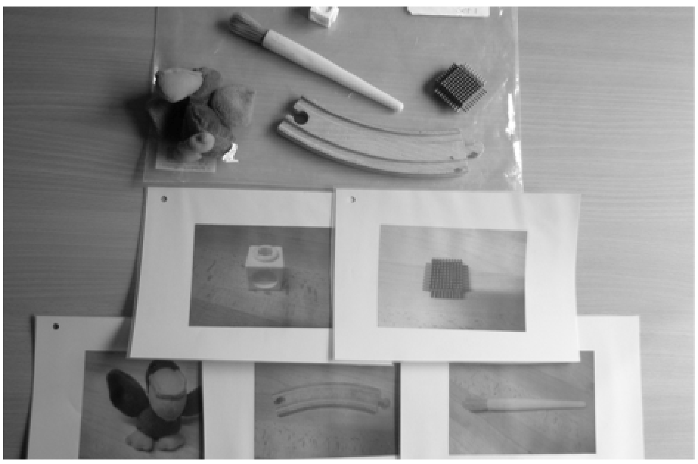


Figure 6.3 Sample 3b training materials.

Reinforcers. Highly preferred items/social interactions, or *reinforcers*, were used for each pupil during their usual academic learning sessions within the class. These varied according to the individual consisting of, for example, small pieces of edibles (e.g. flakes of cereal, raisins), social interactions (e.g. "high 5" or tickles), access to preferred items (e.g. toys) or conditioned reinforcers such as tokens for a token economy system. The same range of reinforcers used for pupils within usual academic sessions were used in the pre-requisite skill training sessions, and were given contingent on correct responses. At the start of each training session, a stimulus preference assessment was conducted to identify a preferred item for use as a reinforcer. Research has shown that multiple-stimulus preference assessments can produce results that are comparable to the results of a paired-stimulus procedure, (Higbee, Carr & Harrison, 2000; DeLeon & Iwata, 1996) and that a multiple-stimulus format in which selections are made without replacement takes less than half that required to do a paired-stimulus procedure (Deleon & Iwata, 1996). This method is therefore recommended by Cooper, Heron & Heward (p.280, 2007) as appropriate when time is limited. A brief stimulus preference assessment method with few items in an array was conducted. This was done by presenting the pupil with a small range of items known to be preferred items. The pupil was asked to “choose something to work towards” and then after responding verbally or through pointing at or touching the item, the item was selected. Reinforcers were varied to keep the potency higher.

Reinforcement criteria. In the first training session, reinforcers were provided for each occurrence of the target behaviour. A fixed rate (FR) schedules was selected over a continuous schedule as higher rates of correct responding and learning rate have been observed under fixed rate ratios when compared with continuous ratios of reinforcement (Stephens, Pear, Wray & Jackson, 1975). In addition to the comparatively high response rate, the FR schedule has an additional benefit in that after “an initial phase of ratio reinforcement, the high rates initially generated may continue under interval schedules” (p.559, Sulzer-Azaroff and Meyer, 1991). The schedule of reinforcement was thinned from a fixed ratio of every correct response (FR 1) to a FR2 or FR3 ratio and eventually after every fifth correct response (FR 5). Each pupil’s performance guided progression from a denser schedule to a thinner schedule; thinning was planned to decrease dependence on reinforcement while simultaneously increasing independence. Ongoing evaluations informed the process and small increments of schedule change were made, as recommended by Cooper, Heron & Heward (p.285, 2007), to avoid ratio strain (p.314). From the second training session, if 2 correct responses occurred consecutively, the ratio changed to FR2, then after 3 consecutive correct responses it changed to FR3, and so on. Each pupil's schedule of reinforcement was written on the data collection sheet. As the ratio changed, this was noted by hand on the data collection sheet, which ensured consistency between the different adults who worked with the pupil.

Measures. The trainer collected data during sessions that occurred approximately four or five times per week. A data collection sheet was used, in real time measurement. To maintain continuity for the adult participants, it was decided to use the data collection sheet already designed and used within the class for other pupil learning sessions, rather than the design used by McClannahan and Krantz (2010). This was adapted for each of the skills; the pupil's learning objective was added with instructions for adult presentation of materials and vocal cues to the learner. The data collection sheet designed by McClannahan and Krantz (2010) consisted of 10 trials for some skills and 5 trials for others. In the absence of a rationale from McClannahan and Krantz (2020) for differing number of trials for different skills, and to avoid confusing pupils and staff, it was decided to standardise the number of trials. This provided a consistent approach for all. Five trials were conducted for each of the 3 skills (15 trials in total) to promote a consistent approach across skill tests. Figure 6.4 presents a sample data collection sheet for skill 1a.

Pupil: *B*	
ABLLS Curriculum Area: Visual Performance – attending to a picture	
Resources: *Set 1a*	**Learning Objective:** *To identify a picture from a background*
	Adult Presentation: *Place book on table facing pupil* *Turn a page in the book*
	Adult Instruction: *Say "where's the picture?" or "touch the picture"*
Reinforcement Schedule: *FR1*	**Pupil Target Response:** *Points to or touches picture*
Prompting Code: /=correct x=wrong vp=verbal prompt gp=gestural prompt pp= physical prompt	

Date	Staff	Probe	1	2	3	4	5	%	Comment
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							
		Y N							

Figure 6.4. Sample data collection sheet for skill 1a.

As consistent with usual classroom procedures, a probe test for each skill was conducted on a daily basis before any training took place. This consisted of a skill test being presented, which resulted in a Y (yes) or N (no) being recorded to indicate if the pupil had accurately responded. For each of the skills, if N was recorded, this was followed by 5 trials. A correct response was defined as the pupil "points to or touches the picture" in the picture versus background task, and "points to, touches or picks up the matching item" in matching identical objects and picture-object correspondence tasks. Correct responses were recorded as a diagonal line (/). The highest level of prompt was recorded for each trial as physical prompt (pp), gestural prompt (gp) or verbal prompt (vp).

Criterion for success. At the end of the training session, a percentage of trials completed correctly was obtained by totalling the number of correct responses, dividing by 5 and multiplying by 100. A criterion for mastery of each skill was set at 100% accuracy with both sets of materials with at least two adults.

Reliability. Each trainer collected event-recording data during training. The target of mastery with at least two different adults was designed to test for generalisation of skills across individuals. Each pupil worked with several different trainers across each week. Results of data collection sheets were reviewed on a weekly basis. When data collection sheets indicated that a pupil had mastered the skill with two different adults, either the HLTA or the researcher conducted the tests independently to verify that the pupil could complete each task objective.

Procedure. When conducting a probe test, no form of prompting was given by the trainer to elicit a correct response. However, during training, specific teaching procedures were used to teach the pre-requisite skills as recommended by McClannahan and Krantz (2010). These were based on discrete trial teaching (DTT) techniques and used methods to evoke errorless learning. Prompting procedures incorporating verbal, gestural and physical prompts used are described. All three skills were taught concurrently; each pupil worked on each skill during their regular learning sessions, which included other learning objectives.

Picture versus background procedure – skills 1a and 1b. A folder of pages with stickers was put on the table in front of the pupil. The trainer sat opposite the pupil and verbally prompted the pupil to locate the sticker by saying, "point to the picture" or "where's the picture?" The command was varied within each session. The pupil was given approximately three seconds (3-s) to respond. If the pupil responded correctly then he was praised by saying, "good pointing to the picture" or "good finding the picture". Reinforcers were given contingent on correct responding, and were delivered on a FR schedule determined on an individual basis, as noted on the data collection sheet.

If the pupil moved to make an incorrect response, for example by touching a part of the page without the picture, then the trainer intervened physically by guiding the pupil's hand towards the picture to avoid an error occurring. If the pupil made no response, the trainer gave additional prompts to locate the picture using most-to-least (MTL) prompting strategies; a physical prompt was given to guide the pupils had towards the image on the page while the adults said "here's the picture".

Prompts were faded over subsequent trials as appropriate; full hand-over-hand prompting, a lighter touch to the hand, gestural prompts or further verbal prompts were used to elicit correct responding. If errors occurred, an error correction technique was used and no reinforcement was given. The trainer turned folder pages unless the pupil turned the pages independently, and the procedure was repeated until 5 trials had been completed.

Matching identical objects procedure – skills 2a and 2b. The trainer had pairs of identical items in a wallet. One item from each pair was placed in an array of 3 across the table in front of the pupil. The trainer held up one item at a time saying, "find the same" or "match". The command was varied. The pupil was given approximately 3-s to respond. If a correct response was made the pupil was praised by saying "good matching" or "good finding the same". Reinforcers were given contingent on correct responding, and were delivered on a FR schedule determined on an individual basis, as noted on the data collection sheet.

If the pupil moved to make an incorrect response by reaching for an incorrect object, the trainer physically intervened by guiding the pupil's hand towards the correct object to avoid an error occurring. If, following the verbal command, no response was made; the trainer gave additional prompts for the pupil to match the item. This involved a physical prompt to guide the pupil’s hand to touch the correct item, while saying, "match" or "the same". Prompts were faded as appropriate to pupil performance; gestural prompts or further verbal prompts were used to elicit correct responding. This procedure was repeated until five trials had taken place. The order in which the items were held up was varied. When each pupil mastered matching objects in an array of three, the demand was increased to an array of five.

Picture-object correspondence procedure – skills 3a and 3b. The trainer had five objects in a wallet. Corresponding photographs of objects were placed in an array across the table. The trainer gave the pupil an item from the box and said, "Match" or "find the same". The command was varied. The pupil was given approximately 3-s to respond. If a correct response was made, by picking up the corresponding item or putting it down to make a pair, the pupil was praised by saying "good matching" or "good finding the same". Highly preferred items were delivered on a FR schedule determined on an individual basis, as noted on the data collection sheet.

If the pupil moved to make an incorrect response by reaching towards an incorrect photograph, the trainer physically intervened by guiding the pupil's hand towards the correct photograph to avoid an error occurring. If, following the verbal command no response was made, the trainer gave additional prompts for the pupil to match the item to the photograph, using MTL procedures as described for skills 1 and 2. The photographs were positioned in a random order each time. The objects were also presented in a random order each time. When each pupil mastered picture-object correspondence in an array of three, demand was increased to an array of five.

Measures to promote consistency. Measures to promote a consistent approach during re-requisite skill training and data collection were considered. Recording sheets used by adults during pre-requisite skill training sessions included a written procedure and script. This included the 'learning objective' to describe the aim of the task and a 'resources' section that listed what materials were required. An 'adult presentation' section outlined what the adult should physically do with the materials, an 'adult instruction' stated what should be said to the pupil and a 'pupil target response' described specifically what the expected pupil target response was, as shown in Figure 6.4.

All adults participating in the study delivered pre-requisite skill training. All members of staff attended training workshops prior to skill training being delivered to pupils. The workshops included verbal instruction, modelling of procedures, sharing of protocols and scripts, and role-play with the materials. To ensure that all members of staff delivered training in a consistent manner, each of the adults was observed individually. The recording sheets completed by adults were reviewed periodically. As pupils met targets using an array of three items (for skills 2 and 3), demand was increased. As the first set of materials was mastered, as second set was introduced. When data indicated that mastery had been achieved, these results were validated via direct observation.

Results

Following the training program, six pupils fully mastered each of the three skills prior to commencing activity schedule training. The months and year in which they mastered each of the skills is presented in table 4.1. Three pupils did not fully meet the criteria for mastery of all three skills; however, skills that were partially mastered by these pupils are indicated. The month and year in which activity schedule training was started is also shown in Table 6.1.

Table 6.1

Results of Pre-requisite Skill Training

Pupil	Skills 1,2 & 3 Introduced	Skill 1 Mastered	Skill 2 Mastered	Skill 3 Mastered	Activity Schedule Started
B	10/2012	04/2013	03/2013	04/2013	04/2013
C	10/2012	04/2013	03/2013	04/2013	04/2013
D	10/2012	04/2013	04/2013	04/2013	06/2013
H	10/2012	04/2013	04/2013	06/2013	06/2013
K	10/2012	05/2013	06/2013	06//2013	10/2013
F	10/2012	03/2013	04/2014 (partial)	04/2014 (partial)	04/2014
G	10/2012	07/2013	04/2013	04/2013	04/2014
E	10/2012	06/2014 (partial)	04/2014 (partial)	06/2014 (partial)	06/2014
J	10/2012	04/2014	06/2014 (partial)	06/2014 (partial)	06/2014

Note. (Partial) denotes a skill partially mastered.

Results for pupils B, C, D, K, H and G. Of the six pupils who mastered all three skills, time taken to mastery varied. Pupils B, C and D each mastered the skills by April 2013. Pupils H and K mastered them all by June 2013. Pupil G mastered the skills in July 2013.

Results for pupils F, E and J. When progress was reviewed in March 2013, pupils F, E and J had not made as much progress as the other pupils. A decision was made to modify the training procedures for these pupils by reducing demand and/or for modifying the materials. As pupil skill increased during modified training procedures, the demand was gradually increased with the aim of each pupil achieving full mastery of each skill. This was done on an individual basis; modifications are described in an additional observations section.

Additional Observations

Performances in training sessions are summarised for pupil F, E and J. Subsequent modifications made to pupil resources and procedures are described.

Pupil F. Pupil F mastered skill 1 by April 2013, however he had made limited progress with skills 2 and 3. Skill 2 was modified, by reducing the number of objects in the array from three to two. Pupil F successfully matched object to object in an array of two. The demand was increased to an array of three and he mastered this by April 2014. He therefore achieved partial mastery of skill 2 as he had matched within an array of three, but not five objects.

Skill 3 was modified by reducing the number of photographs in the array from three to two, and by putting a corresponding object above the photograph on the table. Pupil F was taught to match the object to the photograph with this additional cue. The object was gradually positioned further away from the photograph until it was removed altogether, and pupil F matched object to photograph in an array of two photographs. The number in the array was then increased from two to three. Pupil F was still working on matching object to photograph in an array of three in July 2014. He therefore achieved partial mastery of skill 3, as he could match in an array of two but not five photographs.

Pupil E. By April 2013, pupil E had made limited progress in all three skills. During training of skill 1, instead of touching the image, pupil E repeatedly hit the page with his open hand. The images were small and it was unclear if pupil E could see them clearly as it was suspected that he had difficulties with his vision. Materials for training skill 1 were modified by enlarging the images placed on the pages of the book. Pupil E continued to hit the page, so the materials were modified further. Instead of using a book, two individual pieces of paper were held up, one was blank and one had a sticker on it. Pupil E was asked to identify the page with the sticker. He achieved this by consistently hitting the page with the image. He therefore mastered a modified version of this skill.

Reducing the number of objects in the array, from three to two, modified skill 2. Pupil E mastered this by April 2014, and therefore achieved partial mastery of this skill, however, he had not mastered an array of three by July 2014. Reducing the number of photographs in the array, from three to two, modified Skill 3. An object was placed on the photograph, as described in procedures for pupil F. By June 2014, pupil E consistently achieved 80% mastery of this, and therefore had partial mastery of skill 3.

Pupil J. Pupil J achieved full mastery of skill 1 in April 2014; she successfully located a picture from a background. Reducing the number in the array from three to two modified skills 2 and 3. However although she sometimes matched picture to object or object to object, each in an array of two, her performance was inconsistent. Due to her medical needs, pupil J did not always participate in training sessions and when she did, her concentration was variable, possibly due to seizure activity. This could explain the variability in her performance.

Limitations of results.

Results of this study must be interpreted with caution and within the context of what was, and was not, part of planned procedures. The lack of some procedural elements, such as the absence of individual pupil data and inter-observer agreements, limit the believability and reliability of results. Only summary data was provided, and it is possible that the data collected did not accurately reflect pupil performance. Furthermore, no treatment fidelity measures were taken and therefore there is no data to indicate how consistently the training procedures were applied by teaching assistants. It is possible that inconsistent or poorly applied procedures limited pupil progress. These substantial limitations have potential implications for the results, particularly for those pupils who did not master the skills.

A further limitation is the number of trials allocated to each pupil during training sessions. Perhaps if there were more trials per skill, per session (perhaps 10 rather than 5) or if sessions were delivered on a more frequent basis (perhaps twice a day) pupil progress may have been more rapid.

Beginning training. Although these three pupils did not fully master each of the pre-requisite skills, a decision was made to attempt activity schedule training, while continuing with their skill training programs. Although he had not fully mastered skills 2 and 3, of the three pupils who had not fully mastered the skills, pupil F demonstrated most skill at this time. He was therefore selected to begin his activity schedule training with pupil G. The intervention phase of the study was nearing completion in July 2014, and although pupils E and J had not fully mastered the skills by June, a decision was made to begin training with both of them.

In the event of failure of any or all of the pupils to acquire schedule following skills, it would perhaps confirm that the three skills were indeed pre-requisites necessary for successful activity schedule training. Or perhaps, in the event of learning to follow a schedule, or having made demonstrable progress, it would reveal that these 'pre-requisite' skills could actually be acquired during activity schedule training.

Summary and Conclusion

This chapter outlined methods used to teach the three pre-requisite skills identified by Krantz and McClannahan (2010) as necessary for learning to follow a schedule. Results were presented for all six pupils who successfully acquired the skills. Results for those three pupils who did not were presented and examined in more detail. Modifications made to teaching procedures and materials were outlined and discussed, and the varying degrees of success following these modified measures presented. Limitations were discussed. The implications of three pupils not having fully mastered the pre-requisite skills were considered and the possible outcomes of activity schedule training were speculated. Following pre-requisite skill training, pupils were introduced to the main intervention; activity schedules. This is presented in the following chapter.

Chapter 7

Activity Schedules – Training Methods and Results

Overview

This chapter presents the main intervention; activity schedule training. Pupils were taught to follow activity schedules firstly via an initial training stage. Following this, some pupils progressed to a generalisation stage and finally to a maintenance stage. Criteria for progression through the stages were changed gradually and progressively via shaping and reinforcement procedures. Methods used within each of these stages are outlined in this chapter. The setting used for the intervention is described. An account is given of how pupil progress was measured, and inter-observer agreement is reported. A materials section provides an overview of resources used and presents a rationale for how activities and corresponding materials were selected. A detailed account of activities and materials for each pupil is given on an individual basis. This is followed by a comprehensive description of the teaching procedures used in each of the training stages. Measures taken to promote a consistent approach are described.

Following an account of methods used, the results of activity schedule training sessions are presented. This is done on an individual basis in the order in which activity schedule training was delivered. Follow up data were taken 11 months following the end of the study; these results are also presented. Observational notes made on pupil performance were taken during training sessions during the study as well as during the follow up sessions. These are summarised and discussed.

Methods

Methods used to teach activity schedules are described.

Setting and participants. Pupils B, C, D, E. F, G, H, J, and K, already described in Chapter 5, engaged in activity schedule training. Some of the adult participants, also described in Chapter 5, took part in training sessions as observers and/or trainers. All activity schedule sessions took place in the natural learning environment of the classroom. The initial training sessions were conducted in an area that was screened off with a large portable screen. This reduced visual distractions for the pupil in training. A single table and two storage units containing activity schedule resources were in the training area.

As pupils became proficient at schedule following (as described in the procedure section), they progressed from the initial training stage to the generalisation stage. These training sessions took place in the main area of the classroom, at the table on the other side of the screen used to separate the initial training area from the rest of the classroom. Figure 7.1 provides a layout of the classroom.

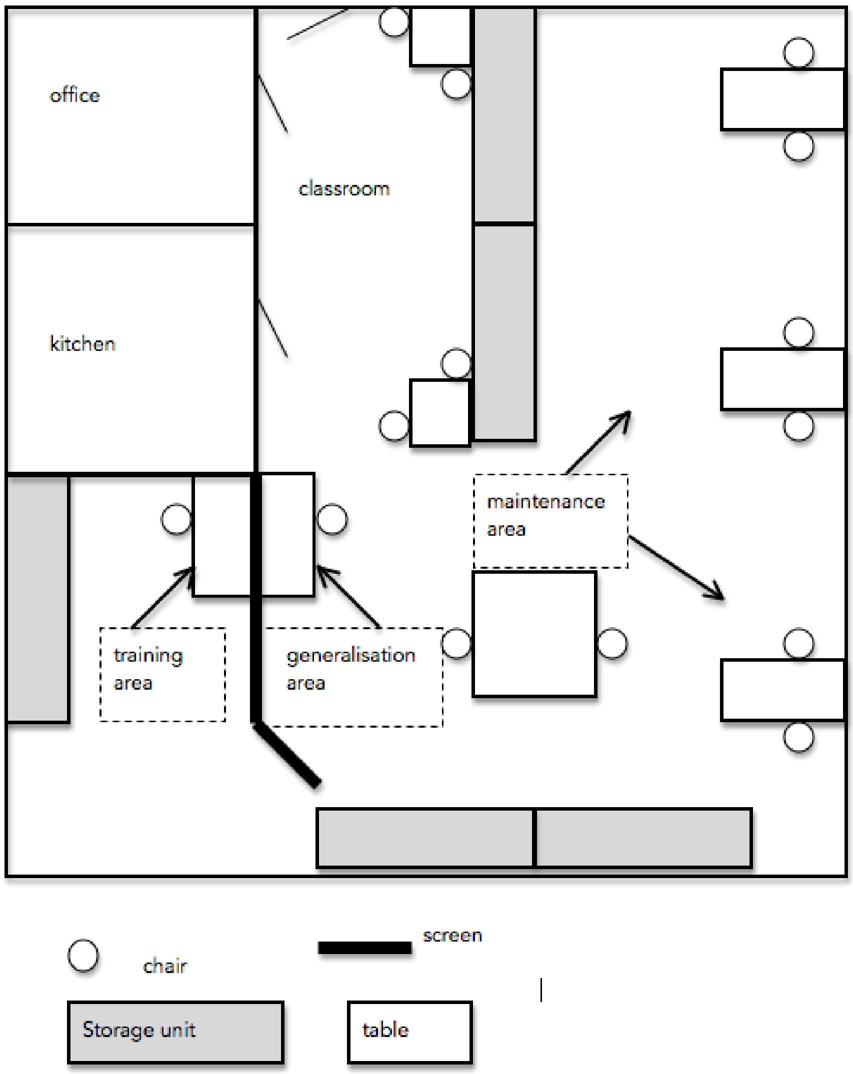


Figure 7.1. Classroom layout showing areas for activity schedule training, generalisation and maintenance.

When pupils met criteria for mastery of the generalisation stage, they progressed to the maintenance stage. These sessions took place at any table within the main area of the classroom. At all stages of training, while individual pupils were taught to follow their activity schedules, other pupils continued to work in the main area of the classroom at their learning stations. Up to five other pupils and five trainers were in the same room while the training sessions took place.

Materials. Each pupil had a personalised activity schedule box, with resources, and a corresponding ring-binder folder. Each folder contained pages with photographs representing the different activities within the schedule. Photographs were mounted onto A5 sized pages within plastic hole punched pockets, which were placed into the ring-binder folders. To maintain continuity, the pages and photographs were the same size as the ones used during pre-requisite skill training sessions. Figure 7.2 shows a ring-binder folder opened to a jigsaw puzzle task.

Figure 7.2. Sample activity schedule ring-binder folder with a photograph depicting a jigsaw puzzle activity.

Individual activity schedule boxes contained a number of transparent wallets holding materials for each planned activity within the schedule. Photographs attached to the top of each wallet corresponded with those on the pages within the ring-binder folder. For example, Figure 7.3 shows a wallet with materials required for a sorting activity. Wallets were stored in an upright position within the box, facing the same way with the photograph in front. This facilitated the action of rifling through the wallets to identify the one that was needed.

Figure 7.3. Sample wallet with materials necessary for a sorting activity.

As recommended by McClannahan and Krantz (2010), photographs used in wallets and folders represented how materials were used, by capturing a task partially completed. For example, as shown in Figure 7.4, a task of building a tower using Duplo, had a corresponding a photograph showing some Duplo blocks combined in a tower and some blocks on the table.

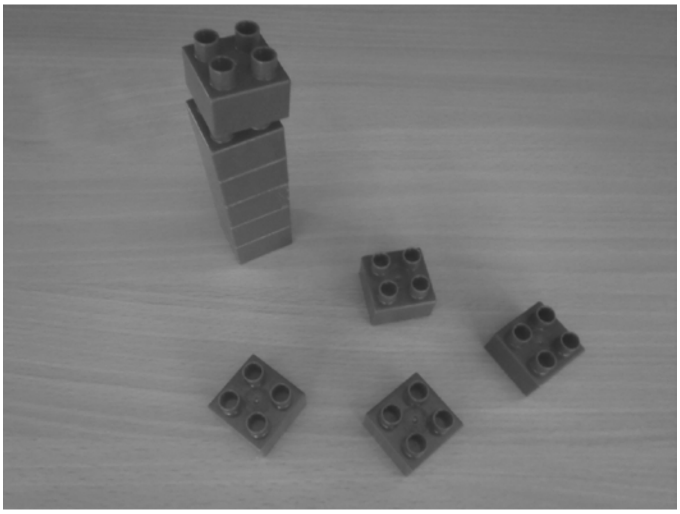


Figure 7.4. Sample photograph showing partially completed activity.

Materials for the final activity. The final activity for each pupil was highly preferred, and the materials could, therefore, be distracting. For this reason, instead of being kept in individual pupil activity schedule boxes, materials for final activities were kept separately within the storage units in the training area. These materials were made available to pupils at the appropriate time in the schedule.

Materials for each pupil were individualised, and are described in the Individual Resources and Activities section.

Selecting activities for each pupil. The number of planned activities for each pupil ranged from 4 to 6 initially, and was followed by a preferred activity. This was the terminal activity within the schedule. A minimum of five and a maximum of seven activities were designed for each pupil in total. The number and type of activity was dependent on pupil skills. As following a schedule was a new activity for all pupils, independent schedule following was targeted as the main skill for acquisition. Activities within the schedule were designed to be broadly within each pupil's repertoire.

Unique capabilities and preferences were taken into account and activities were chosen accordingly. Activities were designed for each individual on the basis that they were either similar in relation to materials used in current academic learning tasks, or in the action required to complete them. For example, for a pupil who could build a tower of five wooden bricks but did not use Lego, a task to build a tower using five Lego bricks could be suitable – the action of placing one on top of another is similar, however the materials are different. Some actions that were incorporated into the schedules would not typically be considered play. For example, sorting items according to a given criteria, or matching items that were the same, could be viewed as academic rather than play skills. These actions were selected because they are prerequisites for many other play behaviours. For example, sorting and matching items are prerequisite skills for grouping farm animals and putting them into their appropriate farm buildings.

Consideration was also given to which play materials individual pupils had independently engaged with during prior child-initiated play sessions. Some activities were specifically designed using play materials that the pupil had not independently engaged with. It was hoped that in future child-initiated play sessions, these materials would be selected independently and that skills would generalise. Some tasks were based around an action that the pupil had performed independently, so that only the materials themselves presented a new challenge. To reduce unnecessary distractions, where possible any materials that had previously invoked self-stimulatory behaviour during play sessions were deliberately not chosen for the activity schedule.

A schedule for each pupil was therefore designed with the following criteria: a) tasks would be relatively easy to achieve, b) some activities involved materials already used within daily learning tasks, c) some activities involved actions already within the pupil's repertoire but with novel play materials or play materials not previously selected by the individual and d) some of the materials were readily available within child-initiated play sessions.

Reinforcers. Two types of reinforcers were used during training sessions: *terminal reinforcers* and *in-schedule reinforcers.*

Terminal reinforcers. Highly preferred activities and/or items were identified for each individual, these were used for the final preferred activity within each schedule, and functioned as terminal reinforcers. Photographs of these items were placed on individualised choice boards for each pupil; an example of this is shown in Figure 7.5. Following a preference assessment, the selected photograph would be placed on the last page of the schedule. Terminal reinforcers were varied throughout the project to maintain pupil interest. Each pupil had a choice of at least two terminal reinforcers during each session. These items were varied throughout the project to maintain reinforcer effectiveness and avoid satiation.

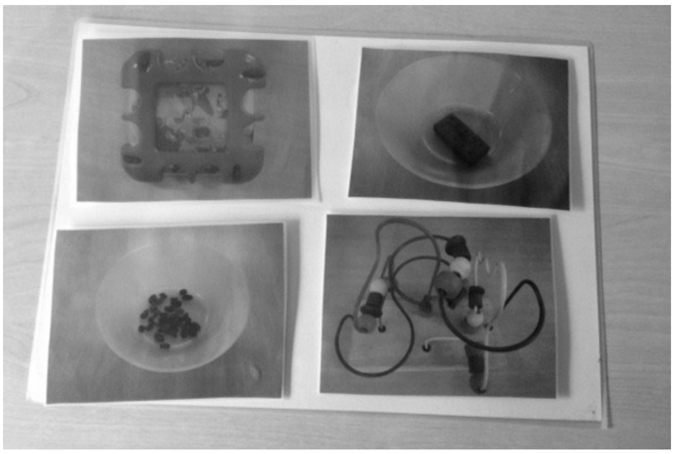


Figure 7.5. Sample choice board.

In-schedule reinforcers. In-schedule reinforcers were also identified for each pupil. These were highly preferred activities/play items or food items that the trainers had observed the pupils choosing above other food items during daily snack times. Following a preference assessment (described in the procedure section), the preferred items were delivered to the pupil by the trainer throughout the schedule, contingent on independent schedule following. As with the terminal reinforcers, in-schedule reinforcers were varied throughout the project to maintain reinforcer effectiveness and avoid satiety.

Pupil progress boards. An individual white board for each pupil was placed on the wall near the training area. These were used to make notes regarding pupil progress, and could be referred to prior to and after each training session. Information on practical aspects of the intervention such as the pupil’s training stage, preferred items and frequency of reinforcer delivery were made on the boards.

Individual Resources. Activities designed for each pupil's first activity schedule are presented, with a list of the corresponding materials required. A description is given of individual skills demonstrated during usual learning sessions, when R+ were available. An account of individual preferences during independent play sessions is also given; taken together, these provide a rationale for materials and activities selected for activity schedule sessions. Reinforcing items identified for use as terminal reinforcers and in-schedule reinforcers are also indicated.

Pupil B. In his usual learning sessions, Pupil B completed a 5-piece jigsaw puzzle, matched pairs of symbols and identified letters in his name. His fine motor skills were good; he threaded beads onto a string, put counters into a slot and pegs into a board. During play skill sessions, pupil B was observed repeatedly playing with the train track so this was deliberately not selected as a resource to be used within his schedule. He did not choose to use Duplo or play with plastic animals. Animals and Duplo were therefore chosen as resources for him. He could sort similar materials by colour, so by giving him green Duplo and different coloured animals to sort, the action was similar but the materials were new. Table 7.1 lists activities and materials used within pupil B's schedule.

Table 7.1

Resources used for Pupil B's Activity Schedule

Materials	Activity
10 green Duplo bricks, 10 toy animals, 2 sorting dishes	Sort the Duplo and the animals into 2 dishes
6 piece puzzle	Complete the puzzle
15 Duplo blocks	Build a tower of Duplo
A small pegboard, 10 small yellow pegs, 10 small red pegs	Make a repeating pattern using the pegs around the outside of the pegboard
Magnetic board, Printed name, Magnetic letters	Put the letters on the magnetic board to make own first name
Board with a row of 5 pictures, A set of matching 5 pictures	Match the pictures to the corresponding images on the board
Terminal Reinforcers	**In-Schedule Reinforcers**
Marshlander magazine, iPad	Pombear crisps (plain)
Bowl of Pombear crisps (cheese)	Hula hoops, Gluten free biscuits

Pupil C. When working with an adult, pupil C sorted by colour and matched colour pictures to identical pictures on a grid. She had limited fine motor skills however she had completed a 3-piece puzzle, put coins into a piggy bank and joined Duplo together. In play sessions however, she did not choose to play with Duplo independently. She identified her own name from a choice of two printed names, though did not independently write or use magnetic letters. A letter-matching task to make her name was designed using magnetic letters.

During play sessions, pupil C was observed playing repeatedly and repetitively with the small world figures and a “happy land” play set. For this reason, small figures were not selected for her schedule. She did not choose cars during play sessions, so these were used in her schedule. She had not been observed to touch the train set so this was selected for her schedule. As she had sorted items by colour, she was given an activity of sorting red Duplo from different coloured cars. Each of these activities presented an action that she could already do, but with materials she did not usually engage with. Table 7.2 lists the activities and materials used within pupil C's schedule as well as the preferred activities and in-schedule reinforcers provided.

Table 7.2

Resources used for Pupil C's Activity Schedule

Materials	Activity
7 red Duplo bricks, 7 toy vehicles, 2 bowls	Sort the Duplo and the vehicles into 2 dishes
4 piece puzzle	Complete the puzzle
12 Duplo blocks	Build a tower of Duplo
Magnetic letters for her name, magnetic board	Move the letters to create her first name, matching to the sample
1 board with a row of 5 pictures, a set of matching 5 pictures	Match the pictures to the corresponding images on the board
Curved train track, 3 train carriages	Join the track together to make a circle Put the trains onto the track
Terminal Reinforcers	**In-Schedule Reinforcers**
Argos catalogue iPad Bowl of Quavers crisps	Small pieces of crisps (any type, varied), Small gummy sweets (varied).

Pupil D. In his usual learning sessions, pupil D matched to sample and sorted by single criteria, for example, blue and red items. He placed large, different shaped puzzle pieces into an inset puzzle board. Pupil D displayed a high rate of engagement during play skill sessions. He chose to use the small world figures during these sessions however his behaviour with them was stereotypical – he repeatedly rubbed spit onto them and either carried them around the room or rattled them back and forth on a tabletop. He sometimes engaged in this behaviour using small plastic animals. For this reason, small world figures and animals were not selected. He did not independently use any other play materials. Table 7.3 lists the activities and materials used within pupil D's schedule as well as the preferred activities and short term reinforcers provided.

Table 7.3

Resources used for Pupil D's Activity Schedule

Materials	Activity
2 bowls, 6 toy cars, green Unifix cubes	Put all the cars into one bowl and all the cubes into the other
9 piece inset puzzle – different shapes	Complete the puzzle by putting all pieces into the corresponding holes
Peg board, 5 yellow pegs, 5 green pegs	Put the pegs into the holes to make a 2-step repeating pattern
8 red Duplo blocks	Use the Duplo to build a tower
Terminal Reinforcers	**In-Schedule Reinforcers**
Bouncy ball 2 ginger biscuits in a bowl, iPad Small world people	Small pieces of biscuit (bourbons, custard creams, pink wafers)

Pupil H. When working with an adult, Pupil H completed a familiar large piece inset puzzle, string large beads onto a lace and build a tower using five wooden blocks. During a typical free play session, pupil H did not pick up any materials available. Pupil H exhibited aggressive and self-injurious behaviour during some free play sessions. It was thought that this behaviour was escape maintained as it often resulted in access to a preferred item, which was the iPad. Pupil H frequently engaged in aggressive behaviour as well as SIB during unstructured sessions. To minimise the likelihood of any occurrence of aggressive behaviour, tasks were chosen on the basis that he would likely achieve them easily. Actions included picking up and putting down, sorting and completing puzzles. Table 7.4 lists the activities and materials used within pupil H's schedule as well as the preferred activities and in-schedule reinforcers provided.

Table 7.4

Resources used for Pupil H's Activity Schedule

Materials	Activity
3 toy cars, a road (paper with line down the middle)	Place the road on the table and place the cars in a line on the road
6 piece inset puzzle – picture of shops	Complete the puzzle by putting all pieces into the corresponding holes
2 bowls, 6 plastic pigs, 6 blue Unifix cubes	Put all the pigs in one bowl and all the cubes in another
6 green Duplo blocks	Use the Duplo to build a tower
Terminal Reinforcers	**In-Schedule Reinforcers**
iPad, Bowl of plain crisps Bouncy ball	Small pieces of crisps (varied, any flavour)

Pupil K. In his usual learning sessions, pupil K had completed a 30-piece jigsaw puzzle with some prompting from an adult. He had made a 3-step repeating pattern using pegs in a board, matched single words and matched objects to pictures in an array of 10 pictures. Pupil K's level of engagement with play materials was relatively high however he did not play co-operatively and did not share materials with others. Furthermore, the quality of his play was repetitive and limited. Although during free play sessions, pupil K used cars appropriately by pushing them around tracks, this play was very repetitive and he did not demonstrate conventional play skills with other play materials. For example, he picked up Duplo but did not build with it conventionally – instead he lined up the blocks to make a track for a car. He sometimes picked up animals and dropped them, or used them as targets to aim cars at. He sometimes became aggressive towards others during free play sessions. Pupil K's schedule included the use of Duplo, with a conventional building task. His tasks are outlined in Table 7.5.

Table 7.5

Resources used for Pupil K's Activity Schedule

Materials	Activity
5 green Duplo blocks and 5 red bricks	Join the blocks into a tower to make a repeating pattern matched to photo on wallet
12 piece jigsaw puzzle	Complete the puzzle
Multiple plastic animals – cows, horses, pigs, laminated sheet with symbol of animals	Sort the animals and put them in the correct column matching to the symbol
Peg board, pattern card, 6 green, 6 red and 6 blue pegs	Put the pegs in the board to make a repeating 3-step pattern, matching the pattern card
Magnetic board, Magnetic letters, name written on a card	Use the magnetic letters to make his name, matching to written sample
Terminal Reinforcers	**In-Schedule Reinforcers**
iPad, 2 bourbon biscuits	Small pieces of dolly mixtures
7 dolly mixtures in a bowl, Noisy books	Pieces of biscuit (varied)

Pupil F. During his usual learning sessions, pupil F had put shapes into a shape sorter. He had completed a 6-piece inset puzzle with some physical assistance. In play sessions, pupil F sometimes picked up Duplo bricks and hit them together but did not use them conventionally by joining them. He sometimes put them through an open window or threw them across the room. He often paced about the classroom or lay on the floor. Although his level of engagement was low, he did sometimes pick up animals, and then drop them to the floor. He was not observed to touch cars or trains.

His schedule involved the action of picking up and putting down. As matching shapes into corresponding holes was a challenge for him, a task of putting shapes into a container with a large opening was devised. A simple inset puzzle piece was another activity, with only four large pieces. Putting cars onto a track was selected for another task. Conventional use of Duplo was chosen for pupil F. His tasks are listed in Table 7.6.

Table 7.6

Resources used for pupil F's Activity Schedule

Materials	Activity
4 piece inset puzzle - shapes	Put the puzzle pieces into the corresponding holes
6 blue rubber vehicles, plastic container	Put the objects into the container
2 plastic cars, road map	Put the cars onto the road map
5 blue Duplo blocks	Use the Duplo to build a tower
Terminal Reinforcers	**In-Schedule Reinforcers**
Bourbon biscuit	Dolly mixtures
Tweenie toys	Small pieces of biscuit – bourbon, pink wafer
Phonics book	Pombear crisps

Pupil G. In his usual learning sessions, pupil G had completed a 6-piece inset puzzle with some physical assistance from an adult. He had matched black and white images to a grid of six images, although had not generalised this skill to novel images. During free play sessions, he sometimes touched cars and pushed them down a car ramp. He had not been observed to touch trains, Duplo or animals. His level of engagement was very low. A variety of simple activities were identified for pupil G using a range of different play materials, as described in Table 7.7.

Identifying short-term reinforcers for pupil G was a challenge. Pupil G had an extremely limited diet and his parents had requested that food and drinks were not used to shape behaviour. He was motivated by music however, and a CD player was used during his usual learning sessions. He was observed to use the controls to rewind and play the same segment of music from a SpongeBob CD. For his activity schedule, a short term reinforcer was designed based on this; an auditory switch device was used to record 6-seconds of the same segment of music, with a picture of SpongeBob placed on the top.

Table 7.7

Resources used for Pupil G's Activity Schedule

Materials	Activity
4 piece inset puzzle - dinosaurs	Put the puzzle pieces into the corresponding holes
Large peg board, 5 white pegs	Put the pegs into the board in a line
6 blue Unifix cubes, 6 plastic pigs, 2 bowls	Sort the pigs and cubes into the 2 bowls
4 yellow Duplo blocks, 4 red Duplo bricks	Use the Duplo to build a tower, making a 2-step repeating pattern
Terminal Reinforcers	**In-Schedule Reinforcers**
IPad, Noisy books V-tech camera toy	Recorded sound of SpongeBob song on BigMac switch device

Pupil E. Pupil E had a pronounced tremor when picking up and handling objects. It was difficult for him to be precise with his actions. As discussed in Chapter 6, he had not fully acquired the three pre-requisite skills; although he had identified a picture from a background, his matching to sample skills were limited. During his usual learning sessions, pupil E was developing skills in picking up and releasing objects accurately, and with intent. During play sessions, pupil E rarely engaged with any play materials unless physically prompted. Pupil E's first activity schedule was designed to be relatively simple, as shown in Table 7.8. His puzzle was a 1-piece inset with a large hole. His pegboard was a large one, with pegs that had a diameter of approximately 5cm; his task was to put the pegs into any hole. The pieces of plastic fruit fitted easily into the bowl.

Table 7.8

Resources used for Pupil E's Activity Schedule

Materials	Activity
2 piece inset puzzle - circle and square	Put the puzzle pieces into the corresponding holes
Large peg board, 2 white pegs	Put the pegs into the board
1 bowl, 3 pieces of plastic fruit	Put the fruit into the bowl
3 yellow Duplo bricks	Join the Duplo together
Terminal Reinforcers	**In-Schedule Reinforcers**
IPad, Noisy books Bowl of sweets, Toy car	Small pieces of: Sweets (fizzy type, gummy bears), Crisps (spicy flavour), Cheese cubes

Pupil J. The success rate of pupil J's performance was variable during her usual learning sessions. Her concentration level seemed to be dependent on variables such as how much sleep she had had the night before and if she was experiencing seizure activity. One of her learning objectives was to pick up and release objects with intent; this was inconsistent and some days physical prompting was necessary for her to let go of items within her grasp. During free play sessions, pupil J engaged in stereotypical behaviour, often picking up small items such as small world figures, and tapping them repeatedly on her face. She sometimes picked up a hollow shape sorter and tapped it next to her ear. Selecting materials for pupil J was challenging due to her propensity for stereotypical behaviour with a wide variety of objects. Small world people and animals were excluded. However other small pieces of material were necessary for any activity, and picking up and releasing items was part of all tasks. Table 7.9 presents materials and activities selected for pupil J.

Table 7.9

Resources used for Pupil J's Activity Schedule

Materials	Activity
1 piece inset puzzle – square	Put the puzzle piece into the corresponding hole
Large peg board, 2 white pegs	Put the pegs into the board
1 bowl, 3 pieces of plastic fruit	Put the fruit into the bowl
3 yellow Duplo blocks	Join the Duplo together
Terminal Reinforcers	**In-Schedule Reinforcers**
Bowl of sweets, Noisy books	Small pieces of: Gummy sweets, Pombear crisps, jelly snakes

Measures. Data were collected to provide a measure of independent schedule following. This was done via a component completion data procedure, using a paper-based recording sheet. An event recording procedure was chosen as an appropriate measure for discrete behaviours (Sulzer-Azaroff and Mayer, 1991). All sessions were recorded in real time.

A component completion data sheet was designed based on one designed by MacDuff et al. (1993) as provided by McClannahan and Krantz (2010), in their guide for practitioners. In their design, each of the activities was broken down into a chain of five separate components; turn page, point and look at page, obtain materials, complete activity, put materials away. For this study however, three additional components were added; removing materials from the wallet, returning materials to the wallet, as well as returning to the activity schedule folder. These additional components were added as, during the pilot study, pupil A had initially required physical prompts for these actions. It was anticipated that pupils in the main study would also need prompting to complete these steps. Breaking down the behaviour chain into smaller components ensured more detailed data collection. For this study, each activity was comprised of eight components, as shown in Figure 7.6; turning the page, pointing to or looking at the photograph, obtaining materials from the box, removing materials from the wallet, completing the task, putting materials back in the wallet, returning the wallet to the box and finally returning to the activity schedule folder ready for the next activity.

Activity Schedule Recording – Component Completion Data

Pupil:	Trainer:	Date:	IOA: Y N Observer:

Initial Verbal Prompt: *"get your activity schedule"*

Definition of Physical Prompt: *trainer's hand makes contact with any part of pupil's body*

Key: / = component completed independently p = prompt given to complete component

Order	Activity	Open book/ turn page	Point/look at photo	Obtain resource bag from box	Take resources out of bag	Complete activity	Put resources back in bag	Put resource bag back in box	Return to book
	Obtain Activity Schedule book	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Turn page	Point/ look at photo	Obtain item from table	Complete/ consume R+	Return item to table	Return to book	Close book	Return book
	Preferred Activity:								

Number of components completed independently = Total number of components =

Percentage of components completed independently:

Additional Information:

Figure 7.6. Activity schedule recording sheet.

Between five and seven activities were included within each pupil's activity schedule, each broken down into eight components. Obtaining the activity schedule at the beginning of the session was also classified as an individual component. An activity schedule consisting of five activities therefore had 41 separate components. By using a component completion recording system, a percentage of independent schedule following behaviour could be obtained regardless of the number of individual activities within any one schedule. A diagonal line (/) indicated that a component was completed independently while a letter "p" indicated that the trainer gave a physical prompt. A physical prompt was defined as "trainer’s hand makes contact with any part of pupil's body". The number of components completed independently was totalled; this number was divided by the total number of components, and then multiplied by 100 to achieve a percentage of components completed independently.

A section for additional information was included on the data collection sheet. Any additional observations were noted, including, for example, the addition of novel materials or a novel trainer within the procedure, the pupil reaching criteria for generalisation or maintenance stage, notable occurrences of SIB, aggression or stereotypy or any event occurring during training that may have impacted on pupil performance.

Data were taken during every session during the training and generalisation stages. During the maintenance stage, probe data were taken approximately once every week. Some DVD footage was recorded using a camcorder for inter-observer agreement (IOA) and for training purposes. For reasons of confidentiality, it was not permissible to record footage of pupils who were classified as Children in Care (CIC).

Reliability. Reliability measures for component completion data were taken during each phase of the intervention. To obtain inter-observer agreement (IOA), either two observers independently observed each pupil at the same time in real-time measurement, or each observer reviewed DVD footage independently at a later time. IOA was obtained by comparing component completion data (event recording, Cooper, Heron & Heward, 2007, p.115) taken by each observer, during which independent responses and/or trainer prompts were recorded. An exact count-per-interval IOA procedure was used to calculate IOA as this is “the most stringent description of IOA for most data sets obtained by event recording” (Cooper, Heron & Heward, 2007, p.115). As directed by Cooper, Heron and Heward (2007, p.116), the number of components in which both observers recorded the same behaviour (*x* for trainer’s prompt or */* for pupil’s independent response) was totalled, divided by the total number of components and multiplied by 100. This produced a percentage of components in which both observers recorded the same behaviour.

IOA was taken frequently during initial training sessions to ensure that data were reliable, and was then taken approximately once a week for each pupil, within the current convention of 20-33% of sessions (Kennedy, 2005). IOA was taken for 26-39% of sessions (29% pupil B, 28% pupil C, 26% pupil D, 32% pupil H, 27% pupil K, 30% pupil F, 30% pupil G, 30% pupil E, 31% pupil J). IOA for each pupil was calculated as being above the minimum conventionally acceptable percentage of 80% agreement (Kennedy, 2005). IOA for pupil B was 97.4% (range 88-100%), pupil C 96.7% (range 86-100%), pupil D 97.4% (range 85-100%), pupil H 96.8% (range 80-100%), pupil K 99.2% (range 94-100%), pupil F 96.1% (range 88-100%), pupil G 97.4% (range 93-100%), pupil E 97.1% (range 90-100%) and pupil J 97% (range 93-100%).

Reliability during follow-up. To obtain inter-observer agreement (IOA), two adults observed simultaneously in real-time measurement, with the researcher being the first observer and the new class teacher or the HLTA being the second observer. Two adults obtained component completion data. IOA was obtained by comparing the data taken by each observer, using an exact count procedure as used in the main study. IOA was taken for each of the sessions and was calculated as: pupil B 95.9%, pupil C 90%, pupil D 100%, pupil H 97.5%, pupil K 100%, pupil F 95.1%, pupil G 97.5%, pupil E 87.8% and pupil J 75.6%. With the exception of pupil J, IOA for each pupil was calculated as being above the minimum conventionally acceptable percentage of 80% agreement (Kennedy, 2005). It was not possible to observe pupil J a second time as she was absent for school on subsequent days during the observation week, therefore this data point has been included.

Procedure. Schedules were introduced to pupils in pairs for ease of organization. However, all pupils were trained individually. First activity schedules were designed for pupils B and C. As pupils B and C became proficient at their schedules, pupils D and H began their activity schedules. Schedules were subsequently introduced to pupils K, F and G and finally E and J. The teaching procedure had 3 stages; training stage, generalisation stage and maintenance stage. These 3 stages are described in detail.

Training stage. The training procedure was as follows:

Preparation. A trainer protocol was designed to ensure consistency of approach amongst trainers working with the pupils (see Figure 7.7). Prior to beginning the activity schedule, the trainer leading the session prepared the training environment. The pupil's activity schedule box was placed on top of the storage unit, situated approximately 2 meters from the table where the pupil completed activities within the schedule. The lid was removed so that the wallets inside were easily accessible to the pupil. The pupil's activity schedule folder was placed on the table.

Identifying potential reinforcers. At the start of each training session, a stimulus preference assessment was conducted to identify the terminal reinforcer used as the final activity within the schedule. Multiple stimulus preference assessment procedures have been shown to be effective and time-efficient (DeLeon & Iwata, 1996; Higbee, Carr & Harrison, 2000), and are recommended by Cooper, Heron and Heward (2007, p.280) when time is limited. For this reason, a brief stimulus preference assessment method with a small number of items in an array was conducted. This was done by offering a pre-task choice: the trainer presented the pupil with a choice board containing 2 to 4 photographs of items known to be preferred items. These could be edible, such as crisps or biscuits, or tangible such as specific toys. The pupil was asked to "choose one for your schedule" and then after responding verbally or through pointing at or touching a photograph; their selection was subsequently placed as the last page in the activity schedule folder. The folder was placed back on the table. Following this, a stimulus preference assessment for the potential in-schedule reinforcers was conducted. Two stimuli, known to be preferred items, were presented simultaneously to the individual. These could be edible or other items. The stimulus selected by the pupil was used throughout that activity schedule session.

Following the schedule. The trainer said, "do your activity schedule" then refrained from all forms of vocalization, remaining silent until the activity schedule was complete. Following the initial verbal prompt, the pupil target responses were to obtain the schedule folder, open the folder and point to or look at the photograph, go to the box on top of the nearby storage unit and obtain the wallet containing the corresponding task materials. He/she then took it to the table, completed the activity, put the materials back into the wallet, returned the wallet to the box, went back to the schedule, turned the page and looked at the next photograph. This procedure was repeated until all activities within the schedule were complete. The pupil then turned to the final page with a photograph of the terminal reinforcer. The trainer placed the relevant item on the top of the storage unit. The pupil obtained the item, which was consumed if it was edible, or engaged with if it was tangible.

Edible items had a natural ending, as the final activity would end when the food was consumed. Tangible items did not have a natural ending and were therefore time restricted through use of a digital timer that the trainer set to a pre-determined duration, between one and five minutes, depending on the activity and the pupil. The timer ringing signalled the end of the activity. On completion of the terminal reinforcer, the pupil put away the item/bowl and returned to the activity schedule folder. The folder was then closed and the final component was putting the activity schedule ring-binder folder into the resources box. The activity schedule session was then complete. The trainer then engaged verbally with the pupil by giving praise.

Physical prompting. Throughout the activity schedule, the trainer physically prompted the pupil to follow the procedure as necessary. This was done from behind the pupil via physical guidance to avoid errors becoming part of the routine. The trainer began the initial training sessions in close proximity to the pupil using a most-to-least graduated guidance procedure as recommended by McClannahan and Krantz (2010). Hand-over-hand techniques were used initially to physically prompt the pupil to complete the routine. As the pupil became more proficient, the trainer followed graduated guidance strategies from spatial fading to shadowing, eventually decreasing the physical proximity until the pupil followed the routine independently. Decisions regarding when to prompt, and which type of prompt to provide were made on a moment-to-moment basis, and faded within sessions in frequency and intensity as recommended by Bryan and Gast (2000).

Varying the order and the trainer. After the initial activity schedule session, the order of the pages within the activity schedule folder varied every few sessions. This measure ensured that the photographs became relevant discriminative stimuli to occasion schedule following behaviour. The order of activities was written on the component completion data sheet each time. A second trainer, the HLTA, began to deliver some of the training sessions once the pupil demonstrated increased mastery. This promoted generalisation of skills across trainers.

Reinforcing schedule following. Preferred items were given to the pupil by the trainer throughout the training sessions. As preferred items appeared throughout to strengthen and maintain behaviour they will be referred to as terminal and in-schedule reinforcers. Items were delivered contingent on independent schedule following. As recommended by Cooper, Heron and Heward (2007, p.287), for each pupil there was an initial high rate of delivery, and with a view to maintaining participation, this was reduced as the pupil increased proficiency. Reinforcer delivery was thinned throughout each activity within the schedule. Each activity consisted of 8 separate components; initially a reinforcer was delivered after each component completed independently. To reduce dependency on reinforcers, this was gradually thinned to an FR2 schedule after 2 consecutive components were completed independently, then to and FR3 after 3 consecutive components and so on until an in-schedule reinforcer was delivered only at the end of each activity. The thinning of reinforcement was done gradually to avoid ratio strain, and was individualised depending on each individual's responses to activity schedule teaching within and across sessions. To facilitate consistency, the frequency with which reinforcers were delivered was noted on an individual pupil progress board on the wall near the training area. As criteria were reached, pupils progressed from the initial training stage to the generalisation stage.

Criteria for progression to generalisation stage. Progression to the generalisation stage was dependent on the following:

- 90% or more components completed independently with two different trainers,
- Two or more consecutive sessions with 90% of components completed independently, and
- Spatial proximity of the trainer at least one meter away (unless prompting required).

Generalisation stage. Sessions within the generalisation stage were conducted in the same way as in the training sessions however they occurred in the main area of the classroom on the other side of the screen. In this area of the classroom there were more visual and audible distractions; other pupils and trainers worked at different tables or moved around the room. The trainer conducted the stimulus preference assessment for short-term reinforcers as well as the preferred activity, or terminal reinforcer, of the schedule, as described in the initial training stage procedure. The trainer gave the initial verbal prompt to "do your activity schedule", then remained at a distance of approximately one meter from the pupil unless a physical prompt was required. Physical proximity was gradually faded. Procedures to reinforce schedule following were conducted in the same way as in the initial training stage, however the schedule of reinforcement was thinned even further. Initially, a reinforcer was delivered after independent completion of each activity within the schedule; this was thinned to every 2 activities, every 3 activities and so on until no reinforcers were delivered during the schedule. Notes regarding the frequency of reinforcer delivery were made on the pupil progress board. The terminal reinforcer was made available at the end of the schedule.

Increasing generalisation skills. To ensure that further generalisation across trainers occurred, three different trainers worked individually with each pupil during this stage. To increase generalisation across materials, some activities were changed. The level of difficulty within the activity remained the same, however the materials were varied. For example, a 6-piece jigsaw puzzle was removed and replaced with an alternative 6-piece puzzle. The corresponding photograph within the folder was also changed to match the new materials. Data were collected on a session-by-session basis. Novel materials were noted on data collection sheets. The presence or absence of physical prompts when novel materials were added indicated if skills generalised to novel materials during the generalisation training session.

Criteria for progression to maintenance stage. Progression to the maintenance stage was dependent on the following:

- 90% or more components completed independently with three different trainers,
- Two or more consecutive sessions with 90% of components completed independently,
- Spatial proximity of the trainer at least three meters away (unless prompting required),

- Successful independent completion of two new activities within the schedule, and
- Schedule completed without in-schedule reinforcers.

Maintenance stage. In this stage, each pupil continued to access regular activity schedule sessions and was monitored by an observer within the same room. The observer remained at a distance of more than three meters unless intervention was required. The observer intervened and physically prompted only if the pupil became off-task for more than 5-seconds, or if self-injury or aggression towards another individual occurred.

Probe data were collected approximately once a week during this stage to ensure that mastery remained at 90% or above. Any physical intervention was recorded during the data collection sessions and if any pupil's mastery fell to below 90% independence over two consecutive sessions, procedures were returned to those followed during the generalisation stage.

Measuring generalisation skills. During maintenance sessions, materials continued to be varied for each pupil. Activities were varied in order, and novel materials were placed periodically within each pupil’s schedule. The number of novel materials increased from 1 in a schedule to 3 in a schedule, and then entirely novel schedules were presented to pupils. When probe data were collected, the presence or absence of any form of physical prompting during the procedure indicated if skills had generalised to novel materials, and/or novel schedules.

Criteria to progress through the training stages. A summary of the criteria to progress through the different stages is presented in Table 7.10.

Table 7.10

Criteria for Pupil Progression through the Stages

Procedural Elements	Criteria for Generalisation Stage	Criteria for Maintenance Stage
Spatial proximity from trainer to pupil	1 meter or more	3 meters or more
Number of trainers	2	3
Percentage of components completed independently with each trainer	90%	90%

Number of novel activities	None	2
In-schedule reinforcers	Fixed ratio, faded	None given

Extension of activity schedules - introducing choice.

During the maintenance stage, an element of choice was designed as an additional component for any pupil who had mastered their schedule for more than 6 weeks. As the intervention took place in an educational environment with a focus on continued demonstrable progress of skills, an extension activity was part of usual procedure. An element of choice was deemed to be an appropriate ‘next step’ in developing independence. The choice entailed the pupil being offered a selection of materials for a Duplo task and/or for a pegboard pattern-making task. The activity schedule page had words/symbols that specified, "choose pattern". A photograph of several sets of materials for building different Duplo structures or pegboard patterns was also on the page. The materials represented a choice of different patterns to recreate, and different levels of difficulty. Two or more sets of materials were placed within a Duplo wallet, each for building a different structure, and two or more sets of materials were placed within a pegboard wallet, each with materials to create a different pattern. The wallets had corresponding photographs that matched the one in the folder. The individual sets of materials were placed in smaller wallets, each with a photograph of the pattern to be made.

Follow up data. Visits were made to the school in June 2015, 11 months after the study ended, to collect follow-up measures during activity schedule sessions. Of particular interest to this study was the longevity of activity schedule training, specifically if individual levels of independent schedule following had maintained over time. To obtain directly comparable data, each of the nine pupils was observed using the data collection procedures that were used in the main study.

Participants. The pupil participants were the same nine pupils in the main study. The adult participants comprised the HLTA and some of the TAs who participated in the main study. However, 4 TAs who participated in the main study no longer worked within the class. Some new members of staff had joined the staffing team; these were trained by the HLTA. The new class teacher was trained in

ABA procedures as part of her MSc in Intellectual Disabilities. In order to become familiar with AS procedures she had met with the researcher and observed activity schedule sessions towards the end of the study

Setting. Following the end of the main study, the class had moved to a different environment that consisted of 2 parallel classrooms. Activity schedule sessions took place within these classrooms. Pupils B, D, K and G worked in an open plan classroom. Within this environment, pupils worked at individual tables approximately 2-3 meters away from the table where the activity schedule materials were placed. Pupils J, C, E, F and H worked in the other classroom. Pupils C and H worked at individual tables approximately 2-3 meters away from the table where the activity schedule materials were placed. Pupils J, E and F worked at a table next to a window with a screen to one side and a screen in front of the table. Their activity schedule boxes were placed at a table behind the one they worked at, at a distance of 1-2 meters.

Measures of consistency. Measures to promote a consistent approach to activity schedule training and data collection procedures were considered.

Training procedures. An activity schedule protocol clearly stating the different procedures involved in activity schedule training was designed. This included a preparation section comprising a checklist for trainers prior to training and a preference assessment section for identifying in-schedule and end-of-schedule reinforcers. An initial instruction section specified verbal prompts to be given, a trainer intervention section specified trainer actions to be made, a pupil target responses section specified target pupil responses and a recording section gave instructions of how data should be collected, as shown in Figure 7.7.

Activity Schedule Protocol

Preparation:

- Check resource wallets are in box, with photos facing the front
- Check schedule folder photos match wallets in box
- Re-sequence folder and/or wallets if appropriate
- Get in-schedule and end of schedule reinforcers ready
- Put box on top of counter, facing pupil
- Put schedule and preference assessment materials on the table
- Get recording sheet, clipboard and pencil
- Take pupil to the table where he/she will work

Preference assessment – identify in-schedule and end of schedule reinforcers:

- Show pupil 2 or 3 photos of preferred items and identify reinforcer
- Put photo of reinforcer as last page of schedule folder
- Do paired stimulus reinforcer assessment for in-schedule reinforcers
- Put schedule folder on the table

Initial Instruction:

Say "get your activity schedule"

Target Pupil Responses:	**Trainer Intervention:**
• Get the schedule • Open the folder • Point to/look at photograph • Obtain resources from box • Complete activity • Return resources • Return to folder and turn page • Repeat steps above until last task is completed • Obtain and use/consume end reinforcer • Put folder away	• Physically prompt from behind to avoid pupil errors • Give minimum level of prompts – fade out • Remain silent while pupil completes schedule • Deliver in-schedule reinforcers silently and quickly following independent behaviour • Put end reinforcer on the counter when the final page of the schedule is turned • Give verbal praise only when folder has been returned at end of final activity

Recording:

Record for each separate component of the schedule

/ = completed independently   P = physical prompt given

Complete percentage calculation. Make note of any extra information that could be relevant.

Figure 7.7. Trainer protocol for activity schedules.

Pupil progress boards. Individual white boards for pupil progress were placed on the wall near the training area. These were used by the researcher to make notes regarding each pupil's progress during the intervention, and could be referred to prior to and after each training session. Although the researcher conducted the majority of activity schedule training sessions, it was important that procedures remained consistent when other trainers were introduced. Notes regarding pupil progress included which training stage the pupil was at and the frequency with which in-schedule reinforcers were delivered.

Data collection. Fluency and accuracy of teaching procedures had been developed during the pilot study. In the main study, a camcorder was used to record the initial training sessions with some pupils to ensure that procedures were accurate. DVD footage was shared with the HLTA and other adult participants for training purposes. The HLTA was trained by via direct modelling of procedures and discussion. The HLTA was observed delivering the training to pupils, and DVDs of these sessions were viewed for further discussion. When the HLTA followed training procedures consistently, a TA was trained to the same standards. To ensure a consistent approach throughout the study, only these three adults delivered activity schedule training to pupils.

A recording sheet was designed to calculate the percentage of components completed independently during activity schedule training (as already shown in Figure 7.6). The recording sheet was used by the trainer as well as by a second and sometimes third observer. To ensure that prompts were recorded consistently, a definition of physical prompt as "trainer's hand makes contact with any part of pupil's body" was provided. The HLTA had been trained to use the recording sheet; this was done by simultaneously viewing DVD footage of a training session while each independently completed a recording sheet. Results were compared and discussed until the procedure was consistent and accurate. Further adults were trained via modelling the procedure and discussion; the adults who delivered activity schedule training as well as a further three adults. This number of trained adults was required in order to collect inter-observer agreement. Inter-observer agreement was high throughout the study indicating that procedures were valid.

Results

Pupils B and C began their schedules first, followed by pupils D and H, K, F and G and finally E and J. Pupils were taught individually, however they were introduced to AS training two at a time. Following procedures outlined in the Methods section, six of the pupils progressed from the initial training stage, to the generalisation stage and finally to the maintenance stage. While the other three pupils made progress, they remained within the initial training stage at the end of the study. Each of the nine pupils within the main study was observed individually within a 1-week period, 11 months after the main study ended. Results for pupils are presented in the order in which they began AS training.

Component completion data shows each pupil's percentage of independent schedule following across training sessions. A line of mastery, set at 90% for each training stage, is shown on each graph. A single data point indicates results for each pupil at the 11-month follow up. Where appropriate, information gleaned from additional notes made on data collection sheets is included, such as novel activities added, first novel trainer worked with pupil and any other events that may have affected pupil performance. Different data points indicate where novel activities were added, and completed independently. These suggest that schedule following generalised to novel materials without adult prompting.

Pupil B. Pupil B completed 42% of components independently during his first training session, as shown in Figure 7.8. He reached criteria to progress to the generalisation stage after only 13 training sessions. When new materials were introduced his level of mastery remained above 90%. He reached criteria for the maintenance stage after 26 training sessions. Pupil B was given an entirely novel schedule in session 38, which he completed 100% independently. An element of choice was added in session 43, and subsequent sessions. Weekly probe data were taken to measure his proficiency approximately once a week. His level of mastery remained above 90%.

Follow up data indicates that pupil B's schedule following skills had maintained over an 11-month period.

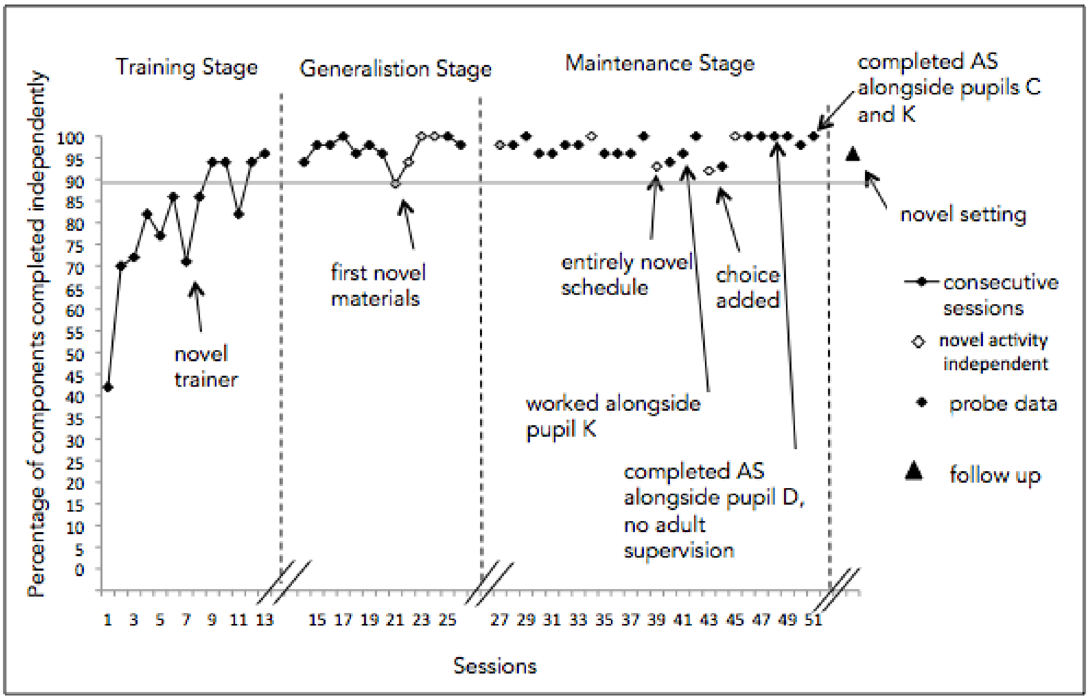


Figure 7.8. Activity schedule component completion data for Pupil B.

Pupil C. Pupil C completed 9% of components independently in her first training session and 90% of components independently during session 27. Performance after this was variable although there was an overall upward trend, as shown in Figure 7.9. Pupil C met criteria for the generalisation stage after 61 training sessions, and her performance became more consistent. She reached criteria for the maintenance stage after 77 sessions. Her first session in maintenance occurred the following day, and her performance fell to 88% independence. However, there were several distractions with groups of people entering the room unexpectedly, which could explain this decrease in independence. The following probe data revealed performance rates of 90% or above in all subsequent sessions.

Follow up data indicated that pupil C's schedule following skills had maintained over an 11-month period.

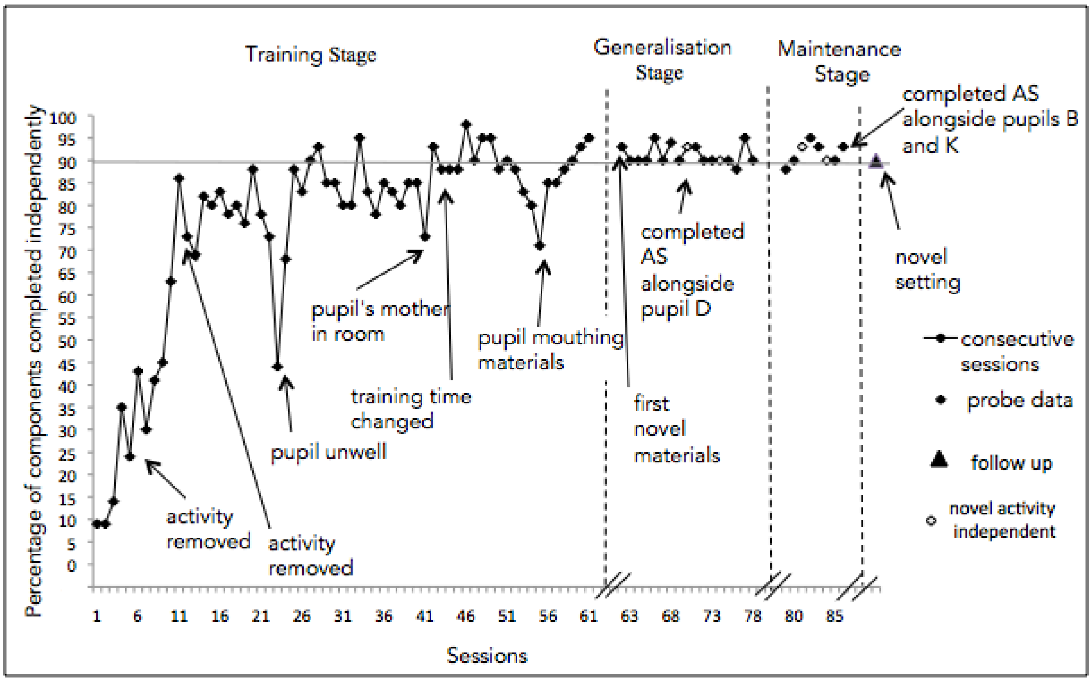


Figure 7.9. Activity schedule component completion data for Pupil C.

Pupil D. Pupil D completed 29% of components independently in his first training session and this eventually rose to 90% of components independently during session 33. However, following this, his performance was inconsistent in subsequent sessions, as shown in Figure 7.10. Pupil D's performance was affected by any change to routine such as novel trainers working with him as indicated in sessions 10 and 42 with lower levels of independence. A change to pupil D's timetable was introduced at session 76; his AS session was scheduled as his first activity following his arrival at school in all subsequent sessions.

Follow up data after 11 months indicated a slight decrease in pupil D's schedule following skills. At 84% mastery, his performance during that session was broadly comparable to his performance during the generalisation stage.

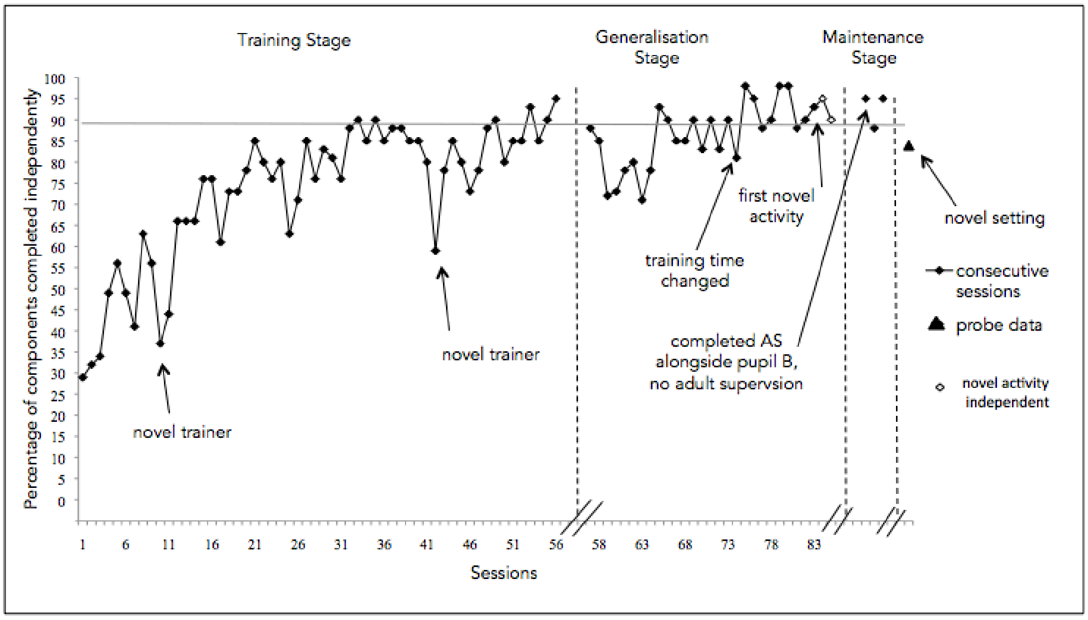


Figure 7.10. Activity schedule component completion data for Pupil D.

Pupil H. Pupil H completed 27% of components independently in his first training session, as shown in Figure 7.11. He achieved 90% independence during session 20. His performance fluctuated for several sessions before reaching criteria to move into the generalisation stage at session 39, and into the maintenance stage after 62 sessions.

A slight decrease in performance was observed during the follow up session as indicated by the single data point. At 84% independence, his mastery fell to levels seen during the generalisation stage.

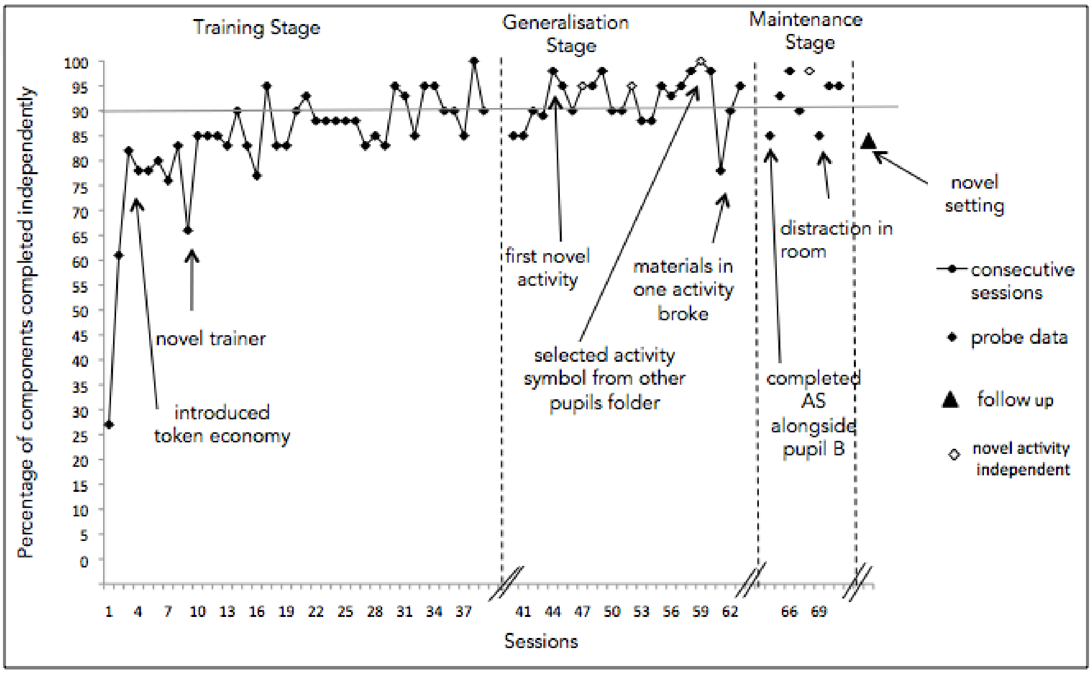


Figure 7.11. Activity schedule component completion data for Pupil H.

Pupil K. Pupil K completed 63% of components independently in his first session and continued to make progress, achieving 90% of components independently during his 5th activity schedule session. He completed his schedule 100% independently in only 11 sessions, as shown in Figure 7.12. Pupil K met criteria for the maintenance stage in session 25. He followed an entirely novel schedule and began to make choices within 2 of his activities while in the maintenance stage.

Results from the follow up session indicate that pupil K's level of mastery had maintained over the 11-month period.

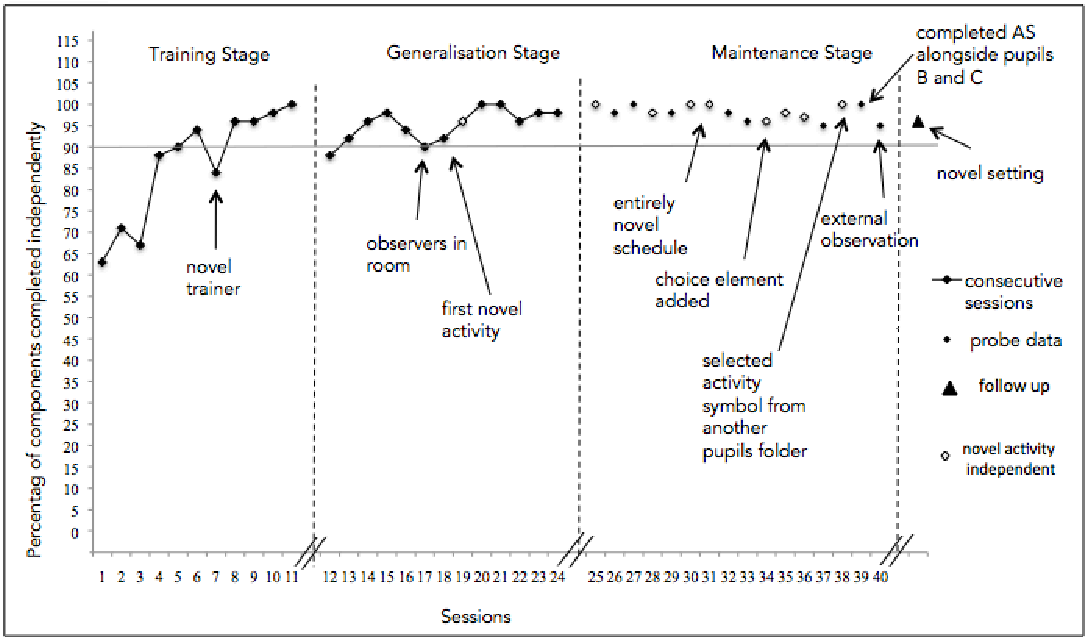


Figure 7.12. Activity schedule component completion data for Pupil K.

Pupil F. Pupil F completed 10% of components independently in his first training session, as shown in Figure 7.13. Pupil F had 33 training sessions before the intervention phase of the study ended. The upward trend of his data points, as shown in a trend line, suggests that had the intervention continued, his level of independence would perhaps have continued to increase.

The follow up data indicates that pupil F's level of mastery was similar to levels seen at the end of the study. Although he had not progressed to the generalisation stage, his skill level had maintained over the 11-month period.

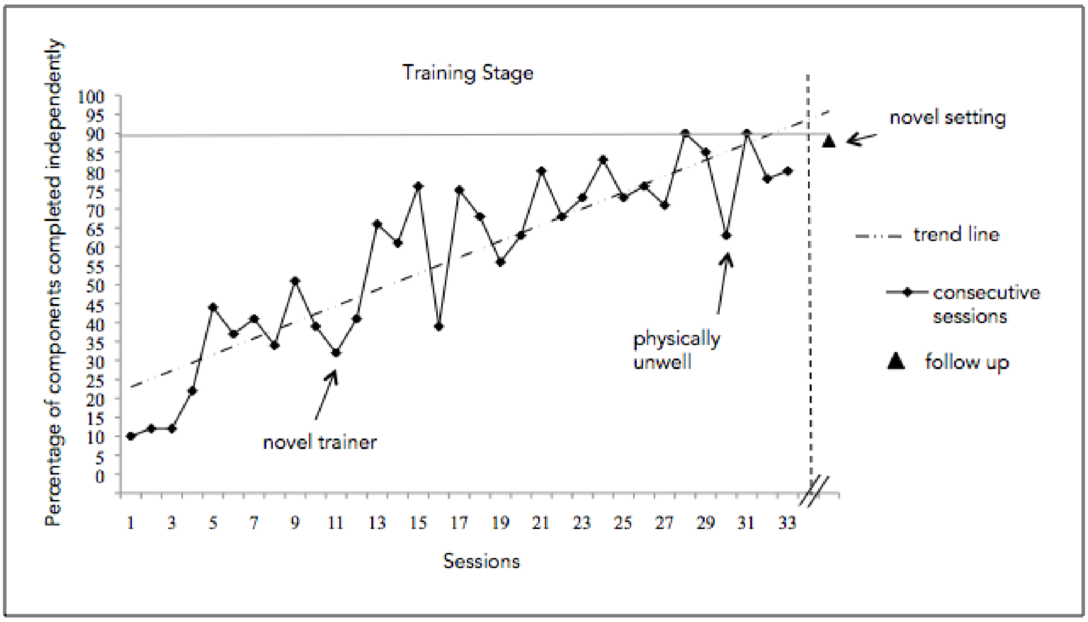


Figure 7.13. Activity schedule component completion data for Pupil F.

Pupil G. Pupil G completed 34% of components independently in his first training session, as shown in Figure 7.14. In session 26, repetitive behaviours resulted in use of increased physical prompting to remain on task. Pupil G reached the generalisation stage in session 30 and the maintenance stage in session 33.

Follow up data indicates that pupil G's level of mastery had decreased since the end of the main study. His level of mastery had decreased to levels below 90% independence, as previously observed in the generalisation stage.

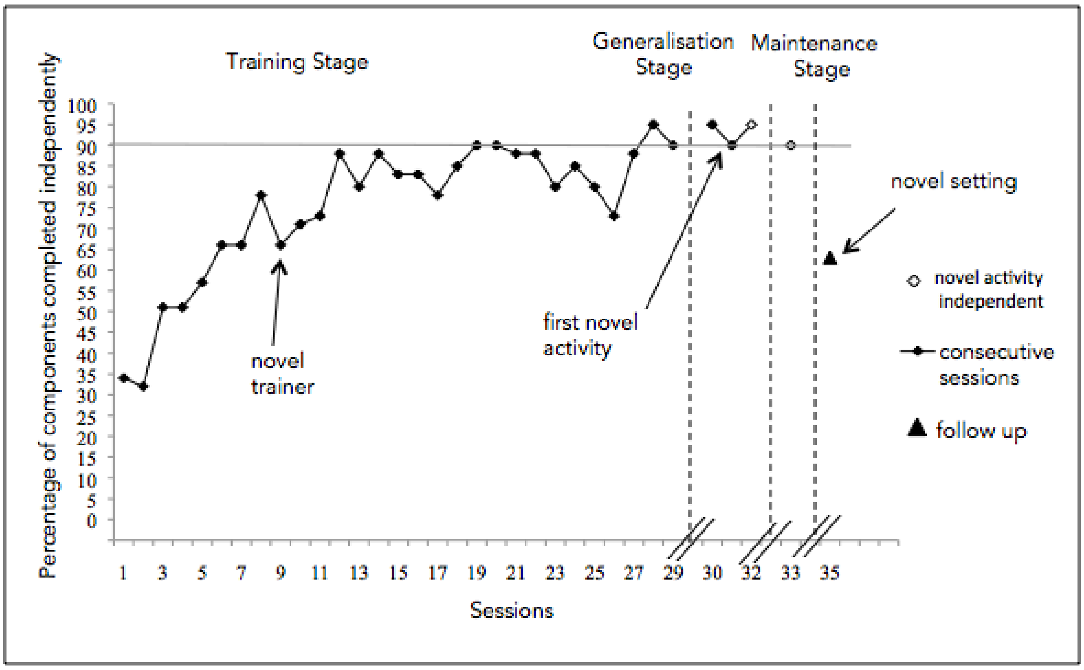


Figure 7.14. Activity schedule component completion data for Pupil G.

Pupil E. Completing only 5% of components independently in his first session, as shown in Figure 7.15. Pupil E had the lowest first data point of all the participants. He had 20 training sessions before the intervention phase of the study ended. The highest percentage of components completed independently by pupil E was 37%. Although progress was slow, the slight upward trend of data, as shown in a trend line, suggests that had training continued, pupil E may have continued to make progress.

During the follow up observation session, pupil E achieved 34% mastery. Although his skills had not progressed to the generalisation stage, the follow up data point shows a comparable percentage of independence seen at the end of the study. His skills therefore had maintained over the 11-month period.

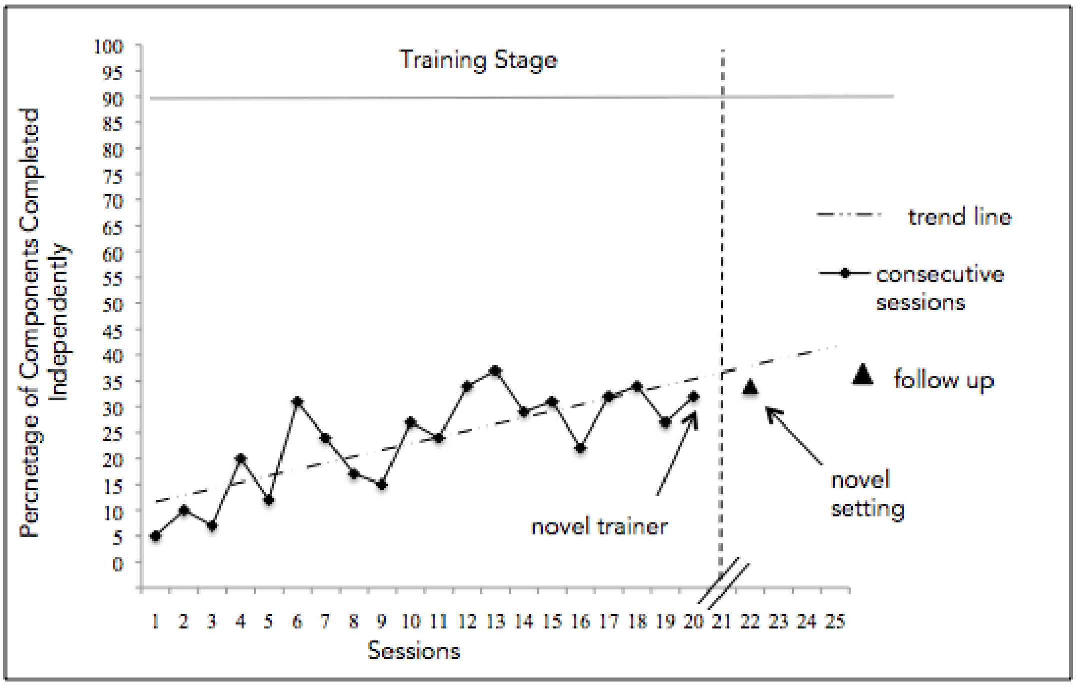


Figure 7.15. Activity schedule component completion data for Pupil E.

Pupil J. Pupil J had an initial data point of 10% of components completed independently, as shown in Figure 7.16. Levels of engagement increased very gradually over 22 training sessions, before the intervention phase of the study ended. The highest percentage of components completed independently by pupil J was 51%. The slight upward trend of her data points, demonstrated with a trend line, suggests that had training continued she might have continued to make progress.

Results of the follow up session show a slight increase in mastery since the study ended. Although she remained within the initial training stage, she had broadly maintained her skills over the 11-month period.

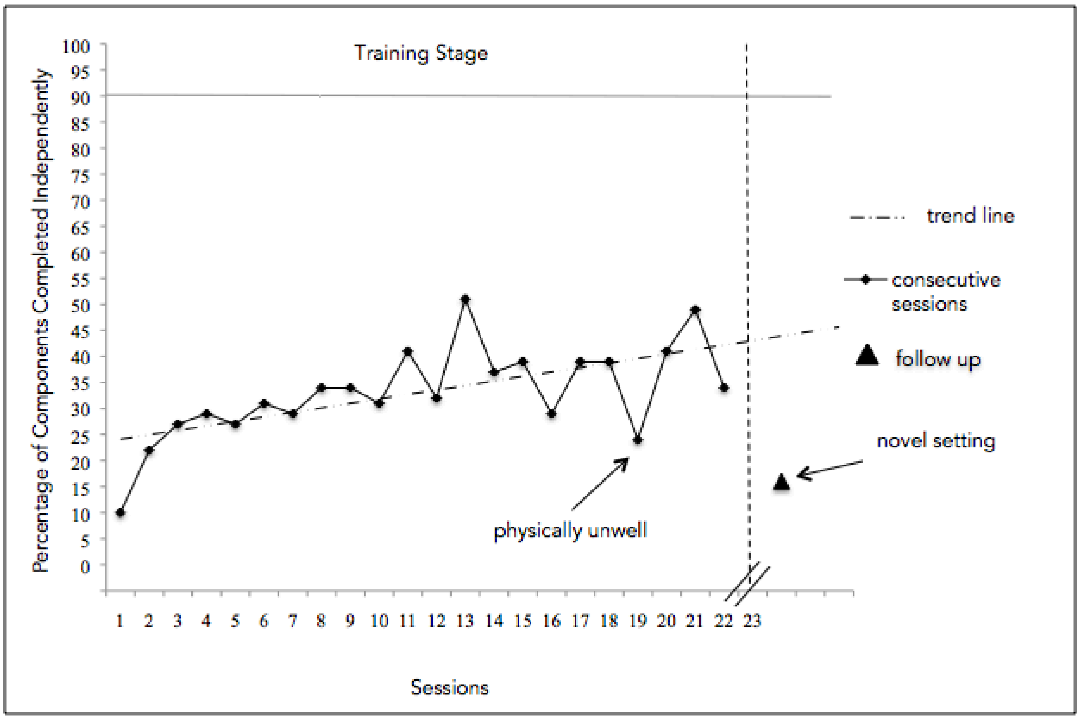


Figure 7.16. Activity schedule component completion data for Pupil J.

Comparison of data for 6 pupils. Results have been presented for each of the nine pupils. Six of the pupils who engaged in activity schedule training reached criteria for mastery; they could follow an activity schedule independently. Information presented in Table 7.11 provides a comparison of data for these six pupils. Of particular interest was if there was any correlation between individual initial starting points and the number of training sessions required to reach mastery. Percentage of independence achieved in each pupil's first training sessions was considered. Pupils are included in the table in the order of most to least independence; at the top of the table is pupil K with the highest first data point of 63% independence and at the bottom of the table is pupil C with the lowest first data point of 9% independence.

Table 7.11

Relation between Initial Levels of Independence and Number of Sessions to Mastery

Pupil	First Data Point	Number of Sessions to Generalisation	Number of Sessions to Mastery	Order of Mastering Schedule
K	63%	12	25	1st
B	42%	14	27	2nd
G	34%	30	33	3rd
D	29%	57	86	6th
H	27%	39	63	4th
C	9%	62	78	5th

Table 7.11 shows numbers of sessions to generalisation, followed by total number of sessions required to mastery. The final column places the pupils in the order in which they met criteria for mastery. Tentatively, there seems to be a relation between levels of independence shown in the first data points and the number of sessions required to reach mastery. Pupils K, B and G had the 1st, 2nd and 3rd highest starting points, and they met criteria for mastery in the same order. Pupil D's results differ from this; although he had the 4th highest starting point, he required significantly more training sessions and was 6th to master schedule following.

However, if pupil D's results are removed from the table, for the remaining five pupils there seems to be a relation between levels of independence shown in the first data points and the number of sessions required to master schedule following. Although this sample is small, the information is potentially useful for those planning an AS intervention as initial starting points could broadly be indicators of pupil progress. Those with a lower starting point are likely to require more training sessions than those with a higher starting point.

Comparison of data for all pupils. A comparison of performance across all pupils is problematic given that each pupil received a different number of training sessions, and not all pupils mastered schedule following. With a total of 86 sessions prior to reaching mastery, of the six pupils to master schedule following, Pupil D required the most training sessions. The three pupils who did not master schedule following had significantly fewer training sessions than the other six pupils. Pupils E, J and F had 20, 22 and 33 sessions respectively and did not reach mastery within the number of sessions available.

All pupils received a minimum of 20 sessions and therefore a comparison of pupil progress can be made across these initial training sessions. To simplify results, three data points for each pupil have been identified; the initial data point in the first training session, the data point from session 10 and the data point from session 20. Figure 7.17 shows these data points from sessions 1, 10 and 20 for each of the 9 pupils.

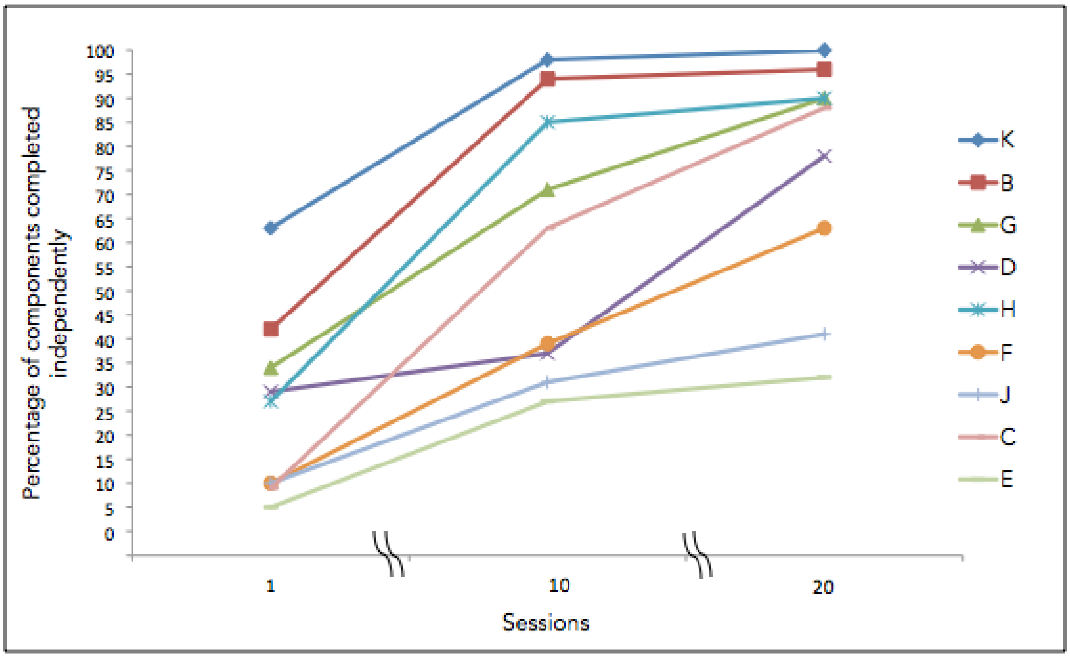


Figure 7.17. Levels of independence in 1st, 10th and 20th training sessions.

Figure 7.17 demonstrates that for each pupil, activity schedule training impacted positively on levels of independence. The effect of activity schedule training has been replicated across all participants; the upward trend of each pupil's data indicates an increase in independent schedule following across 20 training sessions.

It is not known the effect that continued activity schedule training would have had on the performances of pupils E, J and F. However, the upward trend of their data indicates that for each of these three pupils, levels of independence were increasing.

Additional Observations during Main Study

Component completion data results have been presented within the Results section. However, additional notes made on data collection sheets provide further information on pupil performance. While training sessions impacted positively on pupil skill acquisition, many pupils engaged in behaviour that interfered with schedule following that appeared to function as disruptive or avoidance behaviour. However, as activity schedule following behaviour increased, interfering behaviour within individual repertoires decreased and gradually faded. These observed behaviours are summarised and presented for each individual, in the order in which pupils began activity schedule training. Details of any factors that may have affected rates of progress, such as self-stimulatory behaviour, are discussed. To counteract difficulties, some subsequent changes were made to procedures, pupil resources or time of training. Any changes that occurred are described.

Pupil B. At 42%, Pupil B began with a relatively high percentage of independence in first training session. However, during the early stages of training, pupil B made loud crying noises and looked towards his trainer. His ‘crying' seemed to function as avoidance behaviour. This behaviour was put on extinction; delivery of short-term reinforcers was made while following his schedule but contingent on absence of crying noises. This crying behaviour subsequently reduced, and he reached criteria for mastery. While in maintenance, pupil B sometimes became distracted and, for example, wandered across the classroom to look out of the window. He was occasionally prompted to return to task if he had not done so within 5 seconds. Despite this, probe data indicated that his level of independence still remained at 96% or higher. There were several occasions that pupil B completed novel materials independently, indicating that schedule following skills had generalised and occurred under the control of a single visual cue. Furthermore, pupil B completed entirely novel schedules that had been designed for pupils K and H. Pupil B worked alongside pupils C, B, D and K independently. When working alongside pupil D, the trainer left the room and observed via a window. Both pupils independently completed their schedules.

Pupil C. Of the 6 pupils to achieve mastery, Pupil C began with the lowest levels of independence, with only 9% of components completed independently in her first training session. Pupil C occasionally put materials into her mouth necessitating physical prompting to remove them. The picture-matching task in particular was mouthed, resulting in some pictures being broken. This task was removed after 5 sessions. A second set of materials was removed in session 12: the train track. She consistently attempted to turn the page when she saw the photograph and required prompting to join the pieces to make a circular track. By session 12, as full physical prompting was still required to make the track, a decision was made to remove this activity from her schedule. Pupil C originally had 7 tasks within her schedule, so at session 13, this had been reduced to 5. As the overall demand had decreased, it was hoped that her rate of progress would increase.

Progress within the training stage was variable for pupil C. Her regular training session had been timetabled early in the school day, resulting in a delay to her preferred activity: using the computer. A timetable change at session 42 ensured that activity schedule sessions occurred after time on the computer. Once this was established, her rate of progress increased. During usual regular DTT sessions, pupil C typically sat in one place, there was no requirement to move around the room. An apparent preference for remaining seated was evident during AS training sessions and she initially required a high degree of prompting to get up from the chair to obtain resources. Physical prompting sometimes occasioned loud noises from pupil C, as well as resistance. Schedule following behaviour was reinforced through access to edibles and gradually, high levels of physical prompting were faded. Pupil C continued schedule following when working next to pupils B, D and K. She completed several novel activities without adult prompting, indicating that schedule following had occurred under control of the visual cue alone.

Throughout the study, pupil C experienced changes in her body as she reached puberty. At times she vocalised loudly and chewed on her clothing and/or learning materials. Although the extent to which private events (Skinner, 1957) acquired covert stimulus control is unknown, it may be that hormonal changes affected pupil C's behaviour and rate of progress. Nevertheless, pupil C reached criteria for maintenance.

Pupil D. Despite achieving 76% independence in session 15, pupil D did not reach the generalisation stage for a further 41 training sessions. His performance was variable. Closer observations of training sessions revealed that pupil D looked repeatedly towards the face of the adult collecting data. The adult was alerted to this and eye contact from her was averted more consistently. Following this, his rate of progress increased.

Pupil D sometimes engaged in self-stimulatory behaviour during training sessions via repetitive rattling of small objects against the table. To prevent this behaviour becoming embedded within the schedule, the trainer physically prompted him to complete the activity or return materials to the wallet. Edible items were provided contingent on schedule following, and not given if self-stimulatory behaviour occurred. Pupil D paged through the pages of his schedule book to the photograph of the terminal reinforcer. This was resolved by physically prompting him to hold down the first page, thus preventing further pages being turned, and then prompting movement towards the resources box. These prompts were gradually faded. A difficulty for the trainer was pupil D's apparent reliance on short-term reinforcers. He frequently paused and looked towards the trainer's pocket, where edibles were stored. Reinforcers were delivered contingent on schedule following behaviour, and not given if pausing occurred. Shaping this behaviour was a slow, gradual process and timing of reinforcer delivery was crucial to success. Nevertheless, pupil D did reach criteria for maintenance on his 86th training session. Pupil D continued schedule following when working next to pupils C. He completed several novel activities without adult prompting, indicating that schedule following had occurred under control of the visual cue alone.

Pupil H. During the school day, Pupil H's preferred activity was using the iPad. When using it immediately prior to AS training sessions, terminating use of the iPad sometimes resulted in aggression towards others, destruction of property or SIB. It seemed that being shown the AS symbol elicited these challenging behaviours. To counteract this difficulty, a token economy system was implemented. It was anticipated that a self-management technique using tokens (as used by Pierce and Shreibman, 1994) would promote compliance. This intervention was a success and the demand placed on him was gradually increased from one token to five tokens, to gain access to the iPad. He was physically prompted to place tokens onto his token board. Prompts were faded until eventually all tokens were placed on his table and after each activity; pupil H independently placed a token onto his token board.

Prior to session 34, when pupil H was using the iPad, as he saw his trainer approach with the symbol, put down the iPad, took the symbol from her hand and went to the training area independently. It seems that AS following had become a preferred activity for this pupil.

A decrease of SIB and aggression was observed and soon these behaviours ceased altogether during AS sessions. It was wondered if this was because his state of arousal was lower during these sessions. In his usual lessons, conducted on a one to one basis with an adult, pupil H was required to listen to verbal instructions, look at the trainer and engage with the materials being presented. In contrast, during AS sessions, there were no verbal prompts. He was not required to look at the trainer as prompts were given from behind. High states of "arousal" and "anxiety" are said to be part of the Fragile X condition (Morris, Kondratenko & Griffiths, 2014). The evidence suggests that for this pupil, conditions in AS sessions may be more conducive to learning than conditions during 'lessons as usual'.

As he became proficient at schedule following, Pupil H made different selections for the last page of his folder. In session 58 he put the symbol for 'home' onto this page, although this request could not be honoured during the morning. Other requests however could; in session 59 he went to another pupil's PECS folder and took the word/symbol for 'cheese' and placed this in his book. Once he had mastered schedule following, Pupil H indicated a preference for doing his AS at play time, and at other times of the day, by taking the photographic symbol representing AS from the class timetable and giving it to his trainer. He was often observed skipping around the room holding the symbol, smiling and laughing before approaching an adult. Pupil H continued schedule following when working next to pupil B. He completed several novel activities without adult prompting, indicating that schedule following had occurred under control of the visual cue alone.

Pupil K. During session 28, pupil K said, "try something different". He then made a pattern using the Duplo blocks that was different to the one on the photograph; he had used the materials within the wallet but in a different way. An element of choice was introduced in session 33; a selection of wallets was provided with photographs of different Duplo block patterns to make and the relevant materials. Probe data indicated that he remained proficient at schedule following, remaining at above 90% when new materials and choice making were introduced. Pupil K sometimes engaged in aggressive behaviour (including kicking or hitting) towards others during the school day, however it was noticeable that these behaviours did not occur during AS sessions.

Mid way through session 37, an inspector from the Office for Standards in Education, Children’s Services and Skills (Ofsted) and the school's Head of

Education came in to observe the class. Pupil K remained focused on his schedule despite this unexpected event. Pupil K often asked to do his AS and frequently congratulated himself on completion of different activities within the sessions by saying "hurrah!" and "well done!" Pupil K made novel selections for the final page of his activity schedule folder (the terminal reinforcer). In session 38 for example, he took a photo/symbol of 'strawberry laces' sweets from another pupil's choice board. Pupil K continued schedule following when working next to pupils B, D and K. He completed several novel activities without adult prompting, indicating that schedule following had occurred under control of the visual cue alone. Furthermore, he completed entirely novel schedules that had been designed for pupils B and H.

Pupil F. During his first session, pupil F repeatedly dropped to the floor necessitating physical prompts to get up and resume the activity; this seemed to function as task avoidance behaviour. Pupil F experienced hormonal changes within his body as he reached puberty, and was observed dropping to the floor in multiple settings and in a variety of activities. During AS sessions, edible reinforcers were given to reinforce schedule following behaviour. By session 5, dropping to the floor reduced and engagement increased.

Pupil F sometimes needed physical prompting to end a task. This was due to a tendency to repeat the task, such as putting items into a container and then removing them, several times. Although these tasks had a natural ending, he repeated them and was observed laughing while he did so. It is possible that this stereotypic behaviour was automatically reinforced through intrinsic reinforcement. While independent engagement with play activities was the aim of training, stereotypy was to be avoided. Any interruptions to the procedure could have become embedded into the schedule. To prevent this happening, the trainer allowed the activity to be repeated once. Pupil F was then prompted to put the resources away if necessary. On completion of the activities, pupil F sometimes threw the resources back into the box. This behaviour was shaped via judicious use of edible reinforcement, which was provided contingent on putting the materials away accurately and independently.

Pupil G. Pupil G initially resisted prompts from the trainer to transition into the training area of the classroom. The trainer used a ‘SpongeBob reinforcer’ (six seconds of a preferred song recorded onto a switch device) to reinforce movement with the adult until in the training area. The image of SpongeBob placed on the switch device was shown to pupil G while the music played. After several sessions pupil G responded to being shown the symbol, without being played the song, by following the trainer to the training area. By pairing it with the music, the symbol had become a conditioned reinforcer. Aggressive behaviour was sometimes noted; pupil G barged at adults to get them out of his way or grabbed an adult's forearm and twisted it with his hands. At other times, he picked up an adults hand and rubbed his chin hard onto the back of it. These behaviours occurred in the early training stage but as AS following skills increased, these undesirable behaviours decreased.

Pupil G's performance was affected by repetitive behaviours associated with OCD such as licking his hands repeatedly and squatting on his chair, seemingly to avoid touching it. If he dropped any resources (such as a Duplo block) he repeated dropping and picking it up several times before recommencing with the schedule. The trainer physically intervened to prevent this behaviour becoming embedded within the routine, and reinforced schedule following in the absence of OCD behaviour. Timing of reinforcer delivery was crucial to the success of this.

Pupil G completed several novel activities without adult prompting, indicating that schedule following had occurred under control of the visual cue alone.

Pupil E. Pupil E had the lowest starting point with only 5% of components completed independently in his first training session. Physical prompts were required for almost all components; to get up from his chair, walk to the resources box, pick up the wallet, turn around, walk to the table and sit down again. Physical prompts to stand were gradually faded to a light touch to the elbows and then faded altogether.

During his usual learning sessions, social reinforcement was typically used to reinforce appropriate behaviour. This strategy was disallowed during AS sessions when eye contact was specifically avoided. Pupil E looked repeatedly towards the trainer's face and towards any adult collecting data. He sometimes physically approached the adults and put his face close to theirs. He also made repetitive high-pitched noises. When this disruptive behaviour occurred, pupil E was physically directed back to the schedule and eye contact was averted. Edible items were used to shape behaviour and were delivered contingent on looking at the materials rather than the adults. By the end of the study, pupil E focused his eyes on the schedule materials more frequently. With only 20 training sessions, he had the fewest number of training sessions of all pupils.

Pupil J. Pupil J's physical condition often seemed to adversely affect her performance. Epileptic seizure activity during the night resulted in her being tired, as did repeated petit mals during the school day. Pupil J was sometimes absent from school due to medical appointments or illness, and therefore she did not participate in as many training sessions as planned.

Pupil J initially resisted physical prompts from the trainer to sit down or stand up. It was not ethical to apply force and therefore at times the trainer had to wait for co-operation. Primary reinforcers were used to shape schedule following; for example, by placing a sweet next to the resource box, pupil J walked towards it. Primary reinforcers were provided as she walked in the direction of the schedule resources.

Pupil J preferred to keep hold of specific resources within her schedule, rather than put them away. She engaged in self-stimulatory behaviour with materials by tapping small items repeatedly against her face. Physically prompting her to release items was challenging and involved use of primary reinforcers. Pupil J repeatedly flapped the pages in the activity schedule folder. This behaviour was blocked by the trainer physically prompting engagement in the next component of the schedule. Resistance to adult prompting and the occurrence of self-stimulatory behaviour reduced as sessions progressed, and engagement with the process gradually increased.

Additional Observations during Follow Up

It is encouraging that after an 11-month period, independent schedule following skills had maintained for 7 of the 9 pupils within the study. However, with any teaching procedure, the aim is to increase skills over time. Therefore, both the slight decrease in skills noted in two pupils (D and G), and the apparent lack of progress in three pupils (F, E and J) warrants further consideration. Notes made on data collection sheets during follow-up observation sessions revealed some underlying issues that may have affected rates of individual pupil progress. These include changes made to the setting in which sessions took place, prompting procedures used during training, types and rate of reinforcement contingencies, the frequency with which pupil training sessions occurred and the ongoing training opportunities given to adult participants. A summary of factors that may have impeded progress is given.

Changes to setting. During the main study, pupils in the training stage worked in an area screened off from the rest of the classroom. This ensured visual distractions were kept to a minimum. Within this setting, the pupil could not see other pupils, adults or classroom resources. At the end of the main study, pupils J, E and F were in the initial training stage of learning to follow activity schedules, and still required a setting with minimal distractions.

In the follow up sessions, being in a different classroom was unavoidable. However, the furniture arrangement meant that pupils J, E and F were exposed to multiple visual distractions. The table in the training area was adjacent to a window overlooking an outdoor play area. It was bordered on two sides by low screens, which blocked out visual stimuli only when pupils were seated and facing forwards. The resource box containing wallets was placed on a table, two meters behind the pupil’s chair in the main area of the classroom. When standing to obtain or return resources, he or she could see other pupils, members of staff, classroom resources, a cloakroom area and a door to the outdoor environment. All of these visual stimuli were potentially distracting. During the observations, pupils were observed attending repeatedly to faces of adults, attempting to obtain preferred resources not part of the schedule and/or abscond to other areas. The environmental contingencies within this setting are likely to have impacted negatively on progress made during the previous 11 months.

Delays in physical prompting. In the main study, physical prompting had been used within the procedure to prevent errors or delay becoming part of individual behavioural repertoires. Physical prompts were delivered quickly in these instances. However, there were times during the observation sessions when delays in trainer prompting were noted, particularly so for pupils D, E, F, G and J.

For example, pupil G was observed tapping materials repetitively. Dropping a resource, such as a Duplo block, resulted in repetition of the action several times before moving to the next component. Long delays occurred while he engaged in this behaviour. Rather than physically prompting pupil G, the trainer waited for the repetitive behaviour to finish. After the session, the trainer reported that pupil G engaged in high rates of repetitive behaviour across the school day and if physical prompts were used, the action was repeated or he went under a table. On this basis, a decision had been made to accept the occurrence of repetitive behaviours. Thus, a variety of repetitive behaviours had become embedded within pupil G's schedule. As Cunningham and Shreibman (2008) point out, “unable to attend at once to several environmental cues, it would be difficult for a child attending to his own stereotypy to simultaneously attend to the salient learning stimuli” (p.3). An alternative strategy of using physical intervention and fluency building techniques could perhaps have prevented such delays becoming part of his repertoire.

Gestural prompts with resources. At times, when pupils did not engage in schedule components independently, the adult touched pupil resources. It seemed that gestural prompting with resources had become part of the training procedure, and subsequently became embedded within pupil routines. For example, Pupil D engaged in repetitive page turning. To prevent this, an adult held down the page each time. This gradually became embedded within his schedule; he was observed turning the page and attending to the adult's face until the adult held down the page. Only then did he engage in the task.

Another example of adult gestural prompting becoming embedded within pupil behaviour was noted in pupil F's session. When he did not respond to the visual cue, the trainer repeatedly tapped the page. Pupil F was observed repeatedly tapping the schedule folder page following the adult's action.

Trainers also gave gestural prompts with resource wallets. This was observed for pupils E, F, G and J. When there were delays taking resources out of wallets, trainers were observed tapping or rattling the wallets to draw attention to them. Sometimes, after several gestural prompts, the pupil responded by taking the resources out of the bags. At other times, physical prompts were given. Rather than using the planned MTL prompting procedure, which leads to fewer errors occurring (Libby et al., 2008; Fentress & Lerman, 2012; Cengher et al., 2015), it seems that staff had adopted a LTM procedure, and subsequently delays and gestural prompting had become part of pupil routines.

The trainer within the schedule. For pupils E, F and J, it seemed the trainer had become embedded within the schedule as a visual cue. Resource wallets were placed, by the trainer, on the box or table in view of the pupil. By physically being between the pupil and resources, the trainer perhaps became part of the schedule. Despite adult attempts to make schedules easier by giving additional prompts, and simplifying the procedure, levels of independence in E, F and J did not increase.

An additional trainer was added to pupil J and G's training sessions. Two trainers worked with pupil G; the first trainer took on the original trainer role, standing behind him ready to give physical prompts while the second trainer sat at the table opposite him, with a CD player used as an in-schedule reinforcer. The first trainer remained very close to pupil G and gave a high number of gestural prompts such as shaking the wallets to gain his attention. The second trainer played 3-sec sections of the CD throughout the session. Two trainers also worked with pupil J: the second trainer sat at the table opposite her, ready to deliver edible reinforcers.

In both cases, the second trainer was clearly visible to the learner and, therefore, the presence of the adult became part of the schedule routine for these pupils. During the main study, eye contact was not given as this could inadvertently reinforce delays within the schedule. Eye contact was known to particularly reinforce behaviour for pupils J and G. With the introduction of a second trainer sitting opposite, eye contact became part of the schedule. This could have been a factor in delaying progress.

Rate of reinforcer delivery. Observations suggest that rate of reinforcer (R+) delivery affected pupil behaviour. It seemed that at times the timing of edible delivery inadvertently reinforced delays within the schedule. For example, when pupil J had partially completed an activity, edible R+s were placed directly into her mouth. As the adult prepared to deliver the R+ by moving her hand into her pocket to retrieve it, pupil J observed the action; she stopped engaging with the materials, and turned her head towards the R+. Thus, schedule following was delayed and the act of putting resources down was inadvertently reinforced.

R+ delivery for pupil G occurred frequently during the observation. In the main study, the in-schedule reinforcer ratio had been thinned across training and generalisation stages, eventually given only at the end of the schedule. However, during the follow-up session, the second trainer sat opposite pupil G with a CD player and played 3-sec bursts of music intermittently throughout the schedule. Pupil G was observed to pause frequently during the procedure, seemingly to wait for music to be played. Self-stimulatory behaviour was observed during these delays. Thus, it seems, the R+ served to reinforce stereotypy rather than schedule-following behaviour.

Staff training. Following the observation sessions, discussions regarding pupil performance took place between the researcher and the TAs; staff seemed unaware that they had introduced some prompts that were previously not provided. It transpired that other changes to procedures had, however, been deliberately made, in the hope that progress would subsequently occur. Nevertheless, changes to procedures did not result in increased pupil independence. Results of the present study coincides with views of other researchers (Hall et al., 1995; Anderson et al., 1997) who suggest the need for further staff training; this could ensure that all individuals fully understand procedures used and their underlying mechanisms. Although staff members had received some conceptual training during the main study, it seems that further on-going training was necessary to strengthen knowledge and understanding of these complex concepts. Training in concepts such as setting events, timing of reinforcer delivery and most-to-least prompting procedures appeared to be necessary.

Also evident was the need for training in data analysis. While data were taken frequently, and graphed, it seems the results were not adequately interpreted. In depth knowledge and understanding of underlying concepts would be necessary to accurately interpret results and consider reasons for the lack of an upward trend. Assessment procedures are only ever worthwhile if they are purposeful and informative. Within a classroom setting, if not used to inform decision-making and increase learning, then data becomes redundant.

Summary and Conclusion

In this chapter, methods used to teach activity schedule following to the pupils within the study were outlined. Materials used by each pupil were described and a rationale for the materials and activities selected was given on an individual basis. Procedures used within each of the three training phases were outlined. Results have been presented for each of the nine pupils.

In summary, six of the pupils who engaged with activity schedule training reached mastery criteria for the maintenance stage; they followed an activity schedule independently. Photographs in their schedules had become relevant discriminative stimuli that occasioned schedule following behaviour. Novel materials were added to their schedules, and with the novel visual cue placed in the folder, schedule following continued. Two pupils followed entirely novel schedules and made choices regarding two activities within their schedules.

Three pupils, E, F and J, did not progress beyond the initial training stage. These were the same three pupils who had not fully mastered the three pre-requisite skills, discussed in Chapter 6. Implications of this, and other relevant information regarding the training sessions for each pupil are discussed in more detail within the Discussion chapter.

A comparison of data was made firstly for the six pupils to have mastered AS following. Tentatively, there seemed to be a relation between levels of independence shown in the first data points and the number of sessions required to reach mastery. Secondly, a comparison of data was made for all pupils by presenting results from the 1st, 10th and 20th training sessions. The upward trend for each pupil's data demonstrated that AS training impacted positively on levels of independence.

An additional observation section provided further information on pupil performance. Behaviours that interfered with AS following were summarised, and changes subsequently made to training procedures were described. In general, these modifications resulted in a decrease in interfering behaviours that coincided with an increase in independent behaviour.

This chapter also included follow up measures of activity schedule training taken 11 months after the study ended. In summary, results indicate that schedule following skills had broadly maintained over time. Pupils B, C, D and K maintained criteria for mastery and pupils F, E and J maintained skill levels within the training stage. For these pupils, individual levels of independent schedule following were similar to levels observed at the end of the study. A slight decrease was seen in the performance of pupils D and G, as levels of independence dropped slightly below criteria for mastery. Notes made during the observation sessions pointed to environmental factors that had potentially limited pupil progress, and contributed to any decrease in levels of independence. These were summarised and discussed.

While AS training was delivered over a 15-month period, regular play skill sessions were also taking place. The following chapter provides a description of methods used to observe and measure independent play skills during observation sessions. Results of these sessions prior to and during activity schedule training are presented and explored for each individual pupil. The effect, if any, of AS training on pupil independence and play skills in a different setting is considered.

Chapter 8

Child-Initiated Play Sessions – Observation Methods and Results

Overview

Throughout the intervention period, regular child-initiated play sessions were held during which various measurements were collected. This chapter outlines methods used to measure independent engagement with play materials during these sessions. Firstly, partial interval recording provided percentage levels of independent engagement with play materials. Any incidents of aggression and/or self-injurious behaviour were also recorded simultaneously if they occurred. Secondly, the types of play materials independently selected by each pupil were recorded, providing an overview of the variety of materials engaged with across sessions. A summary of pupil performance is given both qualitatively and quantitatively. Thirdly, the variety of play material data was also used to calculate the number of types of play material engaged with per session.

Methods used to obtain these data are outlined in detail. The setting is described and an account of materials available during play sessions is given. Behaviours measured are defined and procedures for obtaining the different forms of data are presented. Reliability is reported and measures to promote consistency are provided.

Results are given for each type of data collected. For all types of measurement, pupil independent play performance prior to activity schedule training being implemented provides baseline data. This is compared with independent play performance once the intervention had begun, during activity schedule training. A non-concurrent multiple baseline design shows levels of engagement, SIB and aggression for pupils in play sessions pre-activity schedule training and during-activity schedule training. A second non-concurrent multiple baseline design shows the number of play materials engaged with in play sessions by all pupils. The effect of activity schedule training on independent engagement with play materials is estimated.

Methods

Setting and participants. Play sessions took place in the natural environment of the main classroom. Play materials were placed on tables around the room and were freely available to pupils throughout each session. All of the pupils who engaged in activity schedule training, pupils B, C, D, E, F, G, H, J and K, described in Chapter 5, participated in child-initiated play sessions. The adult participants described in Chapter 5 took part in play sessions by supervising and/or collecting data. To avoid crowding in the room, and to ensure that all pupils had access to all play materials, half the class at a time participated in play sessions. There was a maximum of five pupils and four adults in the room at one time.

Materials. Play materials were decided on the basis that they were broadly developmentally appropriate for pupils and typically found in the classrooms of schools for children diagnosed with special educational needs, as shown in Table 8.1.

Table 8.1

Play Materials used in Play Sessions

Play Materials	Description
Duplo	Inter-connecting blocks designed for building structures.
Happy Land	A tabletop road map with a large plastic house, other small buildings, small figures and cars.
2 x Bead frames	A wooden base from which beads were threaded onto metal rods.
Train set	A wooden train set with a range of trains and wooden track.
Farm yard	Wooden farm buildings and a variety of farm animals.
2 x Shape sorters	Wooden blocks of varying shape, a container for the shapes and a lid with holes that correspond to the shaped blocks.
Car track	A tabletop set consisting of pieces that form a road and bridge circuit and a variety of cars.
Car garage	A straight ramp with parking spaces for cars, and cars
Car ramp	A spiral ramp and cars
Jigsaw puzzles	A variety of inset puzzles and simple jigsaw puzzles
Animals	Various zoo and farm animals
Figures	A variety of small figures of people and action figures
Characters	A box of plastic or soft characters from TV e.g. SpongeBob, Buzz

All of the pupils were already familiar with the resources; materials identical to or similar to these had been available to all of the pupils during play sessions in previous classroom settings. Table 8.1 presents the materials available to pupils during these sessions.

Measures. Several definitions were required for measuring pupil performance during play sessions. However, having considered the issues around defining "play", as discussed in Chapter 2, it was decided that the parameters of this summary label were too broad. As a good behavioural definition discriminates between what is and what is not the target behaviour (Cooper, Heron & Heward, 2007), a more precise term than *play* was necessary, therefore an alternative term *independent engagement with play materials* was selected.

***Dependent variables*.** A definition of independent engagement was necessary, and as stereotypy was precluded from engagement, this also needed defining. As discussed in Chapter 1, for those with severe ID or ASD diagnoses, challenges within the classroom can result in incidents of aggression and/or self-injurious behaviour (SIB). Any incidents of aggression and/or SIB were recorded during play sessions if they occurred; definitions of each of these were required. Problematic behaviours observed in pupils were categorised and listed under summary labels of Self-injurious Behaviour (SIB), Aggression and Stereotypy. Table 8.2 shows problematic behaviours for each pupil, and was considered when specifying behavioural definitions. For some measures, the dependent variable was consistent across all participants, however for others, further individualization was necessary. Machalicek et al. (2009) defined challenging behaviour differently for each participant (as discussed in Chapter 4); this inspired the decision in this study to define stereotypical manipulations of play materials on an individual basis. This was considered necessary as a behaviour could be perceived as play for one pupil but be classified as stereotypy for another (as discussed in Chapter 2).

Table 8.2

Problematic Behaviours Observed in Pupil Participants

Pupil	Self Injurious Behaviour	Aggression	Stereotypy
B	Punches tops of legs	Hits others, Hits table with force	Repetitive vocalization, Banging item on table
C	Bites back of hand	None observed	Mouths item, Rocks side to side
D	None observed	Squeezes adults hand forcibly with both of his hands	Rubs spit on item, Mouths item, Rocks item side to side
E	Bangs head on furniture	None observed	Opens doors, Tips chairs over, Throws item in air
F	Hits own head with hand	Bangs own head into adult's chest or arm	Paces back and forth, Fiddles with ears
G	None observed	Rubs own chin on back of adult's hand with force, Twists adult's forearm with his hands, Pushes adults out of the way with hands or body	Moves hand in front of face repeatedly, Licks fingers, Screams/makes noises
H	Punches head, Bites hand or finger, Bangs own head on table, wall or floor	Kicks or punches others	Skipping back and forth, Swinging stretchy toys
J	None observed	None observed	Mouths item, Taps item next to ear, Taps item on face
K	None observed	Hits or kicks others	Screams/shouts repetitively

The following behavioural definitions were used:

Independent engagement with play materials. Independent engagement was defined as "picking up or holding a play material while manipulating and/or looking at it".

Self-injurious behaviour. SIB was defined as "hitting, scratching or biting self. Banging own head on any surface such as floor, wall or table. Deliberately hurting self in any other way".

Aggression. Aggression was defined as "hitting, punching, pinching or slapping another person. Banging furniture with hand or item. Deliberately attempting to hurt another person or damage property in any other way".

Stereotypy. The definition of stereotypy was individualised for each pupil. The types of stereotypic behaviour observed in pupils, as presented in Table 8.3, were considered and any behaviour pertaining to play materials was identified as behaviour precluded from engagement. As shown in Table 8.3, this was done on an individual basis.

Table 8.3

Pupil Stereotypy with Play Materials

Pupil	Stereotypy with Play Materials
B	Banging item repeatedly on a table
C	Mouthing an item
D	Rubbing spit on an item or mouthing an item
E	Throwing item in air
H	Swinging item around
J	Mouthing an item or tapping an item on face or next to ear

Although they did engage in some forms of stereotypy, pupils F and G had not been observed to engage in stereotypical manipulations of any play materials. A definition of stereotypy with play materials was therefore not applicable to these 2 pupils. Three forms of measurement were taken during play sessions. These are described.

Measures 1: independent engagement, aggression and self-injurious behaviour. Measuring independent engagement precisely presented challenges as some actions are fleeting (e.g. picking up, looking at and dropping a toy) while other actions have a longer duration or are repetitive (e.g. repeated picking up of Lego bricks and joining them together). To simplify proceedings a partial interval recording system was designed, as this was suitable for estimating the occurrence of behaviours without requiring that every event be recorded (Kennedy, 2005). It was also suitable for measuring several behaviours concurrently (Cooper, Heron & Heward, 2007). A paper based partial interval-recording sheet was designed, as shown in Figure 8.1.

Pupil:
Date:

Response Definitions	
Engagement	Picking up or holding a play material while manipulating it and/or looking at it.
Stereotypy	Engagement precludes the following stereotypic behaviour:
SIB	Hitting, scratching or biting self. Banging own head on any surface such as floor, wall or table. Deliberately hurting self in any other way.
Aggression	Hitting, punching, pinching or slapping another person. Banging furniture with hand or item. Deliberately attempting to hurt another person or damage property in any other way.
Recording Code	Slash (/) the letter if the behaviour occurred within the interval: E= engagement S= SIB A= aggression Slash (/) N if no engagement, SIB or aggression occurred within the interval.

Minutes	0-20 seconds				20-40 seconds				40-60 seconds			
1	E	S	A	N	E	S	A	N	E	S	A	N
2	E	S	A	N	E	S	A	N	E	S	A	N
3	E	S	A	N	E	S	A	N	E	S	A	N
4	E	S	A	N	E	S	A	N	E	S	A	N
5	E	S	A	N	E	S	A	N	E	S	A	N
6	E	S	A	N	E	S	A	N	E	S	A	N
7	E	S	A	N	E	S	A	N	E	S	A	N
8	E	S	A	N	E	S	A	N	E	S	A	N
9	E	S	A	N	E	S	A	N	E	S	A	N
10	E	S	A	N	E	S	A	N	E	S	A	N

	E	S	A	N
Number of intervals with behaviour observed / Total number of intervals X 100 = % of intervals during which behaviour occurred				

Figure 8.1. Sample data collection recording sheet for play sessions.

The partial interval procedure consisted of 20-second intervals as used by Betz et al. (2008) with sessions of variable length, between 5 and 10 minutes in duration. This provided a means of obtaining a percentage of target behaviour occurrences, regardless of the number of minutes of observation.

An Interval Timer application (app) for a smart phone was used. The app was programmed to give a 10 second countdown prior to the start of each data collection session which made 10 audible short beeps and then a long beep to indicate the start of the session. It then made an audible sound after every 20-seconds throughout the duration of the play sessions. Each category of behaviour (engagement, SIB and aggression) was recorded if it occurred within each 20-second interval. A recording code was used with letters E, S, A or N representing "Engagement", "SIB", "Aggression" and "No incidents of engagement, SIB or aggression" respectively. If there was an occurrence of engagement, SIB or aggression, then a diagonal line (/) was marked on the corresponding letter. All three letters could therefore be marked within each interval if incidents of these types of behaviour had occurred. If none of these behaviours occurred within the interval, then N was marked.

The same recording sheet was used for each pupil. However, while the definitions of SIB, aggression and engagement remained the same for each pupil, any stereotypical behaviour that involved play materials was listed in a separate stereotypy section to indicate that it was precluded from the definition of engagement. Stereotypy noted in Table 8.3 was referred to. For example, for pupil D, engagement precluded rubbing spit on a play item or mouthing a play item. Stereotypical manipulations of play materials were not recorded as engagement. If stereotypy and engagement occurred within the same 20-s period however, then engagement was recorded.

At the end of each session, the number of intervals during which each target behaviour occurred was totalled and divided by the total number of intervals, then multiplied by 100. This provided a percentage of intervals during which engagement with play materials, aggression and SIB was observed. Levels of engagement in sessions that occurred prior to activity schedule training were compared with levels of engagement in sessions that occurred during activity schedule training.

Measures 2: variety and quality of play. Types of play material independently engaged with during each observation session were recorded on the same data collection sheet that was used for recording engagement, aggression and/or SIB, as shown in Figure 8.1. This provided information regarding the variety of materials engaged with per session. If a pupil independently engaged with a type of play material, the adult participant wrote the name of the play material at the bottom of the paper. Each play material engaged with was recorded only once during each play session, regardless of the number of intervals during which engagement occurred. Additional notes were made, where applicable, to describe the quality of play observed by noting any action taken with play materials, for example, stacking, sorting, banging together, putting in, taking out, or joining together were briefly noted if observed.

Measures 3: numbers of types of play material. Notes made on variety of play materials engaged with were also used to obtain numerical data. Play materials were categorised into 13 different types of play materials as presented in Table 8.1. Where materials belonged to the same summary label (e.g. farm yard) and were located on the same table, they were categorised as one type of play material. For example, if a pupil engaged with a toy cow, a barn building and a tractor at the farm yard table, this was categorised as one type of play material; the farm yard. Where similar items (e.g. cars) were present in different locations in the room, they were categorised separately. Cars were available on the car ramp, on a car track and in a car garage. These were categorised as 3 separate play materials, as they were located at different tables around the room.

Data collection sheets were examined, and the number of different types of play material engaged with per session was totalled for each pupil. A mean was calculated of number of types of play materials engaged with in play sessions that occurred pre-activity schedule training. This was compared with the mean for number of types of play materials engaged with in sessions that occurred during activity schedule training.

Reliability. Inter-observer agreement (IOA) was taken during the partial interval recording sessions across all phases of the study. Two observers independently and simultaneously observed each pupil at the same time in real-time measurement.

Interval-by-interval IOA. The interval-by-interval (I-I) approach, as recommended by Bijou, Peterson & Ault (1968) has many advantages. As noted by

Hawkins & Dotson (1973) “it allows an observer to measure several responses concurrently, it shows changes in either the frequency or the duration of a behaviour and it circumvents the sometimes difficult task of defining and detecting single units of behaviour” (p.1). The I-I approach to IOA, as recommended for data obtained by interval or time sampling measurement by Cooper, Heron and Heward (2007, p.117), was implemented. The recording sheets used by both observers were compared. The first observer’s record for each interval was matched to the second observer’s record for the same interval. The number of intervals agreed were divided by the total number of intervals and multiplied by 100. This produced a percentage of intervals in which the observers agreed. While the convention for IOA is that it is obtained from a minimum of 20% of sessions, a higher figure of 25-33% of sessions is preferable for real-time measurement, as opposed to data taken from a permanent product (Kennedy, 2005, p.120). For this reason, IOA was collected from approximately every third session to give an IOA for 28-33% of sessions (29% for pupil B, 32% for pupil C, 31% for pupil D, 30% for pupil H, 33% for pupil K, 29% for pupil F, 29% for pupil G, 33% for pupil E, and 28% for pupil J).

The mean interval-by-interval IOA for each pupil, for engagement, SIB and aggression was calculated as being above the minimum conventionally acceptable percentage of 80% agreement (Cooper, Heron & Heward, 2007). Mean interval-by-interval IOA for levels of engagement for pupil B was 98.5% (range 88-100%), pupil C was 98.9% (range 89-100%), pupil D was 98.6% (range 93-100%), pupil H was 100%, pupil K was 98.3% (range 93-100), pupil F was 97.3% (range 93-100%), pupil G was 100%, pupil E was 100% and pupil J was 96% (range 87-100).

The same method was used to obtain interval-by-interval IOA for levels of SIB and aggression. Mean interval-by-interval IOA for aggression for pupil B was 100%, pupil C 100%, pupil D 100%, pupil H 96% (range 80-100%), pupil K 100%, pupil F 100%, pupil G 100%, pupil E 100% and pupil J 100%. Mean interval-by-interval IOA for SIB for pupil B was 100%, pupil C 100%, pupil D 100%, pupil H 98% (range 87-100%), pupil K 100%, pupil F 100%, pupil G 100%, pupil E 100% and pupil J 100%.

Scored and un-scored IOA. Although the interval-by-interval (I-I) method of obtaining IOA has its advantages, for high or low levels of behaviour it can be misleading as they are “highly subject to influence by the rate or duration of the behaviour being recorded” (Hawkins & Dotson, 1973, p.1). As interval-by-interval IOA is “likely to overestimate the actual agreement between observers measuring behaviours that occur at very low or very high rates” (Cooper, Heron and Heward 2007, p.118), a more stringent method of obtaining IOA is recommended if a target behaviour occurs at a low or high rate. Unscored-interval (U-I) and scored-interval (S-I) IOA provides a more accurate assessment (Hawkins & Dotson, 1973). For pupils for whom the first observer scored the target behaviour occurring in 30% or fewer intervals, scored-interval IOA was also calculated where appropriate. Mean scored IOA for engagement was calculated at 100% for pupils H, G and E, and at 87.5% for pupil J (range 75-100%). Mean scored IOA for SIB was calculated for pupils B, C, D, H, K, F, G and E at 100%. Mean scored IOA for aggression was calculated at 100% for pupils B, C, D, K, F, G and E, and at 95% for pupil H (range 75-100%).

For pupils for whom the first observer scored the target behaviour occurring in 70% or more of intervals, un-scored-interval IOA was calculated where appropriate. Mean un-scored IOA for engagement was calculated for pupil B at 90.6% (range 25-100%), pupil C 94.4% (range 50-100%), pupil D 83.3% (range 0-100%), pupil K 81% (range 0-100%) pupil E 81% (range 0-100%), pupil F 100% and pupil J 90% (range 80-100%). Mean un-scored IOA for SIB was calculated for pupil H at 80% (60-100%). Mean un-scored IOA for aggression was calculated for pupil H at 67%.

Procedure. Sessions took place during the afternoons on different days of the week, depending on the class timetable. Materials were placed on tables around the main classroom, and the location of each material was consistent across sessions, that is, the train set was always on the same table in the corner of the room, the dolls house was always in the table in the middle of the room.

Baseline conditions. Play sessions began when an adult said, "time to play" or "choose something to play with". Two adults using clipboards, pencils and data collection sheets, using the data collection procedure described, recorded sessions simultaneously. All adults present refrained from all forms of interaction while data collection occurred; there was no verbal interaction, gestural prompts or physical prompts and eye contact was avoided. For ethical reasons adults intervened if a pupil engaged in problematic behaviour that may cause damage to property or injury to any individual. To establish a non-concurrent multiple baseline across participants design, the conditions and procedures followed during baseline were continued once activity schedule training had begun, and remained consistent throughout the intervention.

Frequency and duration of data collection. A 30-minute observation period for each pupil per week would have been ideal however this was not feasible. Circumstances within the classroom did not permit observational recording of each pupil for the entire session; this was partially due to practicalities regarding the number of adults supervising and the number required to collect data and IOA within one session. There were also ethical considerations; extended amounts of time during which pupils were merely observed rather than being taught or encouraged to develop their skills, was not permissible within an educational context. For these reasons, a maximum of 5-10 minutes was allocated per pupil. Sessions occurred on a frequent basis (once a week) for the duration of the study. Data were collected for each pupil approximately once every two weeks, by two observers who independently and simultaneously observed in real time measurement. IOA was obtained using an interval-by-interval approach (number of intervals agreed, divided by total number of intervals, and then multiplied by 100). Unscored-interval IOA was also obtained during low occurrences of the behaviour (number of intervals with agreement of occurrence, divided by total number of intervals, multiplied by 100) and scored-interval IOA was obtained for high levels of behaviour (number of intervals of agreement of non-occurrence, divided by total number of intervals, multiplied by 100), as described on p.220.

Measures of Consistency. Measures to promote a consistent approach during play observations and data collection procedures were considered. The recording sheet designed for recording levels of engagement, SIB and aggression during play sessions included precise definitions, as discussed in the measures section. The precise definitions across all participants provided a consistent approach for the adults when measuring behaviour across pupil participants. However, while definitions of engagement, SIB and aggression were the same for all pupils in the study, a definition of stereotypy was individualised for each pupil, as each exhibited different topographies of stereotypical behaviour. To facilitate the recording procedure for adults, definitions of stereotypy were clearly written on individualised pupil recording sheets.

Minimising confounding variables. Although only one or two pupils were observed at one time, no interaction occurred between any adults and pupils within the room. This was to avoid any confounding variables that could occur if a pupil observed or heard any form of physical, gestural or verbal prompting by an adult to any other pupil within the room.

Results Overview

Three types of results from child-initiated play sessions are presented.

Results 1. Firstly, results of the partial interval recording system provide percentage levels of engagement as well as aggression and SIB. For each individual, results from sessions that occurred prior to activity schedule training provide baseline data. These are compared with data from sessions that occurred during activity schedule training. Individual graphs are presented simultaneously as a non-concurrent multiple baseline design. This is examined to establish the effect, if any, of AS training on levels of pupil independent engagement, aggression and SIB during child-initiated play sessions.

Results 2. Secondly, the variety of play materials that each pupil independently engaged with during play sessions is presented on an individual basis. Results from sessions that occurred prior to activity schedule training are compared with those from sessions that occurred during AS training. These results are examined to establish the effect, if any, of AS training on the variety of play materials used independently during play sessions. Quality of Play tables summarises, for each pupil, quantitative data and qualitative observations on both the variety of play materials engaged with and the quality of play observed.

Results 3. Thirdly, the number of types of play material used by each pupil per session provides additional numerical data. Individual graphs are presented simultaneously as a non-concurrent multiple baseline design. A mean is calculated for number of play materials engaged with in sessions that occurred prior to activity schedule training. This is compared with a mean of number of materials engaged with in sessions that occurred during AS training. These results are examined to establish the effect, if any, of AS training on the number of types of play materials independently engaged with during play sessions.

Results 1: Levels of Independent Engagement, Aggression and SIB

For each pupil, the partial interval recording system provided a percentage of independent engagement with play materials. It also provided a percentage of sessions during which problematic behaviour in the form of aggression and/or SIB occurred. Engagement data is presented for all pupils. Only 2 pupils engaged in problematic behaviour during play sessions; pupils H and K, however levels of SIB and aggression have been included on graphs for all pupils.

Individual graphs are presented as a non-concurrent multiple baseline across participants design, in Figure 8.2. On each individual graph, a phase line indicates when activity schedule training began, dividing the baseline sessions prior to the intervention from sessions that occurred during activity schedule training. For each individual, mean trend lines show the mean for engagement, and median trend line shows median for engagement. The effect, if any, of activity schedule training on levels of engagement, aggression and SIB during play sessions is presented.

Pupil B. Pupil B's level of independent engagement with play materials during play sessions was variable throughout the study. A trend line for engagement during baseline shows an upward trend. This upward trend continues during activity schedule training although it shows a slight decreased in incline. However a median level line shows that his level of engagement was similar pre-activity schedule training to during activity schedule training, with a median of 94% engagement (range 53-100%) before activity schedule training, and a median of 94% (range 40-100%) after activity schedule training had begun. Activity schedule training, it appears, had little effect on pupil B's level of independent engagement with play materials.

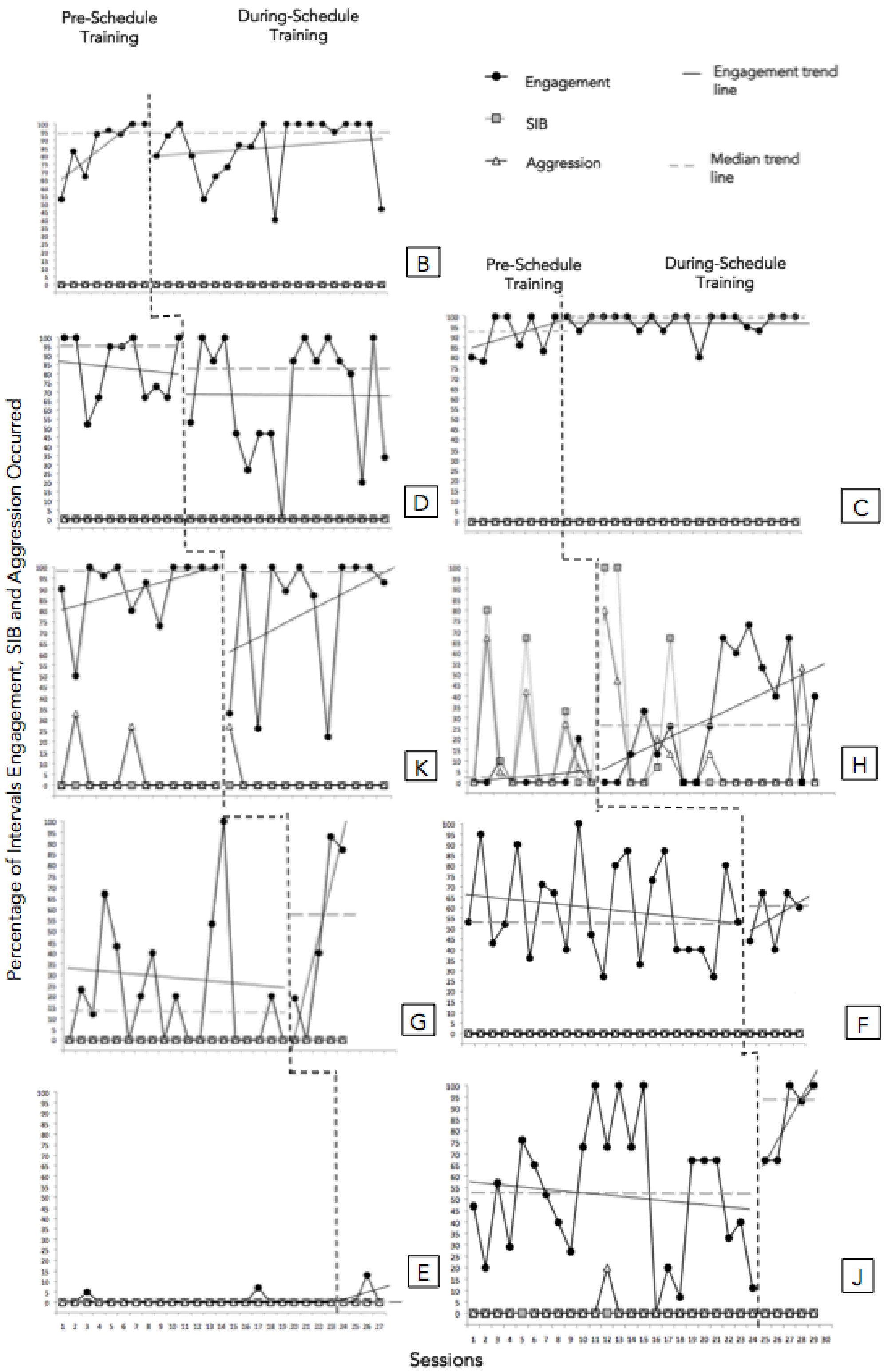


Figure 8.2. Non-concurrent multiple baseline to show levels of engagement, SIB and aggression for pupils in play sessions pre-activity schedule training and during-activity schedule training.

Pupil C. For pupil C, levels of independent engagement with play materials during play sessions were similar throughout the duration of the study. Trend lines show that during baseline conditions, there was an upward trend for levels of engagement, however this level remained constant once the intervention was introduced. Median lines for engagement show 93% pre-activity schedule training (range 78-100%) and 100% engagement (range 93-100%) during activity schedule training which demonstrates that her level of independent engagement was slightly higher after the intervention had been introduced.

Pupil D. Pupil D's levels of independent engagement with play materials were variable throughout the study. The median level lines indicate that levels of independent engagement in play sessions were lower in those that occurred during activity schedule training when compared with sessions that occurred pre-activity schedule training, during baseline conditions, with a median of 95% engagement (range 0-100%) in pre-activity schedule sessions and a median of 84% engagement (range 20-100%) in post-activity schedule sessions. Trend lines show a decrease in engagement during baseline, which then remained constant during the intervention.

Pupil H. For pupil H, levels of independent engagement during play sessions before activity schedules began was very low. The median level of engagement pre-activity schedule training was 0% (range 0-20%). During schedule training, the median level of engagement rose to 13% (range 0-67%). The trend lines indicate that pupil H's level of independent engagement during play sessions was greater during activity schedule training than pre-training. The slight upward trend during baseline increased sharply during the intervention.

SIB was observed in 40% of play sessions pre-activity schedule training. This level fell to 24% of sessions during activity schedule training. No incidents of SIB were observed during the last 11 play sessions. Aggression was observed in 50% of play sessions prior to activity schedule training. This fell to 33% of sessions during activity schedule training, with only 1 incident within the last 8 sessions.

Pupil K. Pupil K's independent engagement with play materials was variable throughout the study. Prior to activity schedule training, the median level of engagement during play sessions for pupil K was 98% (range 50-100%). Once training had begun, the median fell slightly to 97% (range 22-100%). However, both trend lines during baseline and during the intervention show an upward trend for engagement.

Pupil K engaged in aggressive behaviour during some play sessions. Prior to activity schedule training, he engaged in aggressive behaviour during 17% (2 of 12) of sessions. Following activity schedule training, this dropped to 7% (1 of 14) of sessions. No occurrences of aggression were observed in the last 10 play sessions.

Pupil F. Pupil F's levels of independent engagement during play sessions was variable both prior to and during activity schedule training, however a slight increase in engagement is observed during activity schedule training. His median level of engagement was 53% pre activity schedule training, which rose to 60% engagement after activity schedule training began. During baseline conditions, the downward trend line indicates decreasing levels of engagement whereas once the intervention had begun, the upward trend line indicates an increase in engagement.

Pupil G. Pupil G's level of independent engagement during play sessions was variable both prior to and during activity schedule training. Median level of engagement during play sessions was 12% (range 0-100%) during baseline conditions pre-activity schedule training, increasing to 40% (range 0-93%) engagement in sessions during training. In 47% (9 of 19) of sessions prior to training, pupil G's engagement was 0%. Post training this decreased to 20% (1 of 5) of sessions that had 0% engagement. During baseline conditions, the downward trend line indicates a decreasing level of engagement. However, following the start of the intervention, the upward trend line increases sharply.

Pupil E. The level of pupil E's independent engagement with play materials was very low throughout the duration of the study. His median level of engagement was 0% (range 0-7) prior to activity schedule training and 0% (range 0-13) during activity schedule training. Levels of independent engagement were broadly similar in play sessions prior to and during activity schedule training however a trend line during intervention shows a constant level, whereas the trend level once the intervention had begun shows an increase in engagement levels. These results need to be interpreted carefully however as Pupil E engaged with play materials in only 3 play sessions. Two of these sessions took place before activity schedule training began.

Pupil J. Pupil J's level of independent engagement with play materials was variable pre-activity schedule training sessions and post training sessions. Median level of engagement in play sessions was 55% (range 0-100%) during pre-activity schedule sessions. Median level of engagement increased to 93% (range 67-100%) during activity schedule training. Trend lines show differing levels of engagement across the play sessions prior to and during activity schedule training ; during baseline conditions, there was a downward trend with levels of engagement. Following the start of the intervention however, the trend line indicates a sharp upward trend.

Results of levels of independent engagement, aggression and SIB across play sessions have been considered. The following section presents results of which type of play materials, if any, pupils independently engaged with across the sessions.

Results 2: Variety and Quality of Play

The second type of play data is presented. Types of play materials that each individual engaged with during play sessions, if any, were noted on data recording sheets, while additional notes were made regarding the quality of play observed, for example, picking up, putting down, sorting or stacking items. Play materials were categorised into 13 different types of play material, as shown in Figure 8.1. The variety of play materials used is presented in tabular form for each pupil; materials engaged with independently during each session are marked with a black cell. Any white cells indicate that the pupil did not engage with the specified materials. A phase line is included within each table to indicate when activity schedule training began.

Further information is presented in Quality of Play tables; measurements have been quantified where appropriate and the quality of play is summarised for each pupil. Consideration has been given to any difference in the variety of materials independently engaged with by each pupil prior to activity schedule training and during activity schedule training. Variety of play materials tables and quality of play tables are presented for individual pupils in the order in which they began activity schedule training.

Pupil B. The variety of play materials that pupil B independently engaged with was very limited in the play sessions prior to activity schedule training. He engaged predominantly with the train set; his play was repetitive and consisted of pushing carriages forward around a circular track, often with his eyes very close to the track. His brief play with other vehicles involved the same action of pushing forwards. During activity schedule training however, the variety of materials that pupil B independently engaged with increased, as shown in Table 8.4.

Table 8.4

Materials Pupil B Engaged with during Play Sessions

Materials	Pre Training								During Training																			
Shape sorter																												
Bead frame																												
Animals													■									■						■
Characters												■																
Figures																												
Duplo										■	■					■		■			■	■						
Farm yard						■				■			■		■	■		■							■			
Train set	■	■	■	■	■	■	■		■			■	■	■						■		■	■	■		■	■	
Car track								■	■			■				■	■		■	■					■		■	
Car garage																			■	■								
Car ramp																							■					■
Jigsaw puzzle																												
Happy land										■							■				■	■						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	Sessions																											

Quality of play. The quality of pupil B's play developed following the start of AS training; his play involved a greater variety of actions and appeared more conventional. His schedule included the actions of sorting (Duplo and animals) and matching (animal pictures), and building (Duplo). As noted, prior to AS training, pupil B was observed engaging in limited actions; picking up, putting down and pushing forwards. Once AS training had begun, he engaged in a wider array of actions; matching, sorting, building. During free play sessions he engaged with materials that were part of his schedule; Duplo and animals. He sorted various items into separate dishes e.g. cars and animals, and into vehicles and farm buildings e.g. put all the pigs into the pen, all the cows into the tractor. It seems that engagement with these particular play materials, and actions, generalised to free play sessions. In contrast, the play materials that were not part of his schedule – bead frame, shape sorter, figures – were ignored by pupil B both prior to and after the start of AS training. Prior to AS training, pupil B had learned to sort and match during his 1:1 learning sessions. However he had not been observed independently engaging in these actions during other settings or activities. It seems that these actions occurred independently only after AS training. Quality of play is summarised in Table 8.5, which compares quality of play prior to and during activity schedule training.

Table 8.5

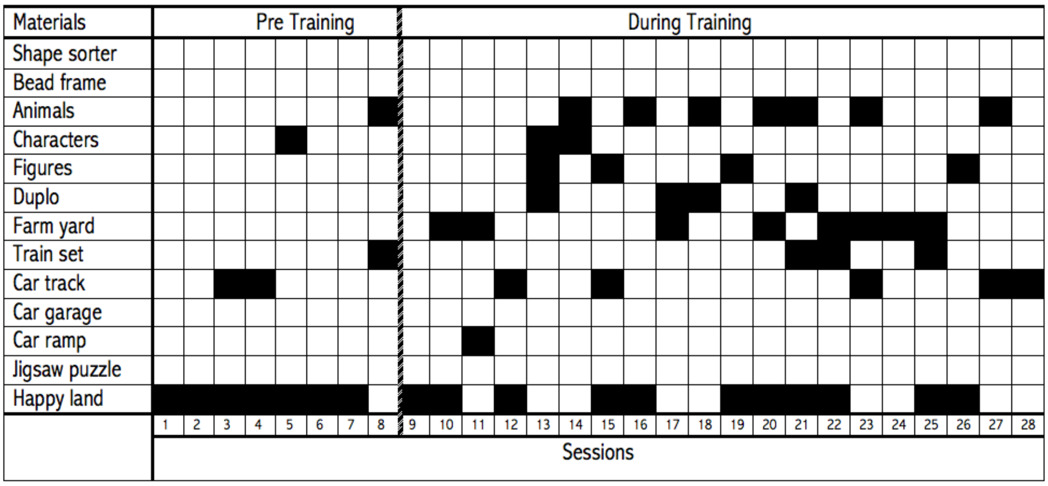
Quality of Play for Pupil B

Pre-Activity Schedules	During Activity Schedules
Engaged with the train set in 88% of sessions	Engaged with the train set in 50% of sessions
Engaged with *only* the train set in 75% of sessions	Engaged with *only* the train set in 15% of sessions
Engaged with a total of 3 different types of play material	Engaged with a total of 9 different types of play material
Did not use Duplo	Used Duplo to build
Play was repetitive and involved a single action – pushing train around a track, pushing car or farm vehicle forwards	Play involved multiple actions e.g. putting animals in and out of farm buildings, lining up cars, putting cars into garage and down ramps, sorting animals and figures, joining and taking apart

Pupil C. Prior to activity schedule training, pupil C engaged predominantly with the dolls house from the Happy Land play set and the animals/figures that went with it. Pupil C spent most of her time seated at the table with the Happy Land set, and the car ramp adjacent to it. She frequently mouthed the materials and occasionally picked up figures out of the dolls house that was part of the Happy Land set. She pushed a car backwards and forwards. In only 1 of the 8 sessions did she get up from the table and move to another part of the room. Following the start of activity schedule training however, the variety of play materials that pupil C independently engaged with increased, as shown in Table 8.6.

Table 8.6

Materials Pupil C Engaged with during Play Sessions



Quality of play. For pupil C, quality of play was more developed in sessions during training and her actions became more conventional than those observed prior to training. Once training began, in most sessions, she was observed getting up from her chair independently and moving to other parts of the room to obtain materials. During AS training, pupil C got up and retrieved each set of materials needed to complete her schedule before sitting down to complete each activity. It seems that this active behaviour continued in free play sessions that occurred following the start of AS training.

Following the start of AS training, pupil C moved around the room and engaged with materials had been incorporated into her schedule; Duplo, vehicles, farm animals. As noted, prior to AS training her actions often involved mouthing the materials, and actions were limited to putting in/on and pushing. However4, in free play sessions during AS training, she was observed engaging in a far wider range of actions, using more diverse materials. For example, she sorted farm animals into containers, put figures in and out of the dolls house and in and out of vehicles. In contrast, she did not engage with materials that had not been part of her schedule; bead frames or shape sorters. It seems that skills acquired during AS training, using specific materials and actions, had generalised to free play sessions. A comparison of quality of pupil C's play prior to and during AS training is summarised in Table 8.7.

Table 8.7

Quality of Play for Pupil C

Pre-Activity Schedules	During Activity Schedules
Engaged with the happy land set in 88% of sessions	Engaged with the happy land set in 55% of sessions
Engaged with *only* the happy land set in 50% of sessions	Engaged with *only* the happy land set in 5% of sessions
Engaged with a total of 5 different types of play material	Engaged with a total of 9 different types of play material
Left seat to move around the room in 13% of sessions	Left seat to move around room in 75% of sessions
Did not use Duplo	Used Duplo to build
Play was repetitive e.g. pick up, mouth item, put item down	Play was more complex e.g. sorting into piles, putting animals into farm buildings, putting figures into houses, joining and taking apart

Pupil D. Prior to activity schedule training, pupil D's independent engagement with play materials was limited and he engaged predominantly with the small figure toys. He engaged in a high level of self-stimulatory behaviour, and while self- stimulatory behaviour continued in the sessions following activity schedule training, the variety of materials that pupil D independently engaged with increased, as shown in Table 8.8.

Table 8.8.

Materials Pupil D Engaged with during Play Sessions

Materials	Pre Training											During Training																	
Sessions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Shape sorter																													
Bead frame											■																		
Animals										■		■	■	■	■	■			■		■				■	■			■
Characters												■																	
Figures	■	■	■	■	■	■	■	■							■	■		■	■		■		■	■	■				
Duplo																						■		■					
Farm yard																■										■			
Train set																		■				■				■			
Car track									■	■					■	■	■	■				■						■	■
Car garage																										■			
Car ramp																												■	
Jigsaw puzzle																													
Happy land						■												■					■			■	■	■	

Quality of play. Following the start of activity schedule training, the quality of Pupil D's play was more developed than it had been previously. Prior to AS training, pupil D engaged predominantly with the small world figures. He continued to engage in stereotypy on a frequent basis, however this decreased in frequency as his engagement with play materials became more conventional. He was observed picking up and putting down with intent; putting figures or animals into containers, farmyard pens and vehicles. He also engaged with cars in conventional ways, pushing them forwards. The quality of pupil D' play is summarised in Table 8.9.

Table 8.9

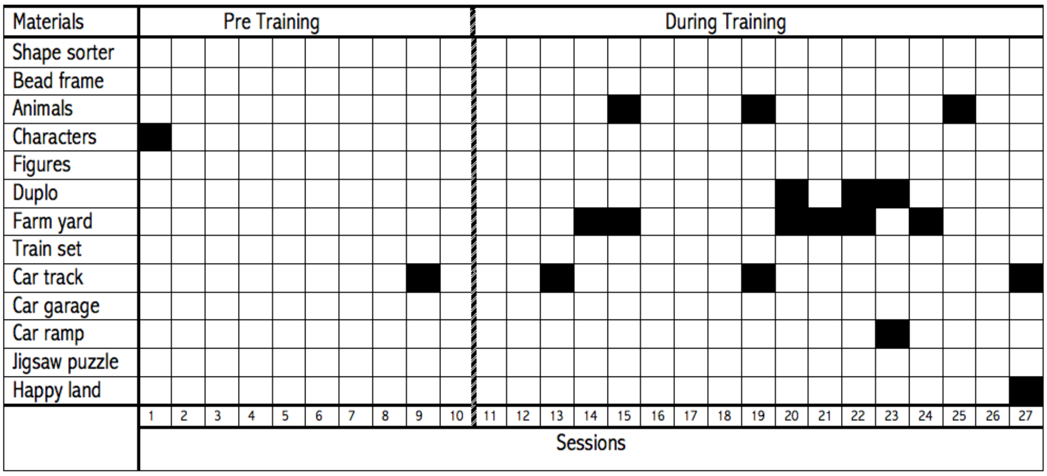
Quality of play for Pupil D

Pre-Activity Schedules	During Activity Schedules
Engaged with figures in 73% of sessions	Engaged with figures in 44% of sessions
Engaged with *only* figures in 63% of sessions	Engaged with *only* figures in 6% of sessions
Engaged with a total of 5 different types of play material	Engaged with a total of 10 different types of play material
Did not engage with Duplo	Used Duplo to build
Engaged in stereotypy and repetitive behaviour e.g. rattling small items on table tops, mouthing and spitting on items	Engaged in more conventional play e.g. pushing/pulling cars and trains, picking up and putting down items in play house/farm

Pupil H. Pupil H independently engaged with play materials in few play sessions pre-activity schedule training. There were many sessions in which no independent engagement occurred. However, following the start of activity schedule training, pupil H engaged with resources more often and the variety of materials increased, as shown in Table 8.10.

Table 8.10

Materials Pupil H Engaged with during Play Sessions



Quality of play. As the variety of materials engaged with increased, the quality of pupil H's play also became more developed and constructive. Pupil H had animals, cars and sorting dishes in his schedule. Following the start of training, Pupil H was observed putting animals in and out of farmyard buildings and sorting them into bowls on the table. He had a building task using Duplo in his schedule. Having begun schedule training, he was observed independently joining Duplo blocks together. Quality of pupil H’s play prior to and during activity schedule training is summarised in table 8.11.

Table 8.11

Quality of Play for Pupil H

Pre-Activity Schedules	During Activity Schedules
Engaged with play materials in 20% of sessions	Engaged with play materials in 64% of sessions
Engaged with 2 types of play material in total	Engaged with a total of 6 types of play material
Did not engage with Duplo	Used Duplo to build
Quality of play very limited e.g. pick up item, throw or drop item	Quality of play more complex e.g. picking up animals and putting into farm buildings, sorting animals into bowls

Pupil K. The variety of materials that pupil K independently engaged with prior to activity schedule training was similar to the variety during training, as presented in Table 8.12.

Table 8.12

Materials Pupil K Engaged with during Play Sessions

Materials	Pre Training												During Training											
Shape sorter																								
Bead frame																								
Animals		■							■			■			■							■		
Characters				■																				
Figures																								
Duplo					■				■	■				■			■					■	■	
Farm yard	■		■					■			■					■			■		■			■
Train set													■	■		■	■	■		■	■			■
Car track		■		■	■				■	■		■			■		■	■	■	■	■		■	
Car garage																								■
Car ramp	■					■	■																	
Jigsaw puzzle		■																						
Happy land												■								■		■	■	■
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Sessions																							

Quality of play. Pupil K had a variety of materials in his schedule; including Duplo and farm animals. Prior to AS training, pupil K's play centred around cars. While he did engage with other play materials, these were used to create tracks to move cars along; Duplo blocks were arranged in a line rather than joined together. After training began pupil K engaged with a similar variety of materials, however his play was more conventional. For example, he used Duplo to build "animals" and "monsters" (as he labelled them). He also engaged with the train set, which he had not previously used. The action of pushing a car forwards and backwards transferred to trains on a track. Prior to training, pupil K used pieces of train track to stack up as a road or barriers for his cars. Once training had begun, he was observed taking the track apart and then building it again by joining pieces together. It seems that the action of joining together, acquired during AS training sessions, generalised to free play sessions using Duplo and train tracks. He was also observed sorting animals by type, and grouping them together into farm buildings or sorting dishes. Table 8.13 summarises the improved quality of his play.

Table 8.13

Quality of Play for Pupil K

Pre-Activity Schedules	During Activity Schedules
Lined up Duplo blocks and puzzle pieces to make car tracks	Joined Duplo conventionally to build structures/animals
Did not engage with train track	Engaged with train track in 67% of sessions
Used animals for knocking over with a car	Sorted animals into type and put them into farm buildings
Play repetitive and limited to lining up items and moving cars forwards	Play more conventional and involved multiple actions e.g. building, sorting, joining

Pupil F. Pupil F independently engaged with a variety of play materials prior to as well as during activity schedule training; this is presented in Table 8.14.

Table 8.14

Materials Pupil F Engaged with during Play Sessions

Materials	Pre Training																							During Training				
Shape sorter																												
Bead frame		■		■			■	■																				
Animals	■				■			■									■								■			
Characters					■																							
Figures																	■					■		■			■	
Duplo	■		■	■		■						■			■		■		■	■			■	■			■	■
Farm yard										■	■			■		■	■				■				■			
Train set					■		■								■	■		■				■	■			■	■	
Car track					■		■	■					■											■	■			
Car garage									■																			
Car ramp																												
Jigsaw puzzle																												
Happy land					■											■								■	■	■		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	Sessions																											

Quality of play. Prior to training, however, pupil F's engagement with materials was fleeting. He was observed picking up and mouthing items, looking at them briefly, then dropping them to the floor or throwing them. When activity schedule training began, his actions became more constructive and purposeful. He was observed stacking multiple Duplo blocks together to build a tower. He also replaced Duplo blocks into the box – this action, having not been observed previously, seemed to mimic the action of returning materials to a box during AS training. He also was observed putting animals into containers; his actions were more controlled, seemingly placing items with intent. These observations were in stark contrast to the fleeting engagement seen prior to AS training, when items were mouthed, dropped or thrown. The quality of pupil F’s play is summarised in Table 8.15.

Table 8.15

Quality of Play for Pupil F

Pre-Activity Schedules	During Activity Schedules
Mouthed animals and dropped them	Put animals into farm buildings with purpose
Picked up and dropped Duplo	Joined Duplo together, put Duplo into box
Quality of play very limited e.g. picking up and throwing or dropping item, mouthing items	Quality of play more constructive e.g. picking up, looking at and putting down with intent

Pupil G. Prior to activity schedule training, pupil G's independent engagement with play materials was low and the variety of play materials he engaged with was limited. When he did engage, his play centred on the car ramp. Table 8.16 shows the variety of play materials engaged with by pupil G.

Table 8.16

Materials Engaged with by Pupil G during Play Sessions

Materials	Pre Training																			During Training				
Shape sorter																								
Bead frame																								
Animals																								■
Characters																								
Figures																								
Duplo								■					■											■
Farm yard					■																		■	
Train set																								
Car track														■										
Car garage																								
Car ramp		■	■	■			■	■		■								■				■	■	
Jigsaw puzzle																				■				
Happy land																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Sessions																							

Quality of play. In sessions that occurred during activity schedule training, there were relatively fewer sessions during which no engagement occurred. Pupil G engaged with a wider variety of materials and the quality of his play was more developed. Prior to AS training, pupil G predominantly engaged with the cars on the car ramp. His actions were restricted to picking up and putting down the car. If he picked up Duplo, he subsequently dropped the blocks. During training, pupil G's activities included items to sort into containers. He was also prompted to join Duplo together. Following the start of AS training, pupil G picked up cars, put them on the ramp and pushed them, and also put them into a garage. Pupil G was observed joining Duplo independently. It seems the deliberate picking up and putting in/on action that was acquired in AS training generalised to free play sessions. This is summarised in Table 8.17, which compares quality of play in sessions that occurred prior to and during activity schedule training.

Table 8.17

Quality of Play for Pupil G

Pre-Activity Schedules	During Activity Schedules
No engagement with any play materials in 47% of sessions	No engagement with any play materials in 20% of sessions
Of sessions with engagement, used car ramp in 70%	Of sessions with engagement, used car ramp in 50% of sessions
Picked up and dropped Duplo	Joined Duplo together
Play very repetitive and lacking focus e.g. picking up and putting down car	Play more conventional e.g. pushing car down ramp, putting car into garage space

Pupil E. The variety of materials that pupil E independently engaged with is presented in Table 8.18 which shows that engagement was low both prior to and during activity schedule training. His engagement, when it did occur, was fleeting and items were dropped or thrown.

Table 8.18

Materials Engaged with by Pupil E during Play Sessions

Materials	Pre Training																							During Training				
Shape sorter																												
Bead frame																												
Animals																												
Characters																												
Figures			■																							■		
Duplo																												
Farm yard																												
Train set																■												
Car track																												
Car garage																												
Car ramp																												
Jigsaw puzzle																												
Happy land																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	Sessions																											

Quality of play. Pupil E went to the door leading from the classroom into the kitchen on a frequent basis. When he had free access to play materials in the classroom, he went to the door and rattled it if it was locked, or repeatedly opened and closed it if it was unlocked. He was frequently observed repeatedly pacing back and forth across the classroom towards and away from the door. If an adult stood between him and the door, he stood in front of the adult clapping his hands, intermittently making loud screaming noises, while looking towards the adult's face. During other educational sessions that occurred in this classroom, an adult limited any occurrence of this behaviour by re-directing his attention. However, the conditions within the play session prohibited interaction and therefore this behaviour was not stopped. As there was no discernible difference in quality of play following the start of activity schedule training, no table on quality of play is included for pupil E.

Pupil J. Pupil J independently engaged with a wide variety of play materials during play sessions that occurred prior to activity schedule training, and a similarly wide variety during training, as shown in Table 8.19.

Table 8.19

Materials Engaged with by Pupil J during Play Sessions

Materials	Pre Training																								During Training				
Shape sorter																													
Bead frame							■																						
Animals	■	■			■	■																				■		■	
Characters													■																
Figures				■																									
Duplo							■											■	■										
Farm yard																									■			■	
Train set			■																										
Car track			■				■										■	■		■				■			■		
Car garage								■	■	■												■							
Car ramp						■					■	■	■		■	■							■				■		■
Jigsaw puzzle					■																				■				
Happy land	■																			■	■	■	■						■
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	Sessions																												

Quality of play. During earlier sessions, prior to AS training, pupil J engaged in a high level of stereotypical behaviour with play materials; this involved repetitively tapping items against her face. Her AS included several 'putting in' activities; putting inset puzzle pieces into recesses, putting pegs into holes and putting items into bowls. After the start of activity schedule training, the quality of her engagement with play materials seemed more developed. While self-stimulatory behaviour still occurred, it was less frequent and the quality of her play was more conventional. For example, rather than tapping a car against her face, or attempting to give it to an adult, she put it on the car ramp. She was also observed putting animals into sorting bowls and farm buildings. It seems that the action of 'putting in', acquired during AS training, generalised to the free play sessions. Table 8.20 compares the quality of her play prior to and during activity schedule training.

Table 8.20

Quality of Play for Pupil J

Pre-Activity Schedules	During Activity Schedules
In sessions that included engagement, used only 1 type of play material in 54% of sessions	In sessions that included engagement, used only 1 type of play material in 20% of sessions
Tapped car against face repeatedly	Put car on car ramp and car track
Tapped animals against face repeatedly	Put animals into bowls and farm buildings
Engaged in stereotypical behaviour e.g. tapping items against face, mouthing items, dropping items to the floor	Quality of play more constructive e.g. picking up and putting into containers, looking at items

The quality of independent play observed in sessions prior to activity schedule training has been compared with the quality of play in sessions that occurred during training. The variety of play materials independently engaged with by the pupils across play sessions has been examined. This same data has been re-examined in the next section and numerical data is presented.

Results 3: Number of Types of Play Materials

The third type of play data is presented. The tables showing variety of play materials were re-examined to create numerical data. For example, as shown in Table 8.4, in play sessions that occurred prior to AS training, pupil B engaged with only 1 item in 7 sessions, and 2 items in 1 session. Following the start of AS training, in 3 of the 20 sessions he engaged with only 1 item, however during the other 17 sessions he engaged with between 2 and 4 different play materials per session. For each pupil, the number of different types of play materials engaged with per session was counted. Results for each pupil are compiled and presented as a non-concurrent multiple baseline across participants design. This is presented in Figure 8.3. Pupil results are presented in the order in which they began activity schedule training: pupils B and C, D and H, K, G and F, and finally E and J. A phase line indicates when activity schedule training began for each pupil. The effect of activity schedule training on pupil independent play can be compared by examining data for sessions that occurred prior to and during training.

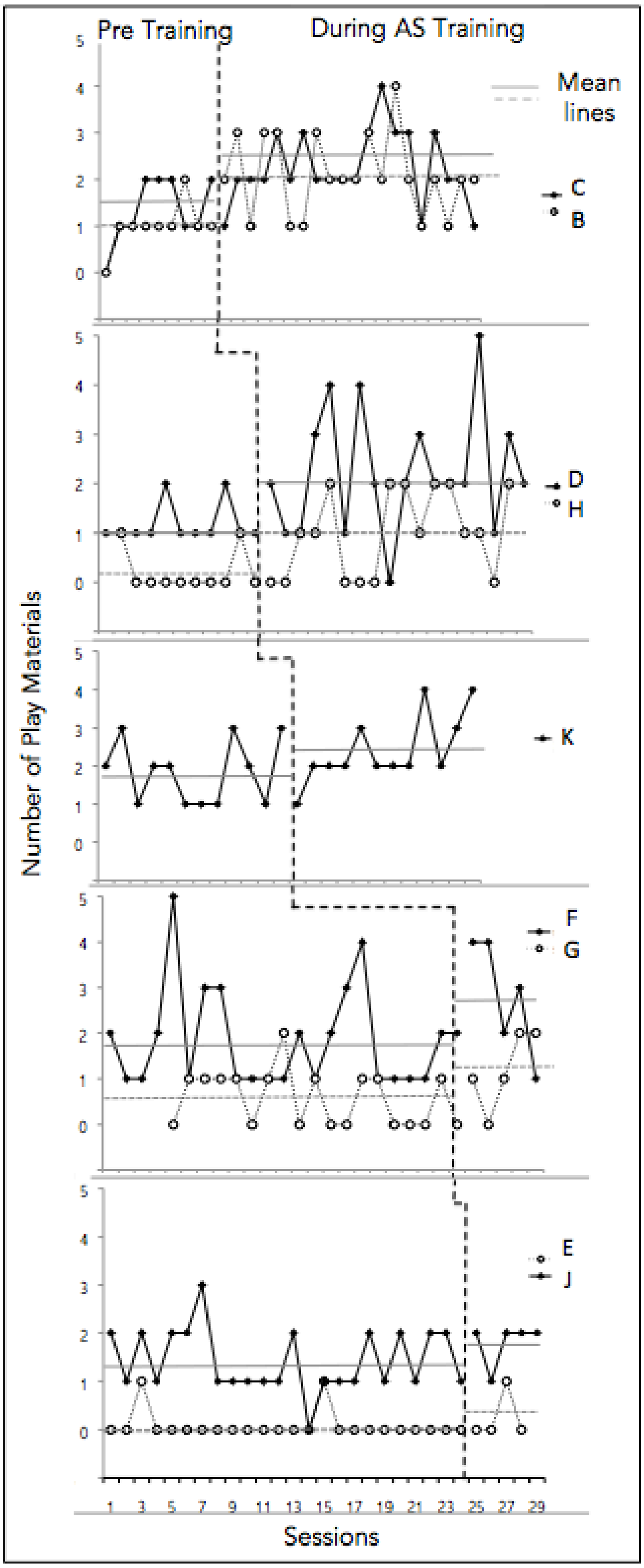


Figure 8.3. Non-concurrent multiple baseline design to show the number of play materials engaged with in play sessions by all pupils.

Mean data for all pupils. A mean was calculated for sessions prior to activity schedule training and for sessions post activity schedule training. To do this, the number of different types of play material used in each session was identified; totals for each session pre-activity schedule training were combined and then divided by the total number of sessions. The same procedure was used to identify the mean across sessions that occurred once activity schedule training had begun. A mean line is presented for each data path on Figure 8.3.

Mean data is presented separately in Figure 8.4. This demonstrates that for each of the 9 pupils, when compared with the mean of play materials independently engaged with prior to activity schedule training, the mean of play materials independently engaged with after activity schedule training had begun was higher.

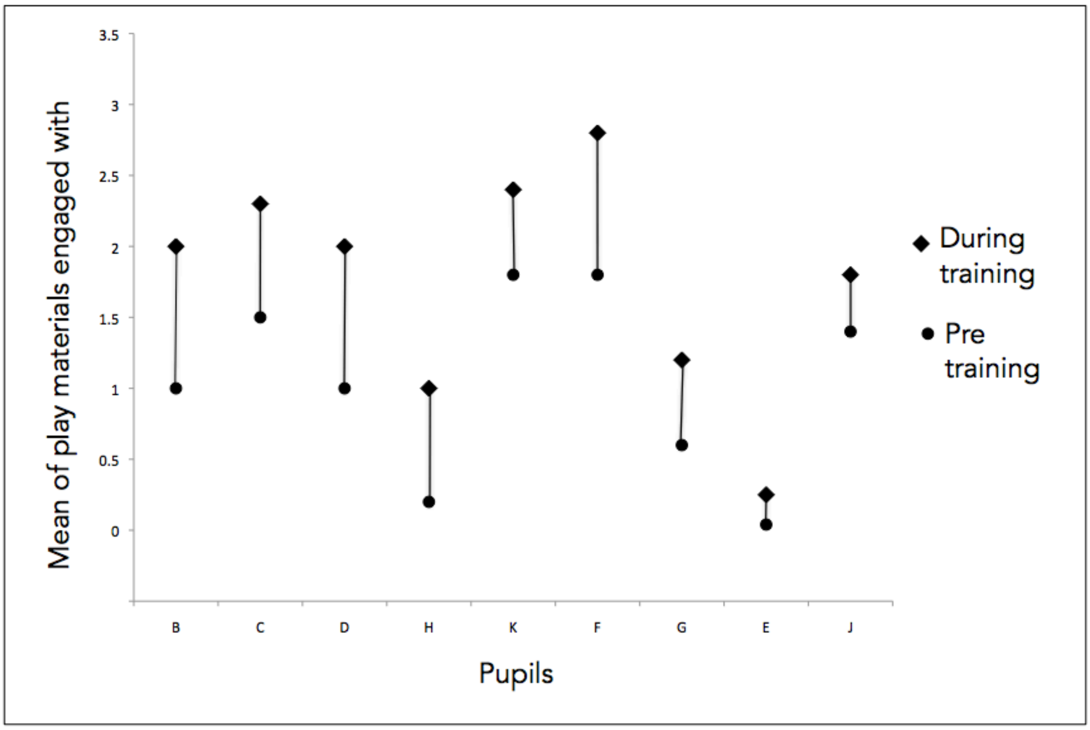


Figure 8.4. Mean of different play materials engaged with.

Results for all types of data collected have been presented. The following section presents a summary of additional observations made during child-initiated play sessions.

Additional Observations and Discussion

Some additional observations have been made during child-initiated play sessions. These are presented.

Quality of play. For all but one of the pupils (pupil E), quality of play observed in sessions that occurred after activity schedule training had begun was more sophisticated than quality of play observed prior to AS sessions. Many pupils were observed using materials that were included within their schedule resources (e.g. Duplo and animals) that were not used in sessions occurring prior to AS training, despite them being freely available. In addition, many pupils were observed independently engaging in actions (e.g. stacking and sorting) that were not observed in sessions that occurred before AS training began. These observations highlight the importance of having included these individual materials, but more importantly it demonstrates the benefit of having focused on specific actions involved in the activities.

As noted in Chapter 7 (p.161), simple actions such as sorting to a given criteria, or matching like-to-like, may not be typically associated with play, however they are pre-requisite skills to early play behaviour, such as grouping farm animals together, and sorting colours for a puzzle. The Quality of Play tables (p.229-241) demonstrate changes in quality of play prior to and after the start of activity schedule training observed for each individual pupil. It seems that these skills were acquired during activity schedule training sessions, and subsequently generalised to play sessions.

Of particular note was pupil engagement with Duplo. Not one of the pupils engaged with Duplo in conventional ways prior to activity schedule training sessions. Those that picked up blocks did not use them in the manner in which they were designed, instead they were mouthed, dropped or thrown. Four pupils engaged with Duplo prior to AS training; pupil G picked up and dropped blocks, pupil F mouthed them or dropped them through an open window, pupil J tapped them against her face, while pupil K lined them up (without joining) and used them as a car ramp. However, once activity schedule training began, 7 pupils used Duplo independently, and their actions were more conventional; for example, pupil F and G joined blocks together and pupil K built models.

Tentatively, it could be surmised that teaching methods used in activity schedule training induced independent Duplo building behaviour. This behaviour did not occur when naturalistic teaching strategies had been used

Non-concurrent multiple baseline designs. It is not always practical for MBDs to be measured concurrently when a study includes multiple participants within an education setting. As in the current study, the researcher must then consider a non-concurrent MBD (NCMBD). A NCMBD in the current study is a related series of A-B designs conducted at different points in time; the baseline to intervention phases are staggered across participants but are not contemporaneous. However, as Cooper, Heron and Heward point out, within this “the absence of concurrent measurement violates and effectively neuters the experimental logic of the multiple baseline design” with a danger that “putting the graphs of three A-B designs on the same page and tying them together with a dogleg dashed line might produce something that ‘looks like’ a multiple baseline design” (p.216).

Nevertheless, they also state that the NCMBD can be valuable: although concurrency is ideal, with an effective NCMBD “replication of effect is demonstrated each time a baseline steady state is changed by the introduction of the independent variable, more or less regardless of where or when the variable is applied. Such nonconcurrent and/or unrelated baselines can provide valuable data on the generality of a treatment’s effectiveness” (p.216, Cooper, Heron & Heward, 2007).

Although it diminishes the experimental logic of the MBD, and is therefore less plausible, it is arguably better to use a NCMBD than to not record the effects of an intervention at all. When scaling up from a one participant design to multiple participants, the logistics of a concurrent MBD become difficult. As noted by Harvey, May and Kennedy (2004), NCMBDs have their advantages as “although considered less rigorous than concurrent multiple baseline designs, nonconcurrent designs have a degree of flexibility that may allow for their use in studying complex social contexts, such as educational settings, that might otherwise go unanalyzed.” (p. 267).

Confounding variables.

Consideration was given to any potentially confounding variables that could have affected pupil progress and presented a threat to internal validity. One potential variable was maturation effects. As children mature over time, normal developmental effects can influence any behaviour being studied (Kennedy, 2005). This is clearly an area that warrants attention in any area of research within educational establishments.

During typical play sessions that had occurred prior to the current study taking place, adult prompting had been part of usual proceedings. Physical, verbal and gestural prompts had been used to model actions and encourage pupil engagement in traditional play. Adult prompting was part of naturalistic teaching strategies employed during typical play sessions. Despite these interventions, play skills demonstrated by pupils at the beginning of the study were low. Pupil assessments within the curriculum areas that included play development showed that very little progress in pupil play skills, if any, had been made by individuals over the 2-3 years preceding the study. From this, it can be assumed that maturation effects, or indeed the naturalistic methods used to teach play, had little effect on pupil play skills in the 3-7 years preceding the study (depending on how long pupils had attended the school). Any maturation effects during the period of play data collection were therefore likely to be negligible.

Summary and Conclusion

Results for all types of data collected have been presented. In this section, results are summarised, and the effect of activity schedule training on pupil independent play is estimated.

Independent engagement. Levels of independent engagement during play sessions in sessions that occurred prior to activity schedule training were compared with those that occurred during activity schedule training. In both phases there was wide variability of performance for the majority of pupils. For further analysis, a median line presented an average of overall responding. A median level line was chosen over a mean level line as it represents the most typical performance within a condition, and is therefore not so influenced by any data points that fall far outside the range of other data points (Cooper, Heron & Heward, 2007). The central tendency of each series of data points was graphically represented and any high or low outliers became less significant. Median lines demonstrate that for two pupils (B and E), levels of engagement were the same prior to activity schedule training as during training, while for another two, (D and K) levels of engagement slightly decreased during activity schedule training. However, for the majority of pupils (C, F, G, J and H), levels of engagement increased following the start of activity schedule training. While encouraging however, these results alone do not provide convincing evidence that activity schedule training had a positive effect on levels of engagement in play sessions. Analyses of other forms of data provide further information.

Aggression and SIB. A more convincing and positive effect of activity schedule training on play sessions is the reduction in levels of aggression in 2 pupils (H and K) and levels of SIB in 1 pupil (H). For pupil H, the increase in engagement coincided with a decrease in aggression towards others and towards himself. For pupil H, both aggression and SIB were likely escape maintained behaviours. Pupil H had previously been observed to respond positively to high levels of structure and routine. In contrast, the play sessions had a lack of structure, as they were child-initiated. This lack of structure can possibly explain the occurrence of aggression and SIB as soon as he was asked to choose an activity. Prior to activity schedule training, pupil H demonstrated limited independent skills with play materials. Perhaps as he gained higher levels of independence as well as greater practical skills with play materials, he became more confident within the classroom environment. This could explain both the increase in desirable behaviour and the decrease in SIB and aggression.

Variety of play materials and quality of play. For the majority of pupils, there was an increase in the variety of play materials engaged with once activity schedule training began. For all but one pupil (pupil E), the quality of play was more sophisticated during sessions that occurred after AS training had begun. Pupils were observed using materials not previously used and/or engaging in actions not previously observed. Tentatively, it seems that actions performed with play materials that were acquired during activity schedule training generalised to play sessions.

Number of play materials. This data yielded perhaps the most convincing results that activity schedule training was effective in developing pupil play skills. With the exception of pupil E, all pupils engaged with a greater number of types of play material once activity schedule training had begun. Means were calculated in sessions prior to AS training, and during AS training. Mean data showed that for all pupils, there was an increase in number of play materials engaged with across sessions following the start of AS training. Pupil E's data however must be considered with caution; he engaged with 2 types of play material across sessions occurring prior to AS training and only 1 following training. Due to the fact that pupil E had 23 sessions prior to training, and only 5 following the start of training, the number of sessions have affected the mean, and potentially skewed the results. This limits the overall results.

Additional observations made during play sessions were summarised. In general, it seemed that the quality of play observed in sessions that occurred once AS training had begun was more sophisticated than the quality of play prior to AS training. The nature of improvements suggested that for some pupils, skills acquired during AS generalised to play sessions.

This chapter has described methods used to measure play, both prior to and during activity schedule training. The resulting data have been presented and discussed. The following chapter addresses the social validity of this study. Methods used to estimate the importance of activity schedule training to pupils are described. Parents, carers and school staff were consulted as part of this process and the resulting social validity measures are presented.

Chapter 9
Social Validity

Overview

Social validity is the "estimation of the importance, effectiveness and/or satisfaction various people experience in relation to a particular intervention" (Kennedy, 2005, p.219). As an increasingly important priority within intervention studies (Olive & Liu, 2005), it was decided that social validity would provide further measures of this study's effectiveness.

Some forms of social validity were obtained prior to and during the intervention. Ethical approval was sought prior to the intervention, teaching procedures were discussed with parents and carers before implementation and their consent was obtained; behaviour change goals were therefore socially validated via approval from families and educational establishments. Parents and carers were kept informed throughout the intervention through invitations to observe the training sessions, progress updates via written notes home, progress updates via graphs that visually displayed pupil data and parent/carer consultation meetings held to discuss pupil progress.

Further measures of social validity were sought 10 months following the intervention. This chapter describes the methods used to obtain social validity, materials and results. An additional observations section comments on pupil willingness to participate in activity schedule training.

Methods

Methods used to obtain social validity measures are described.

Participants. Within a school setting, multiple individuals may be affected by a behaviour change intervention (Kennedy, 2005). Within this particular project, the nine pupils who participated in the main study, and their families were most directly affected by the teaching of activity schedules. Members of staff who participated were also affected. The opinions of pupil parents and carers, as well as school staff, form the basis of this social validity assessment.

Materials. Two social validity questionnaires were designed; one for school staff and the other for parents and carers. Questionnaires contained statements with a Likert-type scale (Likert, 1932) as well as open-ended questions. Statements were modified versions of those in the Intervention Rating Profile ([IRP], Witt & Martens, 1983) and the Behaviour Intervention Rating Scale ([BIRS], Elliott & Von Brock, 1991). Open-ended questions were modified versions of those from the semi-structured interview for social validation designed by Gresham and Lopez (1996). To assess intervention sustainability, questions were included pertaining to the results and the longevity of any improvements made following the intervention. The questionnaires used for this study are therefore modified versions of formal questionnaires and, on this basis, provide informal measures of treatment acceptability.

Questionnaires and letters for school staff. A social validity questionnaire was designed for school staff consisting of 15 statements with a Likert-type scale, two open-ended questions and a space to add further comments (see Appendix K). It was important to ascertain staff opinions of the intervention; if the procedure was easy to administer, if it was effective in producing the desired behaviour change, and if it was an acceptable teaching method. A letter to school staff was written (see Appendix L), containing a summary description of the intervention. The purpose of this was to provide a reminder of the procedures used to teach activity schedules, and the goals of the intervention.

Questionnaires and letters for parents and carers. A social validity questionnaire was designed for parents and carers consisting of 13 statements with a Likert-type scale, followed by one open-ended question and a space to add further comments, (see Appendix M). It was important to know from parents and carers their views on the intervention and if they noticed any improvement in levels of independence or play skills within the home or school environment. It was given to them with a letter (see Appendix N) containing a summary description of the intervention and the ways in which they had been kept informed throughout the study. Although some parents and carers had watched their children being taught to follow AS, the description served as a reminder of the procedures used, and the goals of the intervention. They were also provided with a graph showing their child's progress with activity schedules.

Measures. The assessment at the end of the study measured social validity in three ways, as recommended by Wolf (1978); social significance of the goals, social acceptability of procedures and social importance of the results. Parents, carers and school staff were asked to indicate how much they agreed with the statements on their questionnaires by circling a number between 1 and 6 (from *1* for strongly agree to *6* for strongly disagree) on the Likert-type scale. This provided a measure of agreement and a rating of different aspects of the procedure. A mean score was calculated for each of the statements by combining the scores and dividing by the total number of responses.

Procedure. Letters and questionnaires were distributed to staff, parents and carers 10 months following the end of the intervention (in May 2015, a month prior to collection of follow up data), with a request to complete and return them within a 2-week timeframe. Questionnaires completed and returned by the given date were collected for analysis.

Results

Returned questionnaires from school staff and then parents/carers are summarised:

School staff.

A total of 11 questionnaires were distributed, of these seven were returned. Responses to the statements within the questionnaire were evaluated. The potential responses ranged from *1-6* with *1* (strongly disagree), 2 (disagree), 3 (slightly disagree), 4 (slightly agree), 5 (agree) and *6* (strongly agree). The mean score was calculated for each of the 15 statements by combining the scores and dividing by the total number of responses (seven). The range of scores, mean scores and questionnaire statements are provided in Table 9.1. The overall mean for school staff was 4.95 (range 3.7-5.6).

All of the staff who responded either agreed or strongly agreed with many of the statements about activity schedules being a positive, effective intervention. Results indicate that school staff found the activity schedule to be an acceptable, appropriate method of teaching independence skills (Questions 1 and 2). They believed it to be a good, effective way of teaching independent behaviour and that it would be appropriate for a variety of children (Questions 9, 10 and 15). They approved of the intervention, would be willing to continue to use it in the classroom, and would recommend it to other school staff (Questions 3, 4 and 5).

Table 9.1

Results of Questionnaires to School Staff

	Questionnaire Statements	Range	Mean
1	The activity schedule is an acceptable intervention for teaching independence skills	5-6	5.6
2	Most teachers/TAs would find this intervention appropriate for teaching independence skills	5-6	5.2
3	I would suggest the use of this intervention to other teachers/TAs	5-6	5.3
4	I like the procedures used in this intervention	5-6	5.4
5	I would be willing to use this intervention in the classroom setting in the future	5-6	5.4
6	This intervention is practical in the amount of time required for record keeping	4-6	4.6
7	This intervention is practical in the amount of staff required to deliver it	2-6	4.1
8	This intervention requires little training to implement effectively	2-6	3.7
9	This intervention proved effective in teaching independent behaviour	5-6	5.1
10	This intervention was a good way to teach independence	5-6	5.3
11	The intervention produced a lasting improvement in pupil independence	5	5
12	The intervention improved levels of independence in other settings (e.g. other classrooms, at home)	4-6	5
13	Skills other than independence have been improved by the intervention	4-5	4.9
14	This intervention did not result in negative side-effects for the pupils	3-5	4.4
15	The intervention would be appropriate for a variety of children	5-6	5.3

Results also indicate that the amount of time required for record keeping is a consideration for staff (Question 6 with a mean score of 4.6, range 4-6), as is the number to adults required to deliver the intervention (Question 7, with a mean score of 4.1, range 2-6). The statement that scored least highly was Question 8: "this intervention requires little training to implement effectively" with a mean score of 3.7 (range 2-6) indicating that staff slightly disagreed with this.

Questionnaire questions and comments. The open-ended section of the questionnaire revealed more information. When asked if there were any changes they would make before recommending activity schedules to others, there were two responses. Both of these were around the issue of training; one commented that they would like "more in-depth training", and another acknowledged the need for "supervision after basic knowledge training".

When asked to provide more information about improved levels of independence in other settings, or improvements in other skills, there were 5 responses. Three people said they had noticed an increase in pupil “motivation” to participate in activities, complete tasks and follow directions. Improvements in self-help skills were noted, in particular with the ability to follow a sequence when dressing, undressing and eating. Improved levels of confidence were noted, as was the ability to physically travel from one area to another while retaining information required to do a task.

There were two additional comments. One adult commented positively on having been given the opportunity to participate in activity schedules. Another stated that AS had been particularly beneficial for pupils who were reluctant to listen to, or did not have understanding of, verbal instructions.

Parents and carers. Questionnaires and letters were distributed via the school, to families of the nine pupils within the main study. Of these, four questionnaires were returned. Responses to the statements within the questionnaire were evaluated. The mean score was calculated for each of the 13 statements by combining the scores and dividing by the total number of responses (four). The range of scores, mean scores and questionnaire statements are provided in Table 9.2.

Table 9.2

Results of Questionnaires to Parents and Carers

	Questionnaire Statements	Range	Mean
1	My child needed to develop his/her independence skills	5-6	5.8
2	The activity schedule is an acceptable way to teach independence skills	5-6	5.5
3	Most parents/carers would find activity schedule training an appropriate way to develop independence	4-6	5
4	I would suggest the use of activity schedules to other parents/carers	5-6	5.5
5	I like the procedures used in teaching activity schedules	4-6	5.3
6	I would be willing for my child to continue to do activity schedules in the future	5-6	5.8
7	Activity schedules proved effective in teaching independent behaviour	5-6	5.5
8	Activity schedule training was a good way to teach independence	5-6	5.5
9	Activity schedule training produced a lasting improvement in my child’s independence	4-6	5.3
10	Activity schedule training improved levels of independence in other settings e.g. home, outside of school	4-6	5.3
11	Skills other than independence have been improved through activity schedules	4-6	5.3
12	Activity schedules did not result in negative side-effects for my child	5-6	5.8
13	Activity schedule training would be appropriate for other children	5-6	5.5

All of the parents and carers gave overwhelmingly positive feedback regarding activity schedule training for their child. The overall mean for parents and carers was 5.46 (range 5.0-5.8). The range of responses was 4-6 and the mean response for every question was 5 or above, indicating that on average, they agreed to strongly agreed with the statements. Parents and carers considered that their child needed to develop their independence skills (Question 1) and that the activity schedule was an acceptable and appropriate way of doing so (Questions 2 and 3). Activity schedules proved to be a good and effective way to teach independence (Questions 7 and 8) with results producing lasting improvements in their child's independence that also occurred in settings outside school (Questions 9 and 10).

Questionnaire questions and comments. Additional written comments provided further information. One parent commented that the procedure was an effective activity for teaching and improving independent behaviour. In the future, they hoped their child would have additional verbal or written components embedded within his activity schedule.

Another parent noted improved levels of independence in the home. Their child was engaging in behaviour not previously seen such as being able to sit at the table for meal times with his family. He also engaged in chains of behaviour that had not been seen before, such as helping with food preparation by picking up chopped food and putting it into pans. He put things away, such as taking his plate and cutlery to the sink when finished with his meal. Since learning to follow a schedule, his behaviour in shops had improved; he now waited in queues, packed shopping bags and exchanged money with shopkeepers. These improvements were attributed, by the parent, to skills acquired during AS training.

Another parent commented on her daughter's newfound ability to complete tasks at home. An example given that she put her coat onto a peg in the hall, and if it fell off she returned to pick it up and try again to complete the task. She added, "Before, she wouldn't even hang up the coat, never mind go back and try again". Also noted was "she seems to use her eyes more to see how to do things, not just be aware of movement peripherally. Additionally, she is more willing to try to do things herself, either with or without a verbal prompt to do so". Interestingly, although aware that verbal prompts were not used in the activity schedule sessions, the parent felt that, following training, "she was able to follow more than one instruction, which she couldn't do before, for example, 'do this and then do that'".

Additional Observations

Pupil views were not obtained via a formal or informal interview. The majority of pupils were non-verbal and although many had learned to use symbols as a means of communication, these needed to be taught discretely and individually. Teaching the amount of printed words and symbols necessary to complete even a simple questionnaire would require a substantial amount of time. This was thought unnecessary, as it appeared from the behaviour of pupils in this study that as they gained in skills and became more proficient at schedule following, they demonstrated a preference for engaging in these sessions.

During the study, when shown the symbol/photograph that represented "activity schedule" on the timetable, many pupils independently went to the appropriate area of the classroom to engage in the activity, requiring no verbal, gestural or physical prompts to transition. Furthermore, by the end of the study the majority of pupils had begun to request their activity schedules at different times of the day. They did this verbally (pupils B and K), through pointing at or giving the symbol to an adult (pupils C, G and H) or by going to the activity schedule resource area and either touching or getting out their own box (pupils D and J). This intervention was acceptable to pupils, and may be considered socially valid, in the sense that they opted for activity schedules without prompting.

Summary and Conclusion

Social validity measures were taken to ascertain views of those working with the pupils in the study. School staff, parents and carers were consulted and their views considered. This chapter has outlined methods used to obtain these measures and presented the results. In summary, the findings of social validity questionnaires revealed that both school staff and parents/carers had positive views relating to activity schedule training. All agreed that the teaching procedure is effective and beneficial to a range of pupils. They noted a lasting improvement in independence skills and would recommend it to others as a teaching strategy. All agreed that pupils developed skills in independence and that these skills generalised across settings and resources.

The views of pupils were included via consideration of their responses towards activity schedule training. The fact that all pupils willingly engaged with activity schedule training, and seven even requested their schedules, indicates their approval of the procedure. To conclude therefore, social validity measures indicate that this study was acceptable to all involved and met the three goals of social significance, social acceptability of procedures and social importance of the results (Wolf, 1978).

The following chapter presents a detailed discussion of the intervention. It contextualises the results of pre-requisite skill training, activity schedule training and play observation sessions with the literature reviewed in the earlier chapters. The main question of whether pupils with severe intellectual disabilities and ASD could be taught to follow activity schedules independently of adult prompting is answered fully. The subordinate question of whether skills learned during activity schedule training generalised to other settings, such as child-initiated play sessions, is explored in depth.

Chapter 10
Discussion

Overview

In this chapter a thorough discussion of this research study is made. The introduction provides an overview of the thesis, re-caps on the research questions and provides answers to these questions. Next, weaknesses of the study are identified and discussed in a Limitations section. Then, a section outlining Further Discussion and Implications for Practice provides a more detailed analysis of the results and their implications for practical applications. Further findings from activity schedule training, independent play sessions and social validity measures are discussed. These relate to background theory and literature reviewed in Chapters 1 to 4, which are reconsidered in light of results obtained. Next, a summary of the entire study is made in the Study Conclusion, which reviews the thesis and its outcomes. Finally, a section on Recommendations for Research makes suggestions for researchers interested in this field of study.

Introduction

Within the literature review chapters, the challenges facing individuals with ID and/or ASD were considered. Methods used to develop skills in this minority population were explored; in particular, methods designed to increase independence specifically within the areas of play and recreation were examined. It seemed, from the literature review chapters, that the AS would be suitable for teaching chained responses, and that the PCDI approach, due to its particular prompting procedures, would be most effective for the population with severe diagnoses.

The systematic review sought to compare both the quality and effectiveness of PCDI-AS with AS using other methods. Results suggested that activity schedules in general were *moderately effective* for developing skills in those with ID or ASD, and were *moderately effective* for developing play skills in particular. Results also indicated that the PCDI approach was *highly effective* and therefore more effective than AS using other methods. Furthermore, as it produced greater generalisation than AS using other methods, the PCDI approach appeared to be higher quality.

The narrative synthesis indicated that while some studies had used PCDI-AS to occasion new skills in those with a mild or moderate diagnosis, there was a paucity of evidence to suggest that this procedure would be effective for those with more severe diagnoses. Since MacDuff et al.'s (1993) study, no further studies using PCDI-As to develop independent engagement with play materials in individuals with a severe diagnosis were identified. No studies measured generalisation of skills to other situations with different materials.

An intervention using a PCDI-AS procedure was designed to develop independent play skills in pupils with diagnoses of ID and ASD (or ASD type characteristics) within the severe to profound range. Of interest was if PCDI-AS could be used to teach children with severe diagnoses to engage with independent play materials independent of adult prompting, and if so, would these skills generalise to other, child-initiated sessions? The primary and subordinate research questions have been answered:

Research Questions and Answers

Primary research question. Can PCDI-AS be used to teach children with severe ID and severe ASD to engage with play materials independently of adult prompting?

Answer: Evidence provided within this study suggests that when children with a severe diagnosis are taught via PCDI-AS procedures, they can learn to follow an activity schedule independently of adult prompting. Of the nine children with severe ID and severe ASD, (or ASD type characteristics) six mastered independent schedule following; they each completed a sequence of play activities in the absence of adult prompting. Furthermore, schedule following continued when novel photographs were placed in the folders, evidencing generalisation of skills. The evidence suggests that novel photographs were SDs for schedule following: obtaining relevant novel materials, completing the activity, putting the materials away and returning to the folder to turn the page and look at the next photograph. Of the three individuals who did not acquire schedule following skills, the upward trend of their data suggested progress was being made.

Subordinate research question. If they can be taught to behave independently with traditional play materials, will these skills generalise to child-initiated play sessions?

Answer: Evidence provided in this study broadly suggests that when children with severe diagnoses are taught via PCDI-AS procedures, skills acquired during training sessions can generalise to other, child-initiated sessions. Data collected in child-initiated play sessions prior to AS training were compared with data following the start of AS training. Results of levels of engagement were variable: following the start of AS training for two pupils levels remained the same, for two levels of engagement decreased and for five levels of engagement increased. However, for all but one pupil, the quality of play was more sophisticated during sessions that occurred following the start of AS training; pupils were observed using materials not previously used and/or engaging in actions not previously observed. With the exception of one pupil, number of types of play material engaged with was greater following the start of AS training than before. It seemed that actions performed with play materials that were acquired during AS training generalised to child-initiated sessions.

Limitations

This section addresses methodological limitations identified during the course of the intervention:

The absence of individual data and IOA within pre-requisite skill training limits results. Individual pupil data were not presented in the chapter, therefore this limits the conclusions that can be reached. Pre-requisite skill training results were presented as a summary of progress made over time. This progress was measured by obtaining and evaluating data that had been collected by several different trainers. No treatment fidelity data was taken therefore we cannot be sure how consistently or accurately the training was implemented (this is further discussed on p.269). Additionally, inter-observer agreement (IOA) data were not collected during this phase of the study; these omissions impact negatively on the believability of results. To be believable, as Sulzer-Azaroff and Meyer (1991) state, “behavioral assessment involves choosing and using objective, valid and reliable measures” (p.57). To be valid, measures should be objective. However, having not obtained IOA, we cannot be sure that each trainer was objective, in other words that their interpretations and individual feelings did not affect their recordings. A reliable measure is “one that remains standard, or consistent regardless of who is doing the measuring and on what occasions’ (Sulzer-Azaroff & Meyer, 1991, p.58). Although all trainers received the same training with the measurement system, we cannot be sure that the data was collected consistently and objectively. Consequently, without IOA measures, others are unable to judge the relative believability of the data.

Number of training sessions varied across pupils. During activity schedule training, pupils did not have access to the same number of training sessions. Pupil D had 86 training sessions prior to reaching criteria for maintenance, substantially more than those who started much later. For example, at only 20 training sessions in total, pupil E received less than a quarter of this number. It is not known if pupils E, F and J would have mastered schedule following given the same number of training sessions. A decision had been made to begin training first with those pupils who (based on prior observations) would perhaps acquire skills more rapidly than the others. It was anticipated that if they mastered ASs, they could use them independently while others were being trained. However, it took longer than anticipated to train these individuals. A limitation of the present study is the lack of equality with regards to opportunities given to each pupil. In retrospect, it may have been preferable to provide greater equality across pupil training opportunities. In future, it may be advisable to first begin training with those who acquire skills at a slower rate.

The lack of experimental design limits the findings. A decision had been made to not collect baseline data within the activity schedule training phase of the study. When planning the intervention, it was felt that it would be unethical to do so, given the nature of some pupils’ problematic behaviour. Exposing pupils to new materials within a novel teaching environment could have led to aggressive behaviour towards others, self-injurious behaviour and/or destruction of materials. However, in retrospect, this decision was flawed; other studies including individuals with problematic behaviours have conducted baseline conditions in manners consistent with ethical guidelines.

Baseline procedure in activity schedule research. AS studies included within the systematic review used a variety of experimental designs that incorporated baseline conditions. This variety of designs was noted when assessing the effectiveness of treatment outcomes using the percentage of non-overlapping data (PND) method (Scruggs, Mastropieri & Casto, 1987). Some researchers used alternating treatment designs (e.g. Flannery & Horner, 1994; Anderson et al., 1997; Mechling & Gustafson, 2009); for example, Flannery and Horner (1994) used an ABAB design with the initial baseline phase providing a treatment analysis of behaviour during familiar and unfamiliar tasks. Anderson et al. (1997) used an alternating treatment design to compare engagement when schedules were and were not available. Other researchers employed an AB design (e.g. Browder & Minavoric, 2000; Carlile et al, 2013) with comparison of baseline and teaching phases, while others used multiple probe designs (e.g. Cuhadar & Diken, 2011;); multiple baseline across participants (e.g. Krantz & McClannahan, 1998) across behaviours (e.g. Pierce & Shreibman, 1994) or across settings (e.g. Schmit et al, 2000), and all successfully and ethically incorporated baseline phases.

Baseline procedures and problematic behaviour. Researchers planning activity schedule interventions for individuals with problematic behaviour had additional considerations to ensure ethical guidelines were met. While obtaining baseline measures, it was also necessary to monitor the occurrence of challenging behaviour. Morrison et al. (2002) described how this was achieved using a multiple baseline design (MBD) across participants. Baseline conditions involved pupils being verbally prompted to put photographs on a clipboard, and engage with the activities during a 45-minute play period. A partial interval recording system was used with 10-sec intervals during which the occurrence or non-occurrence of 'on task' behaviour was recorded. Each child was recorded on a rotational basis for 10-sec intervals, and then not for the following 30-sec intervals. By totalling the number of intervals the child was on task and dividing it by the total number of intervals per session, a percentage of intervals during which the child was on task was obtained. This same procedure was also used during the treatment phases, thus providing data for direct comparison. Across all phases, in the event of challenging behaviour, the experimenter "gave immediate specific prompts if the child was engaged in disruptive behaviour" (p.63). The introduction of the intervention was staggered, and the number of baseline sessions varied from 5 to 25 sessions per child. Only behaviour 'such as spinning and bouncing' were reported in the results, and the 'required frequent prompts' to remain on task were not further described. It can be assumed therefore that the problematic behaviour was low level, and as all of the pupils remained within the environment for the duration of the play periods the behaviour was not so problematic as to require removal from the activity.

Machalicek et al. (2009) were more specific about the types of challenging behaviour their participants engaged in, and in measures taken. In their MBD, if a participant left the planned play area "the teacher used graduated guidance to prompt their return to the play area but instances of challenging behaviour were ignored (pica was blocked)" (p.550). Challenging behaviour during baseline was measured using 10-sec partial interval data collection procedures. Challenging behaviour was defined on an individual basis, and across students included hand flapping, hand biting, screaming, pica, rubbing palms on ground, elopement, hitting, pushing, kicking, laying on ground and throwing rocks at others. No mention was made of any intervention that required removal of the pupil from the play area, therefore it can be assumed that the 'graduated guidance' used was successful in managing pupil safety.

As these two studies have demonstrated, it is possible to conduct an activity schedule study that includes participants with problematic behaviour, and do so ethically.

Current study research designs. Although in the current study, the activity schedule data presented provides evidence of individual progress made during training sessions, having not exposed pupils to a baseline condition means there can be no comparison of before and after the independent variable was applied. The absence of baseline conditions has resulted in an absence of experimental design; this is a substantial limitation, as it has impacted on one's ability to determine the presence of functional relations. Furthermore, without a baseline it does not meet evidence standards (Kratochwill, Hitchcock, Horner, Levison, Odom, Rindskopf & Shadish, 2010) as set out by the What Works Clearinghouse. Although it conforms to accepted standards by including a minimum of six phases with as least 5 data points per phase, the absence of a baseline results in it being below accepted standards. One goal of behaviour analytic studies is to establish experimental control by demonstrating a functional relationship between dependent and independent variables. The decision to apply the intervention in the absence of baseline data, while pragmatic and associated with ethical issues, substantially limits the conclusions that can be drawn.

Research designs for future studies. For future research, a method of recording the target behaviour in baseline conditions while ensuring participant safety should be implemented. A design that meets single case design standards as set out by Kratochwill et al. (2010), while meeting ethical guidelines should be planned. A strict protocol around researcher prompting and intervention could ensure participant safety. Some particularly challenging behaviours would likely warrant more observer intervention than others to remain within ethical guidelines. For example, an observer may simply note the occurrence of hand flapping but would likely intervene to prevent an individual from hitting, kicking or throwing rocks at another child. Depending on the severity of aggression, an intervention could possibly include a variety of responses such as blocking, distracting or removal from the area.

Machalicek et al's (2009) research had been instrumental in the design of data collection procedures used in play sessions, as described in Chapter 8 (p.212); aggression, self-injurious behaviour and stereotypy were defined on an individual basis. In retrospect, the observed behaviours, as reported in Table 5.1 could have been used to inform baseline procedures prior to activity schedule training sessions. As in the play sessions, a baseline procedure could have included a partial-interval recording system that recorded engagement as well as problematic behaviour. A protocol could have been designed to ensure the well-being of each pupil; by using a strict procedure that included an option to terminate the activity, baseline conditions would have met ethical guidelines. For example, in the event of stereotypy such as flicking, the behaviour could be noted on the observation sheet, for excessive spinning a physical prompt could be provided to block the behaviour. A more aggressive action such as headbutting the ground could result in a pillow being placed on the floor to prevent injury, while repeated aggression towards self or others could result in being escorted into a different environment, and termination of the session.

In the event of terminating the session, a percentage of intervals in which engagement occurred could still have been obtained (as in the study by Morrison et al., 2002). This same partial-interval procedure could have been continued across the training sessions for later comparison of levels of engagement and problematic behaviours. A MBD across participants with a baseline and intervention phase could have been an appropriate design. The component completion data to show progress during the activity schedule training phase could have supplemented this, and been shown separately, rather than being the main source of evidence for the efficacy of the intervention.

The use of a non-concurrent multiple baseline design limits results. As with the standard MBD, the non-concurrent multiple baseline design (NCMBD) across participants is relatively easy to conceptualise, which makes it an effective experimental tactic when working with different populations such as parents and school staff. This design was selected to demonstrate the effect of activity schedule training on child-initiated play. In the current study parents, carers and school staff readily understood the design.

A main drawback of using an MBD however, is that the treatment variable cannot be applied to subsequent participants until its effects have been observed on previous participants, therefore the MBD requires that the intervention be withheld for some. As this time period can be prolonged, it raises both practical and ethical issues. As Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf and Shadish (2010) point out “if change in the dependent variable is slow to occur, more time is needed to demonstrate experimental control. Such a circumstance might also reduce the number of phase repetitions that can be scheduled due to cost and logistical factors” (p.7). Denying a potentially effective treatment for extended periods of time, due to achieving an MBD design, could be viewed as unethical. Within the current study, as already noted, the time taken to introduce the intervention to the final participants was substantial. The timeline shown in Figure 5.1 demonstrates the duration of the study.

Further drawbacks exist in using a NCMBD; as discussed in Chapter 8, the baseline logic of MBDs is diminished by taking measurements non-concurrently. As noted by Cooper, Heron and Heward (2007), “the requirements of concurrency and plausible influence must be met for the verification element of baseline logic to operate in a multiple baseline design” (p.216), and that stacking a series of AB designs is “of questionable value and is likely to mislead readers by suggesting a greater degree of experimental control that is warranted” (p.216). For this reason they suggest describing the study as a series of AB designs and graphing them in a manner that depicts the actual time frame in which each sequence occurred in relation to each other, as done by Harvey, May and Kennedy (2004).

Although the evidence within the current study is not as robust as it may have been using an alternative design such as a withdrawal design, the findings of the NCMBD within an educational setting add to the body of research in this area. While it was not the most rigorous experimental design, the NCMBD has provided valuable data regarding the effectiveness of activity schedule training on child-initiated play. Of the characteristics of the MBD, “effect replication across series is regarded as the characteristic with the greatest potential for enhancing internal and statistical-conclusion validity”(p.7, Kratochwill et al., 2010). Regardless of the fact that measurements were not taken concurrently, the effect of the intervention has had multiple replications.

Future researchers, if using a NCMBD experimental design, may want to consider a withdrawal phase within the multiple baseline. Using a BABA design, for example, within each tier of the design would add further evidence of experimental control. Those aiming for strong evidence of a causal relation should consider the criteria for demonstrating evidence of relations between independent and dependent variables as noted by Kratochwill et al. (2010) when planning the intervention. Data can then be assessed using six features to examine within and between phase data patterns: level, trend, variability, immediacy of effect, overlap and consistency of data patterns across similar phases (p.18, Kratochwill et al., 2010). Visual analysis of these criteria are used to assess whether the data demonstrates at least three indications of an effect at different points in time; if so, the data are “deemed to document a causal relation and an inference may be made that change in the outcome variable is causally related to the manipulation of the independent variable" (p.19, Kratochwill et al., 2010).

The absence of treatment fidelity measures limits results. Treatment fidelity measures were not taken during this study. The researcher conducted 78% of activity training sessions; two other adult participants conducted the remaining 22%. It was felt that measures taken to ensure a consistent approach amongst these 3 adults were adequate, however, as Cooper, Heron and Heward (2007) state, while "simplification, standardization and training help increase degree of treatment integrity, they do not guarantee it" (p.236). A greater number of adult participants were involved in pre-requisite skill training and data collection procedures. Assuming that trained teachers and teaching assistants have the necessary skills and knowledge to apply the treatment accurately and consistently is inadvisable. As discussed on p.262, in retrospect, treatment fidelity measures could have provided information on the application of the independent variable regarding accuracy and reliability. Without this data, it is not known if there were any inconsistent or improper applications of the independent variable, resulting in confounding variables. The lack of treatment fidelity measures has, therefore, limited the results.

Procedures for measuring engagement, SIB and/or aggression during independent play sessions impacted on results. Regular child-initiated play sessions occurred throughout the study both prior to and during AS training taking place to measure the effect, if any, of AS training on pupil play skills. A partial-interval recording procedure was selected, consisting of 20-second intervals, as used by Betz et al. (2008). Play sessions had durations of 30-40 minutes and during this time each pupil was allocated a single period of approximately 5-minutes for measurements to be taken. This data collection procedure was selected as being suitable for both measuring several behaviours concurrently (Cooper, Heron & Heward, 2007) and estimating the occurrence of behaviours without requiring that every event be recorded (Kennedy, 2005). For some pupils, an increase in engagement was observed once AS training had begun, however, the increase did not demonstrate a convincing effect of AS training in other settings.

In retrospect, the sampling procedure selected may not have been the most appropriate for representing a valid approximation of behaviour. Although continuous measurement is preferable to other systems, it is not always practical. The accuracy of different discontinuous measurement systems have been compared with continuous measurement results, resulting in variable data. Thomson, Holmberg and Baer (1974) asked "how closely does each method represent the actual behaviors of each subject as they would have been recorded throughout the hour without a break"? (p.623). When compared with actual rates, the contiguous and alternating schedules proved to be the most un-representative, whereas the sequential sampling procedure produced results that were closer to the actual data obtained via continuous recording (Thomson, Holmberg and Baer, 1974). Therefore, as suggested by Cooper, Heron and Heward (2007), when measurement cannot be continuous throughout an observation period, it is preferable to sample the occurrence of the target behaviour during intervals that are evenly distributed throughout the session. For example, measuring behaviour in fifteen 20-second intervals equally distributed within a 30-minute session is likely to result in more representative data than an observation of an individual for a single 5-minute period during the same session. In hindsight, had the intervals been distributed across 30-minute periods in this way, the play skill sessions may have yielded different results. Shorter intervals and use of whole interval recording may have been more representative for the independent play data. Therefore, a limitation of the present study was the data collection procedure selected, and how this could have impacted on the results.

Stereotypical behaviour was not measured during independent child-initiated sessions. It seemed that there was a decrease in stereotypical behaviour during child-initiated play sessions once AS training had been introduced. However, a limitation of this study is that stereotypy was not recorded, and this cannot be evidenced quantifiably.

Recording multiple dimensions of behaviour in nine pupils was a complex procedure and by simplifying the system of measurement as much as possible, the aim was for measurement errors to be minimised. Inspired by Machalicek et al. (2009), a decision had been made to preclude stereotypy from the definition of engagement. Due to the wide topography of stereotypy across pupils, it was defined individually, and a decision was made not to record occurrences of it. Occurrences of engagement, SIB and aggression were recorded if they occurred. If stereotypy had been measured, some potentially interesting results could possibly have been obtained.

Variety, quality and types of play data were anecdotal. Notes were made regarding the types of material pupils engaged with as well as the quality of their play with materials, for example if the pupil was picking up or stacking particular materials. However, without the presence of inter-observer agreement, this data must be seen as anecdotal. Reliability, or the consistency of measurement, is an integral component of behaviour analysis. In retrospect, a more formalised method of obtaining data plus the addition of inter-observer agreement measures, could have been implemented. The lack of IOA data significantly limits results; as noted earlier, using objective, valid and reliable measures provides appropriate evidence and adds to the believability of data. Conversely, without appropriate measurement systems, the evidence that the information is objective or reliable is limited.

A single setting limits results. Pupils were taught to follow activity schedules within different areas of the same classroom. When the group moved to a different classroom for the following school year, skills maintained and generalised to a novel environment. However, novel classrooms were within the same school setting. As this study was conducted in one setting, with one group of pupil participants, the generality of findings is limited.

Schedules were not faded or applied to novel activities. A further limitation of the study is that no attempts were made to fade the schedules or to apply them to novel activities. During the study, some pupils generalised skills to novel activities within their own schedules, and others demonstrated independent schedule following with entirely novel schedules. However, having acquired schedule following skills, no attempts were made to fade the presence of the schedule to perhaps a single visual cue. This could be a future aim for this cohort of individuals. Furthermore, during follow-up it was clear that no attempt had been made to vary the activities within the schedules or to apply them to different settings or purposes. As is evident from research, once schedule following skills are acquired, they can be used for a multitude of purposes.

Discussion and Implications for Practice

Having identified and discussed weaknesses of the study, this section considers the main findings in light of these limitations. Each finding makes a contribution towards this area of research by supporting or extending the claims of others, providing conflicting or alternative views or by extending existing knowledge. Results are relevant to the pupils in this study, but more importantly, the findings have wider significance to the general population of children diagnosed with severe ID and/or autism within the severe range. Implications of findings are therefore related to practical applications, as these may be of interest to future practitioners.

Systematic review.

PCDI-AS studies demonstrated more generalisation than studies following other AS methods. When considering the first 10 indicators of quality, the SCED assessment indicated that both studies using PCDI-AS and studies using AS involving other methods were of a similar quality. However, there were differences noted regarding the 11th indicator: generalisation. A minority of 26% of AS studies evidenced generalisation, however, at 83%, the majority of the PCDI-AS studies demonstrated that skills generalised to novel materials or settings, suggesting that those practitioners focusing on skill generalisation should therefore consider this approach for developing skills across individuals, materials and settings.

Effectiveness of PCDI-AS and other AS methods. Assessments of efficacy evaluate AS studies using any method as *effective* with studies following the PCDI-AS approach evaluated as *highly effective*, signalling that those planning a AS intervention should consider the PCDI approach.

AS interventions can be effective for adults with ID or ASD diagnoses. As noted in Chapter 2, there are difficulties in promoting leisure activities among adults with ID or ASD in residential and home settings (Wilson, Reid & Green, 2006), and this can result in individuals spending upwards of 75% of leisure time with no apparent activity (Felce, 1991). Yet the technology exists to support adults with ID/ASD to make choices and follow a schedule of leisure activities; evidence presented in the systematic review indicates AS studies in general have been effective for individuals aged from two years to 40. While a minority of studies used

AS with adults in the age 18 and upward category, they proved effective. It is recommended that practitioners implement schedules with adults in home and residential settings to support engagement in independent leisure activities.

Pre-requisite skill training.

Resources may require adaptation for individuals. As discussed in Chapter 6, pupils E, F and J did not readily acquire the three pre-requisite, or basic, skills during training. To facilitate skill acquisition, procedures and materials were adapted accordingly. For example, for the "identify picture from background" test, larger images were used for pupil E. For the "match object to picture" test, additional objects were added to the procedure and paired with photographs for pupil F; these were gradually faded out (by moving them further away from the photograph) until object to picture matching occurred without the presence of a second object. Tasks were simplified by, for example, putting out an array of two or three items rather than five as originally planned. Additionally, pupil C had limited fine motor skills and for this reason struggled to turn one page at a time; thicker card replaced the paper pages within her binder, which made this task easier. All of these adaptations facilitated skill acquisition. It is recommended that those wishing to implement this training be prepared to modify the tasks and/or materials to suit the learner.

Prioritise training sessions for three basic skills. Evidence presented in this study demonstrates that for those with a severe diagnosis, the three basic skills can take a significant amount of time to master. Within this study four months was the minimum time taken to achieve full mastery of the three skills. The three pupils who did not fully master the tests had each received training four or five times a week during term time for a period of 20-months. This finding confirms McClanahan and Krantz' (2010) statement that for some children, mastery of picture-object correspondence occurs only after several years of instruction. It is recommended therefore that for those with more severe diagnoses, more time be prioritised to basic skill training (perhaps two or three times a day, five days a week).

The data presented in Chapter 7 indicates that even when the basic skills have been acquired, AS training to mastery can take a significant amount of time. Pupil D for example reached mastery of AS after 86 training sessions, over 13 months of regular instruction. In contrast, pupil K mastered AS after only 25 sessions over four months of tuition. Both had acquired the basic skills prior to training, therefore having acquired them is not a predictor of how quickly AS skills can be mastered. When a child has not acquired the basic skills after considerable training, it is not clear how long one should persevere before trying alternative teaching strategies.

Activity schedule training.

Pupils with a severe diagnosis can learn to follow activity schedules. The literature review presented in Chapter 4 provided some evidence that AS could be effective for those with a severe diagnosis. As shown in Figure 4.1, 12 studies were identified as having used AS to develop skills in individuals diagnosed with severe ID or severe ASD. However, of these studies, only two followed PCDI-AS procedures, with a total of 8 participants. Therefore, there was limited evidence that PCDI-AS procedures would be effective for individuals with a severe diagnosis. Evidence presented in this study however, indicates that pupils presenting with ID and ASD within the severe range can be taught to follow an activity schedule using PCDI-AS procedures. Although the current study is limited to one location and by number of pupils to have mastered schedule following (*n*=6), it has contributed to this field of research.

Six children presenting with severe ID and ASD mastered schedule following; this evidence contradicts Rehfeldt's (2002) suggestion that it would be overly optimistic to expect those who work with children with a more severe diagnosis to successfully implement AS training. Lequia et al. (2012) stated that more research is needed to examine effectiveness of AS for those with different ASD severities, a view echoed by Knight et al. (2015) who called for additional research for children with more severe diagnoses. This study makes a contribution to research by showing that if PCDI-AS procedures are followed, it is possible to develop independence skills in those with different ASD severities. It also confirms Koyama and Wang's (2011) statement that AS are not limited to a specific age range, diagnosis or intellectual functioning; if PCDI-AS procedures are followed, then they can be effective for the small population of individuals who have a severe diagnosis.

Time allocation for AS training. On the whole, more training sessions were required to master schedule following than had been anticipated. Of the six children to master AS training, the fewest number of sessions was 25. The highest number was 86. While the numbers in this study are not enough of a sample to predict a trend, this information is potentially useful for anyone undertaking activity schedule training with individuals diagnosed with severe ID or ASD.

Initial baseline measures. As discussed, not obtaining baseline measures was a substantial limitation of this study in terms of providing empirical evidence. It would also have provided valuable information from which to play further elements of the intervention; the number of training sessions required to reach mastery may be broadly indicative from the initial training session data. A relatively high starting point could be an indicator of fewer training sessions required to reach mastery. Conversely, a lower starting point could indicate the time required for the individual to have the skill fully embedded into his/her repertoire, may be substantially longer. As those with a lower starting point are likely to require more training sessions, it may be preferable to either begin their training first, or to plan more frequent training sessions. Perhaps an initial training session conducted with each individual could provide baseline results; this information could inform the order in which pupils receive training: those with a lower starting point may be likely to require more sessions and should therefore begin training first.

By using PCDI-AS procedures, generalised to novel tasks. Within the current study, order of photographs within the folder was varied throughout the teaching sessions. Adult prompts were gradually faded and the rate of reinforcement was thinned. These combined measures resulted in photographs alone becoming relevant discriminative stimuli that occasioned schedule following behaviour. For the six pupils who progressed further than the initial training stage, novel photographs representing novel activities were added to their schedules during generalisation and maintenance phases. As shown in Chapter 7, individual data points for pupils B, C, H, K, G and D indicate that when entirely novel materials were added, schedule following continued without the need for physical prompts. This demonstrated the functional relationship between visual cues and schedule following behaviour. For each of these pupils, the introduction of a novel photograph induced schedule following behaviour using the relevant materials, as depicted in the photograph.

As discussed, there was no baseline condition within the activity schedule intervention, and therefore there could be no ‘return’ to baseline. However, once participants had mastered schedule following, they continued to use their schedules several times a week, as part of usual classroom procedure. Probe data were taken approximately once a week. Novel materials were added during maintenance sessions. These took place in the classroom setting under usual classroom conditions; an adult gave a verbal cue “do your activity schedule’, and the pupil complied with the instruction. As with normal classroom procedures in instructional settings, occasional prompts to remain on task may have been provided, if for example a pupil moved to another area of the classroom. However, each pupil met the criteria for mastery within these sessions, and as noted on individual graphs, novel activities were completed without any physical prompting. It can be said therefore, that pupils engaged independently with their schedules following a single verbal prompt, much as typically developing children do within a mainstream classroom after being given an instruction. Although involving some element of control from a supervising adult, with the initial verbal instruction, and general supervision, pupils who mastered schedule following independently completed individual activities (or chains of activities) without any further control from adults. Furthermore, some students completed entirely novel schedules containing five novel activities.

Frank et al. (1985) considered individuals who had learned to follow picture cues to complete one task, and wondered if skills would generalise to pictures of other dissimilar tasks. MacDuff et al.'s (1993) procedure demonstrated that if taught effectively, skills would generalise. Reviews of studies have shown that relatively few AS studies reported on generalisation (Knight et al., 2015; Koyama & Wang, 2011). Further examination of the studies show that 9 of the 11 studies following PCDI-AS procedures reported on skill generalisation to novel activities or settings without additional training being required (Betz et al., 2008; Bryan & Gast, 2000; Carlile, Reeve, Reeve & DeBar, 2013; Krantz & McClannahan, 1998; Blum-Dimaya, Reeve, Reeve, & Hoch, 2010). The present study has added to this small body of evidence demonstrating that if using PCDI-AS procedures, skills can generalise to novel stimuli. Additionally, the follow-up data evidences generalisation of skills across settings.

Isolating the controlling variable. The present study differed from others that did not use PCDI-AS procedures. In some studies, additional cues were added to the procedure via gestural prompts (for example, Morrison et al., 2002; Hume & Odom, 2007) or with verbal prompts (for example, Machalicek et al. 2009; Hume & Odom, 2007; Pierce et al. 2013). When multiple components were used (such as in Dunlap & Fox, 1999; Dettmer et al. 2000) the controlling variables were not clear. Single aspects of some intervention packages were not isolated and therefore, the elements responsible for behaviour change were not identified. In contrast, the present study provides evidence that visual cues alone were responsible for schedule following behaviour; for six pupils, skills generalised under novel photographic stimuli, without the presence of gestural, verbal or physical prompts. The design ensured that skills generalised across materials and trainers, and occurred in different locations within the same classroom environment.

Changing the order of photographic cues. In the present study, the order of photographic cues within the AS folder was varied within the initial training stage. In some studies, the order of activities remained the same and was, therefore, possibly memorised (Connis, 1979; Wacker & Berg, 1983; Cuhadar & Diken, 2011), while in others visual cues were varied but this occurred later in the procedure. Betz et al. (2008), for example, delayed re-sequencing the visual cues until the maintenance phase, which, for some participants, resulted in deteriorating levels of engagement, which necessitated a return to physical prompting. This example highlights the benefits of adhering to procedures set out by MacDuff et al. (1993). In contrast, in the present study, by varying the order of visual cues from the start, no reintroduction of prompts was required. This further corroborates the validity of the PCDI-AS approach.

PCDI-AS can be effective for developing independent engagement with play materials. For the children participating in this study, photographic cues within schedule folders became discriminative stimuli specifically evoking independent engagement with play materials. In the absence of adult prompting, six pupils independently completed complex chains of behaviour that included play activities.

Jung and Sainato (2013) pointed out that while much research is concerned with the development of skills via play, there is a paucity of studies focusing on the teaching and assessment of individual play skills themselves. Accordingly, they advise educators to consider play skills as a critical area for skill development. The present study endorses this proposal. The systematic review revealed 19 studies that aimed to teach independent play skills to individuals diagnosed with ASD and/or ID using an AS. As identified in Figure 4.1, only six of these studies used PCDI-AS procedures to develop play skills; the current study has added to this small body of literature. Since MacDuff et al. (1993) no studies have taught play skills via PCDI-AS procedures to those with a severe diagnosis. Therefore, the evidence within this study supports the use of PCDI-AS methods to teach independent play skills to those with severe diagnoses.

PCDI-AS can elicit undesirable behaviour. The activity schedule presented pupils in the current study with novel external contingencies. To avoid these new demands, pupils were observed engaging in a range of behaviours that seemingly functioned as task avoidance. Additional notes made on AS data recording sheets indicated that disruptive behaviour such as stereotypy, self-injurious behaviour and aggression occurred when students transitioned from other activities to the AS training area. These findings support Massey and Wheeler's (2000) suggestion that when AS are antecedents to demands or are considered to be demanding themselves, they can elicit challenging behaviour. A range of undesirable behaviour was noted:

Disruptive behaviour during transitions. A photographic symbol with printed words for AS training was used as a visual cue to transition to the AS training area from an activity preceding it. For some pupils, this symbol evoked disruptive behaviour; pupils H, C and G engaged in undesirable behaviour in transitions to AS training during initial sessions. These observations confirm Lequia et al.'s (2012) suggestion that AS can evoke challenging behaviour when transitioning from a preferred to a non-preferred activity.

Avoidance of less preferred tasks. The majority of pupils turned over several pages of the schedule at once, apparently avoiding certain tasks and selecting preferred tasks. This behaviour echoed that of participants in Machalicek et al.'s (2009) study, who removed photographs representing less preferred play activities from their schedules. While removal of photographs from folders was not possible within the current study (they were fixed to the pages), the function of page turning may have been the same. These findings bear resemblance to those by Lequia et al. (2012) who noted that children sometimes rearranged the order of activities on their schedules seemingly to avoid demanding tasks, while in others the rearranging resulted in gaining faster access to preferred activities or items.

Resistance to physical prompting. Some resistance to physical guidance was observed. Pupil C for example resisted prompts to get up from her chair while pupil J resisted prompts to put preferred materials away. Previous experience of working with these pupils suggested that physical guidance was not aversive per se, and was usually tolerated. It was likely, therefore, that resistance to prompting in these instances constituted a form of avoidance behaviour. Resistance to physical prompts reduced as schedule following behaviour increased. As pupil proficiency increased, the level of physical prompting was faded until no longer required. The present study interprets resistance behaviour as task avoidance. This provides an alternative to the explanation for resistance behaviour provided by Spriggs et al. (2007), who attributed it to avoidance of aversive physical prompts.

Planning for problematic behaviour. Any novel teaching procedure presents a change to routine and a new demand. As discussed in Chapter 1, those diagnosed with severe ASD have extreme difficulty coping with change and this can cause great distress (DSM-5, 2013). It is suggested therefore that practitioners anticipate the occurrence of problematic behaviour brought about by novel external contingencies. The evidence presented in the current study however suggests that by using appropriate strategies, these difficulties can be overcome.
The use of a token economy system for example, aided compliance in one pupil (pupil H), and endorsed the strategies suggested by Pierce and Shreibman (1994). Other successful strategies such as changing the time of schedule training, for example, have also been discussed. It is recommended that future researchers while not diverging from the PCDI-AS procedures and principles, should be prepared to employ a range of strategies and adaptations to counteract the occurrence of problematic behaviour.

As Schedule following skills are acquired, less desirable behaviours decrease. Additional notes on data collection sheets suggested that as pupils acquired activity schedule following skills, the occurrence of less desirable behaviour decreased. The purpose of introducing AS to this cohort of pupils was not to reduce the occurrence of undesirable behaviour, but to develop independent play skills in individual repertoires. However, as Lequia et al. (2012) noted, AS can be effective in decreasing challenging behaviour regardless of the intended purpose of an AS intervention. The reduction of undesirable behaviour can be a positive side effect of an entirely different goal (Zitelli, 2007). This study provides further evidence to support these claims. Undesirable behaviour often observed in pupils typical learning sessions decreased during AS training and eventually ceased to occur during AS sessions.

The occurrence of aggression and self-injurious behaviour decreased. A positive side effect was the reduction of aggression and/or self-injurious behaviour observed in pupils H and G. During early training sessions pupil H hit out at trainers, bit the back of his own hand or head-butted furniture. However, after the introduction of a token economy system, and continued AS training, SIB and aggressive behaviour ceased to occur during AS sessions. Pupil G was observed engaging in behaviour such as grabbing the adults hand and rubbing his chin hard on the back of it, barging adults with his shoulder and twisting adults' arms with his hands. However, these behaviours decreased in frequency and then ceased to occur at all during AS sessions. Observations made in the present study support the suggestion that as schedule following behaviour increases, the occurrence of less desirable behaviour decreases (Pierce & Shreibman, 1994; Lalli et al., 1994; Massey & Wheeler, 2000).

Stereotypy decreased. A range of stereotypical behaviours that disrupted the training process was noted on many pupil data collection sheets. These include motor stereotypy with hands, repetitive use of objects and repetitive speech sounds. Stereotypical behaviours appeared to function either as self-stimulation or as task avoidance. As Cunningham and Schreibman (2008) stated, there are a variety of contingencies that maintain stereotypy including social and external reinforcement as well as internal factors. Identifying the maintaining contingencies for stereotypy in these pupils was beyond the scope of this study, however, as pupils became proficient at schedule following, there was a clear decrease in disruptive stereotypical behaviours. Specifically, stereotypy with small play materials decreased for pupils J and D, a reduction in crying was noted in pupil B, and a reduction in mouthing of objects was noted for pupils C and J. Pupil G's sessions, saw a gradual reduction of picking up and dropping items repeatedly. For each pupil, these reductions coincided with an increase in independent schedule following behaviour. Whether they functioned as task avoidance or as self-stimulatory behaviour, notes indicate that stereotypical behaviour decreased as schedule following increased. This evidence supports Koyama and Wang's (2011) assertion that more time is spent engaged in on-task behaviour is likely to lead to less time engaged in maladaptive behaviour.

The photograph and printed word facilitated transitions. Initially, as discussed, the use of a photographic symbol with printed words appeared to evoke challenging behaviour in some pupils (pupils E, C and G). However, the occurrence of disruptive behaviour in the presence of the photograph decreased. Eventually, the use of the photograph resulted in compliance for all pupils. While the purpose of the current study was not to ease transitions per se, in the course of the intervention, further evidence has been provided that a single photograph with individually printed words can be used successfully to aid self-regulation and facilitate transitions (Schmit, Alper, Raschke & Ryndak, 2000; Bryan & Gast, 2000; Sigafoos, Lancioni, Edrishinha & Andrews, 2005; Dettmer, Simpson, Myles & Ganz, 2000; Dooley, Wilczenski & Torem, 2001; Waters, Lerman & Hovanetz, 2009; Cihak, 2011). For all pupils, the use of the photograph facilitated transitioning to the AS training area. Furthermore, by physically giving the photograph to an adult, some pupils used it to request their schedules. Future practitioners therefore may wish to use a photographic symbol/printed word to signal transitions to and from the activity schedule training area.

Most-to-least prompting is effective for those with a severe diagnosis. Most-to-least (MTL) prompting was embedded within PCDI-AS procedures. Physical prompting was faded via graduated guidance and spatial fading. Decisions were made on a moment-to-moment basis, as recommended by Bryan and Gast (2000) and the distance between the trainer and pupil increased during each training stage. MTL prompting was effective for the pupils in this study. For six pupils, all forms of prompting were withdrawn as stimulus control transferred to the photographic cue.

This study supports the work of Libby et al. (2008) who claim that MTL is effective for those who acquire skills at a slower rate. As errors require additional training to correct and produce a lower rate of reinforcement, they may impede learning or result in problematic behaviour. For these pupils with severe diagnoses, for whom errors had been shown to impede learning and increase problematic behaviour, MTL prompting was appropriate. By using this strategy, the likelihood of errors becoming part of the procedure was, perhaps minimised. No comparison has been made between the time taken to acquire these skills using different methods, however, it would seem that time required to fade prompts from any procedure would be less in an intervention that incorporated fewer types of prompt in the first place. The present study has evidenced that MTL can be effective for those with a severe diagnosis, and supports MacDuff et al.'s (1993) recommendation to use this procedure.

AS training was successful without gestural and verbal prompts. The current study did not isolate all types of prompts and compare them; however, a comparison was made between a procedure using only visual and physical prompts and procedures that incorporated additional prompts of gestural and/or verbal prompts. Effectiveness measures indicated that the PCDI-AS approach was more effective than AS using other/additional prompts. These findings could be interpreted that as AS can be taught via graduated guidance and visual cues, additional prompts are superfluous – they are not necessary for the procedure to be effective. For the six pupils who acquired independent AS following skills, MTL prompting procedures were successful; verbal and gestural prompts were not necessary to teach activity schedule following. Unnecessary prompts can potentially increase dependence and simultaneously reduce independence. By following this logic, a so-called “most-to-least” procedure, which is more easily faded, is in fact less intrusive than a system that uses verbal or gestural prompts. It is also potentially less intrusive than a '”least-to-most” (LTM) prompting strategy if errors have become embedded within the routine and then require a fading procedure.

This finding must be viewed cautiously however, as a limitation of the study is that only 6 of the 9 participants mastered schedule following. It is possible that the remaining 3 participants could have mastered the procedure with further training sessions, and equally, it is possible that additional prompts could have been beneficial to their progress. Indeed, other studies have taught schedule following to those with severe diagnoses using other AS procedures. Additionally, no comparison has been made between time taken to acquire AS following with different types of prompting.

However, the current study supports the work of West and Bollingsley (2005), who suggest that to teach new skills to those diagnosed with ASD, prompting procedures without verbal prompts can be effective.

Schedule following may be intrinsically reinforcing for children presenting with severe ID and ASD. As pupils became proficient at schedule following, it appeared to become a preferred activity. Several participants requested their activity schedules at times other than during the training sessions. For example, pupil H did so by independently obtaining a symbol/photograph representing activity schedules and giving it to an adult. Pupil K frequently requested his schedule by verbalizing, "I want activity schedule", while pupils D and H independently went to the resource area and took out their activity schedule boxes. The present study suggests that the activity schedule itself, or the activities embedded within it, had become intrinsically reinforcing to the pupils within the study. These findings support the claims of other studies (Betz et al., 2008; Blum-Dimaya et al., 2010) suggesting that AS can become intrinsically reinforcing. In Blum-Dimaya et al.'s (2010) study, for example, guitar playing was embedded within the schedule. When the AS folder was removed, guitar playing still continued. It is likely therefore that guitar playing was reinforcing.

However, the current findings are dissimilar to those of Brodhead et al. (2004) who taught pupils to play a game co-operatively via an AS. When the schedules were not available, the children did not play; schedule following behaviour only occurred in the presence of the schedules. Brodhead et al. (2004) concluded that the schedules were not intrinsically reinforcing. The AS folders were not removed in the present study, and therefore schedule following behaviour in the absence of schedule folders was not tested. However, the fact that pupils requested their schedules does suggest that they were reinforcing events. This is further supported by the fact that some pupils turned several pages at once to get to the preferred activities within the schedule. That some pupils (F and J) repeated some activities several times, also suggests that activities were reinforcing events.

Choice can be embedded within AS for children with severe diagnoses. This study has shown that children presenting with ID and ASD within the severe range can follow an activity schedule with choice embedded within it. For two participants (pupils B and K), after reaching maintenance, an element of choice making was added to the procedure. A black and white symbol representing "choice" was placed within the schedule folder next to photographs of two of the activities; Duplo building and pegboard patterns. The symbol became the discriminative stimulus for making a choice between different structures to imitate with the Duplo, and different patterns to make with collared pegs. In the presence of the visual cue representing choice, pupils B and K went to the corresponding wallets and independently made selections. Pupil K held up the wallets, looked at the photos, and said "this one" when making a choice.

Few AS studies considered in the literature review incorporated choice into the procedure. During correspondence training and AS training, Morrison et al. (2002) encouraged children to choose which area to go to at playtime. However, the photograph represented the area and general play materials within it, rather than specific activities. True independence is achieved when individuals plan and then follow schedules themselves (Koyama & Wang, 2011). While this level of independence may not always be feasible, Lequia et al. (2012) suggest that a greater degree of choice could be given to a child by allowing them to order the sequence of activities themselves. Allowing choice of activities as well as choice of sequence would provide even more autonomy, and this study has demonstrated that it is possible to incorporate an element of choice for those with a severe diagnosis.

'Pre-requisite' skills may not be essential for successful activity schedule training. While six pupils mastered the pre-requisite skills prior to activity schedule training, three pupils achieved only partial mastery. As noted in Chapter 7, the three pupils who did not master pre-requisite skills were the same three pupils who did not master activity schedules. This evidence suggests that these skills may indeed have been pre-requisites necessary for learning to follow a visual schedule and, if this is the case, confirms McClannahan and Krantz' (2010) advice to teach them first.

However, the three pupils who failed to master these skills did make progress with activity schedule training. The upward trend of AS data for each of these pupils, as shown in Chapter 6, indicates that had training continued, progress is also likely to have continued. Therefore, an alternative explanation is that while the skills are advantageous prior to learning to follow schedules, they may not be essential.

McClanahan and Krantz (2010) stated that they know of some young people who have simultaneously learned picture-object correspondence skills while acquiring activity schedule following skills. However, in their experience, these individuals took longer to master their first schedules than those who had first acquired the skills. Yet in what seems to be a contradiction, for those who have not fully mastered the basic skills, they suggest continuing with picture-object correspondence instruction while also proceeding with activity schedule training by using any matching skills already in the child's repertoire. While some literature refers to the pre-requisite skills having been acquired prior to an AS intervention (e.g. Cuhadar & Diken, 2011), none report on the training. Furthermore, no studies discuss having taught AS without these skills being in individual repertoires. The extent to which these skills were necessary is therefore not clear. No studies could be found that compared AS skill acquisition with or without the basic skills in place, and therefore it is not known which of these approaches is the most effective and efficient. The present study supports Zitelli's (2007) view that there is a lack of empirical evidence regarding the need for pre-requisite skills. This study provides potentially new evidence that pupils can make progress in AS training without having mastered the 'pre-requisite' skills. Basic skill acquisition may possibly occur sooner if skills are embedded within activity schedule training sessions. In the absence of research in the area of basic skill acquisition there is no clear guidance on which method is more efficient.

Component completion data could be more detailed. The component completion recording sheet in the present study was based on recommendations by

McClannahan and Krantz (2010). The pilot study had revealed that taking materials out and returning them to the wallets required prompting. Therefore, two additional components were added to their design, which allowed for more detailed progress to be recorded. This was successful, and it is recommended that those working with individuals with a severe diagnosis may wish to do the same or to divide the chain of behaviour even further. More sub-components could allow for more detailed measurements of progress. For example, the component "obtain resource wallet from box" could be divided into: 1) stand up, 2) walk to box and 3) pick up wallet. For some pupils in the present study, these three proposed sub-components were achieved gradually and this was recorded via narrative comments on the data collection sheet. However, this progress was not reflected in the component completion percentage data. A further recommendation therefore is that the component completion sheet could be tailored to suit the needs of the individual; if working with pupils with a severe diagnosis who are likely to require this level of prompting, more components may be required to adequately reflect progress made.

Activity schedule following skills can maintain over 11-months. Follow-up visits were made to the school 11-months following the intervention, as discussed in Chapter 9. Observations were made of each pupil during an AS session. These data revealed that individual pupil skills had maintained over time. The six pupils who had mastered activity schedules still demonstrated AS following skills. The three pupils still in training at the end of the intervention also maintained their level of independence while following an AS. Reviews of AS literature point to the fact that relatively few studies reported on maintenance of skills (Koyama & Wang, 2011), those that did evidenced that AS skills maintained over time (Newman et al. 1995; Watanabe & Sturmey, 2003; Wheeler & Carter, 1998). Of the nine studies that followed PCDI-AS procedures only two reported follow-up data. These measures occurred at 1-month (Blum-Dimaya et al., 2010) and at 3-months (Carlile, Reeve, Reeve & DeBar, 2013) following the intervention. The present study has contributed to this area by evidencing that skills maintained over an 11-month period.

When collecting follow-up data, the researcher noticed that school staff used additional prompts that were not part of the original training package. Thee prompts were superfluous and possibly hindered pupil progress. These observations are similar to those of Hall, McClanahan and Krantz (1995), who found that classroom assistants are "hesitant to reduce interactions with students with disabilities because their primary role is one of providing support and assistance" (p.208). On-going conceptual training and observational feedback could potentially have ensured a consistent approach. To ensure the longevity of results and to promote further progress, the present study recommends future practitioners consider a more comprehensive training package to continue beyond the intervention.

Independent play sessions. Findings relating to the play observations are discussed, and implications for future practitioners are explored.

Play skills acquired in AS sessions impacted on other settings. To measure the effect, if any, of AS training on pupil skills in other settings, pupils were observed during child-initiated play sessions that occurred prior to and during activity schedule training. Data on levels of engagement, type and number of play materials engaged with and the quality of pupil play was examined, and a comparison of skills demonstrated prior to AS training was compared with those during training. These comparative data revealed that AS training had a positive effect on pupil play skills in four ways. In general, following AS training 1) level of engagement with play materials was higher, 2) the variety of play materials used was greater, 3) there was an increase in the number of types of material used per session and 4) the quality of play was more developed in the sense that materials were more consistently used in the manner in which they were designed to be used. These results suggest that skills acquired during AS training impacted on child-initiated sessions and altered the way in which children engaged with play materials. They occurred in the absence of adult prompting, and under the control of naturally occurring stimuli within the classroom environment. Developments in play behaviour observed following the start of AS training are discussed in more detail.

Levels of engagement increased. It had been anticipated that levels of engagement in child-initiated sessions would increase following AS training. Median level lines on individual graphs, shown in Chapter 8, demonstrated that for two pupils there was a slight decrease in engagement, for two pupils levels remained the same while there was an overall increase for the majority of pupils (five). However, despite this overall increase, levels of engagement remained variable for the majority of pupils.

A more convincing demonstration that there was a direct correlation between AS training and independent pupil behaviour in child-initiated sessions was seen in other dimensions of observed behaviour. Increases in pupil play skills were observed quantifiably via the range and number of play materials engaged with, and qualitatively through quality of play observed.

The variety of play materials expanded. The variety of play materials used by each child across all child-initiated sessions was examined. Play materials engaged with prior to training beginning was compared with those used in sessions that occurred during AS training. Despite a wide range of materials being freely available, it was noticeable that pupils typically engaged with a small selection of what was available. Observations support the work of Van Berckelaer-Onnes (2003), who noted that children diagnosed with ASD typically show a lack of variety in object manipulation and restrict their play to a small selection of objects.

AS training seems to have had an effect on this. For the majority of pupils (five), the range of materials was greater in those sessions that occurred once training had begun. For some children, this increase was marked and represented a much wider repertoire of play experience. Pupil B, for example, handled a total of three different types of play material in the sessions occurring prior to AS training; this range expanded to 10 different types of material in the sessions following AS training. While the play of children diagnosed with ASD is typically restricted to a small selection of materials, data for five children demonstrates that this range of materials can be increased via targeted intervention. The variety of play materials engaged with widened once AS training had begun.

Due to the complexity and design of this study, for some pupils, activity schedule training began much later than for others. This resulted in not only fewer activity schedule training sessions but also fewer child-initiated sessions during training. For the pupils who began training later, there were fewer sessions to compare, and therefore fewer opportunities to demonstrate an increase in the range of materials engaged with once AS training had begun. Nevertheless, for the five pupils who had more sessions in the second condition, there was a demonstrable increase.

The number of types of play material increased. For each pupil, the number of types of play material engaged with per child-initiated session was counted. As shown in Chapter 8, mean calculations produced an average number of types of play material engaged with per session prior to AS training. This was compared with the mean per session during AS training. These data created parity across all pupils regardless of the number of sessions each participated in, and demonstrated that for every pupil, the mean was greater following the start of AS training. Pupil E’s results must be viewed with caution however, as his data is skewed due to the number of play observation sessions. Nevertheless, AS training, had a demonstrable effect on the number of different types of play materials engaged with during child initiated sessions. Furthermore, this increase occurred in the absence of adult prompting.

These findings contradict those of Hume and Odom (2007). They too measured the number of types of play materials engaged with during a with-schedule condition, using a visual schedule known as an individual work system (IWS), and in a condition during which similar play materials were available, but the visual IWS schedule was not. Their results found the reverse of the present study to be true; in their study the number of types of play material decreased following the schedule condition. For their participants, skills had not generalised in the absence of visual cues within the schedule. In contrast to this, the PCDI-As procedure in the present study did evoke an increase in number of play materials engaged with when the schedule was not available.

The quality of play was more developed. For each individual, the quality of play observed in child-initiated sessions that occurred prior to AS training was compared with the quality of play in sessions once AS training had begun. Prior to AS training, pupils demonstrated limited play skills. These observations support the work of Van Berckelaer-Onnes (2003) who stated that as children with autism diagnoses do not acquire skills in the same way as their typically developing peers, they often 'get stuck' at early developmental stages. In the present study, some pupils were 'stuck' by remaining in the manipulation stage of grasping, holding and mouthing play materials. Others were 'stuck' by engaging in repetitive stereotypical manipulations of play materials (such as repeatedly pushing a train around a track). Not all stereotypy functions as self-stimulatory behaviour (Cunningham and Shreibman, 2008), however regardless of the function of stereotypy, there was a general reduction in stereotypical behaviour that coincided with an increase in functional play skills. As demonstrated in the Quality of Play tables in Chapter 8, with the exception of pupil E, quality of play was more developed in sessions that occurred following the start of AS training. Behaviour such as tapping items against the face, mouthing items, picking up and dropping or throwing items gave way to more developed play behaviours including stacking, joining, pushing, pulling, sorting, putting in and taking out.

Observations made in child-initiated play sessions support the findings of Williams et al. (2001) that for children diagnosed with autism play is "less elaborated, less varied and less integrated" than typically developing children of the same age (p.67). However, this study has demonstrated that by using PCDI-AS procedures, it is possible to develop independent play skills that are more elaborated, more varied and more integrated. As already noted, by developing independent play skills in those with a severe diagnosis via PCDI-AS procedures, the present study has contributed some potentially new information to this area of research. Furthermore, it has demonstrated that the more elaborated, varied and integrated play behaviours taught under AS conditions can generalise to child-initiated conditions, and occur in the absence of adult prompting.

PCDI-AS training can have a positive effect on levels of SIB, aggression and stereotypy in other settings. Levels of SIB and aggression were measured if they occurred during child-initiated play sessions. Measurements were taken in sessions that occurred prior to the start of AS training sessions, and in sessions that occurred during AS training. Two pupils demonstrated one or both of these behaviours. Pupil H engaged in both SIB and aggression during child-initiated sessions that occurred prior to AS training. Following the start of AS training there was a gradual decrease in these behaviours, which coincided with an increase in engagement. Eventually, for pupil H, SIB and aggression ceased to occur during play sessions.

Pupil K engaged in some aggressive behaviour in play sessions prior to AS training. Again, levels of aggression fell in child-initiated sessions during AS training, and eventually ceased to occur. These observations add further evidence to support the claim that as appropriate behaviour increases, maladaptive behaviour decreases (Koyama & Wang, 2011).

Anecdotally, for some pupils, levels of stereotypy were high within child-initiated play sessions, particularly so in those that occurred prior to activity schedule training beginning. As with SIB and aggression, occurrences of stereotypy seemed to decrease as more appropriate engagement increased. For example, pupil C frequently put items into her mouth. She demonstrated engagement and stereotypy within the same 20-second intervals. This resulted in high levels of engagement regardless of how often she had engaged in stereotypical manipulations of the same play materials. However, as a noted limitation, data was not collected and cannot be verified. Had stereotypy been recorded separately, a decrease in this behaviour may have been observed within the data.

Play behaviour acquired during PCDI-AS can transfer to naturally occurring stimuli. Few AS studies sought to compare levels of engagement with, or without, an AS schedule as a visual cue (Blum-Dimaya et al., 2010; Brodhead et al. 2014; Spriggs et al. 2007). Those that did used a return to baseline or a no-schedule condition for comparison. Each demonstrated that individual engagement is greater with a visual cue than without, thus evidencing the success of AS cue-ing strategies. However, there is a paucity of literature that has examined the effect of AS training on skills demonstrated in other settings or situations.

Only one study identified within the literature review made a comparison of play behaviour demonstrated in a schedule condition with play behaviour when the schedule was not available. As discussed, Hume and Odom (2007) measured play behaviour in a schedule and a no-schedule condition. However, their study did not follow PCDI-AS procedures; verbal and gestural prompts were used alongside physical prompts in both conditions. There was no attempt to fade prompts and therefore visual cues embedded within their schedules did not acquire single stimulus control. Pupil play behaviour was under the control of adult prompting, and in the absence of visual cues, more adult prompting was required for pupils to engage with play materials. In contrast, this study has evidenced that by following PCDI-AS procedures a) play skills will occur under control of a single visual stimulus and b) play skills acquired in AS sessions can generalise to other, child-initiated sessions in the absence of adult prompting. Play behaviour controlled by visual cues during AS sessions seemed to transfer to naturally occurring stimuli within child-initiated sessions; therefore, the presence of play materials alone occasioned play behaviour. By measuring the effect of AS training on behaviour observed in other settings, this study has made a new contribution to this field of research.

In the current study, the main focus of child-initiated play session observations was to record quantity and quality of independent engagement, as well as the occurrence of SIB and/or aggression. This was obtained via a partial interval recording system. As discussed in the Limitations chapter, in hindsight the system of measurement was perhaps not the most appropriate for estimating these dimensions of behaviour. As sequential recording system is associated with greater accuracy (Thomson, Holmberg and Baer, 1974) ; measuring a behaviour in fifteen 20-second intervals equally distributed within a 30-minute session would likely have resulted in more representative data than an observation of an individual for a single five-minute period during the same session. It is recommended that future practitioners consider measuring an approximation of behaviour during evenly distributed intervals.

In addition to measuring engagement, SIB and aggression, other dimensions of behaviour were of interest. Observations of the variety of play materials used, and quality of play were also made. In the current study, these observations took the form of written notes. In retrospect, a tick system using a table listing the materials available could have simplified proceedings. Likewise, tick boxes denoting quality of play such as stacking and sorting could have been beneficial. Future practitioners may wish to consider using a tick box system for ease of use.

Social validity.

As an increasingly important priority within intervention studies (Olive & Liu, 2005), the collection of social validity measures was an important element to this study. Social validity measures were taken following the intervention via questionnaires with a Likert-type scale, as well as open-ended questions. Parents, carers and school staff completed the questionnaires, as presented in Chapter 10.

Pupil views were taken into account through analysis of their behaviour and responses towards AS training. This section summarises social validity findings.

Social validity measures indicate that teaching PCDI-AS to pupils with SLD is worthwhile and effective. The assessment in the current study evidenced that the PCDI-AS procedures used were considered socially valid in each of the three ways recommended by Wolf (1978); the goals were socially significant, the procedures were socially acceptable and the results were socially important.

There was a paucity of evidence of social validity measures for AS studies; reviews of literature acknowledged that the majority of studies did not provide any (Banda & Grimmett, 2008; Koyama & Wang, 2011; Knight et al., 2015). Those that did have reported favourably (Browder & Minarovic, 2000; Carson, Gast & Ayres, 2008; Massey & Wheeler, 2000; Morrison et al., 2000; Newman et al., 1995; Wheeler & Carter, 1998). Of the nine studies that followed PCDI-AS procedures, three reported on social validity (Carlile, Reeve, Reeve & DeBar, 2013; Bryan & Gast, 2000; Blum-Dimaya, Reeve, Reeve & Hoch, 2010). The present study has provided some social validity measures and added to the small number of studies that have validated the procedure. The results are in accordance with those of other researchers who found that the use of AS could be feasible to implement in classrooms and be beneficial to children (Bryan & Gast, 2000), and that all stakeholders including parents, reported that AS were effective (Knight et al., 2015). The views of the pupils, parents, carers and school staff were taken into account, and are summarised.

Pupils found AS to be acceptable. As discussed, it seems that the activity schedules themselves, and activities embedded within them, had become intrinsically reinforcing to many of the pupils. This echoes a finding of Betz et al. (2008), who wondered if the activity of game playing in their AS study had become a reinforcing event. It differs however from Brodhead et al.'s (2014) finding; when they removed visual schedules, schedule following did not occur therefore the schedule was not reinforcing to individuals.

In the present study, schedules were not removed and therefore schedule following in the absence of the visual schedule was not tested. However, by the end of the study most pupils had begun to request their activity schedules at different times of the day. Although no formal measures were taken to obtain pupil views, this evidence suggests that the AS procedure was acceptable to them, and indeed was a preferred activity for many. This finding is in accordance with Bryan and Gast (2000) who also noted that students in their study requested the use of activity schedules.

Parents and carers approved of the PCDI-AS procedure. Parental views of AS procedures and results were overwhelmingly positive. Several parents commented not only on the success of the intervention within the classroom, but also on the skills that had generalised beyond the school environment. Parents commented on the increase in their child's independence in particular. It was suggested that the children engaged in longer chains of behaviour than had previously been observed and furthermore that these actions occurred in the absence of adult prompting. These views echo those made by parents of participants in Morrison et al.'s (2002) study who reported important positive behaviour changes following the introduction of activity schedules.

Staff approved of the PCDI-AS procedure. Staff responses indicated that the procedure was acceptable and effective; they approved of the intervention and were willing to continue to use it in the classroom. Some minor concerns regarding the practicality of the procedure were mentioned; they slightly disagreed with the statement that the intervention required little training to implement. Some members of staff who were part of the main study were aware of the need for more in-depth training and supervision. They valued its importance as a teaching strategy and wanted to use it to develop pupil skills. This finding contrasts with that of Anderson et al. (1997) who found that despite engagement being demonstrably higher when schedules were used, when given a choice staff did not continue with the schedule. In contrast, in the present study, staff wanted to continue with the procedure, however they acknowledged the need for further support and training to do so effectively. Practicalities regarding numbers of staff required for teaching AS was an area of concern. This is consistent with issues noted during follow-up measures, as the number of adults working with two of the pupils had increased from one to two.

During the early stages of training in the main study, it was necessary to have a second person collecting data for each individual. It was physically impossible for the trainer to physically prompt pupils while also collecting accurate data. When inter-observer agreement (IOA) was collected, two members of staff were required to collect data, with a third as trainer. As pupils became more independent however and fewer or no physical prompts were required, it became possible to collect data and deliver training concurrently. This reduced the number of staff required for most sessions. For the purpose of this study, data were collected in every training session and IOA was collected in approximately a third of sessions. However for school purposes IOA was not required, and perhaps weekly recording sessions would be sufficient to evidence pupil progress and to inform next steps in learning. This would reduce the number of staff required for the majority of training sessions. It is recommended therefore that future practitioners carefully consider what is required to ensure procedures are valid and then ensure that methods of recording are simple, effective and practical within the given working environment.

Study Conclusion

There is an inherent assumption that the provision of choice making opportunities within child-led play sessions leads to positive play experiences (Saracho & Spodek, 1998). Furthermore, it is often assumed that children's manipulation of play materials automatically leads to greater understanding via progression through the manipulation, relational, functional and symbolic stages of development (Casby, 2003). However despite several years of play opportunities, pupils in this study, all presenting with ID and ASD in the severe range, were 'stuck' at these early developmental stages. Therefore, despite the best intentions from teachers, play sessions had not facilitated the development of play skills. Their play skills had in effect stagnated. Left to engage independently, children with autism are likely to engage repeatedly in the same selection of objects and actions (Williams et al., 2001), and this is true of the children in this study who had made little to no educational progress within this area of learning.

A consideration of children’s rights and the responsibilities of educators (Van Houten et al. 1988; Bannerman et al., 1990; Sheldon, 1995) led to some conclusions that guided the present study. While children have the right to play, they also have the right to effective teaching. Some may argue that these pupils had the right to engage in stereotypical behaviour with play materials during child initiated sessions. However, the ethics of being a bystander while individuals mouth, spin, flick or throw Lego bricks repeatedly because this is their preferred way of using Lego must be questioned. The right to access preferred activities needs to be balanced with their rights to acquire more functional, conventional play skills. These skills promote independence and effective functioning in society.

As discussed in Chapter 1, while typically developing children use their imitative skills when acquiring play skills, children diagnosed with ASD have difficulties with imitation (Rogers & Williams, 2006). For children with ASD, the acquisition of play skills is therefore more difficult. As discussed in Chapter 2, research suggests that independent play skills are more easily acquired in structured rather than unstructured sessions (Wong & Kasari, 2012; Kishida & Kemp, 2006), and that children diagnosed with autism have a preference for engaging with play materials independently over group play opportunities (Homes & Willoughby, 2005; Lord, 1984; Reseal & Magill-Evans, 1984; Wong & Kasari, 2012).

A review of teaching strategies in Chapter 3 considered the effect of different forms of prompting on skill acquisition. When using multi-component programmes it is not always clear which prompts were responsible for behaviour change and which were essential components for success. When comparing procedural variation, research indicated that manual guidance was preferable to modelling and gestural/verbal prompting, as skill acquisition had been shown to be more rapid with physical prompts alone (Bancroft, Weiss, Libby & Ahearn, 2011). When using physical prompting, research suggested that for those who acquired skills at a slow rate and whose progress was impeded by errors, a MTL procedure was more effective than LTM, as it minimised the occurrence of errors (Libby et al., 2008), could be more effective (Libby et al., 2008; Fentress & Lerman, 2012; Cengher et al., 2015) and was associated with better performance in maintenance probes (Fentress & Lerman, 2012). Verbal prompts were shown to hinder progress in some research (West & Billingsley, 2008), and therefore should be avoided for some.

When considering an intervention to teach independent play to those with severe ID and/or ASD, research from Chapters 2 and 3 suggested that an individually applied, structured intervention would be most effective, and that manual guidance would be preferable to using modelling or gestural prompts. A MTL procedure would be more effective than a LTM procedure, and verbal prompts should be avoided. The activity schedule (AS) as designed by MacDuff et al. (1993) met these criteria - it provided a teaching method that did not involve imitation but did enable individuals to engage with play materials independently, via a structured procedure. It was a 2-component procedure that utilised MTL prompting with visual cues, known here as the PCDI-AS.

Reviews of AS studies, summarised in Chapter 4, revealed procedural variations within interventions – some AS incorporated modelling, gestural and/or verbal prompting. Conclusions reached in Chapters 2 and 3 suggested the PCDI-AS approach would be more effective than AS using additional prompts, however, in the absence of a direct comparison of the different approaches, it was unclear as to which procedure was more effective and, which resulted in increased generalisation. A systematic review addressed this; it measured and compared the effectiveness and quality of research using PCDI-AS with research of AS using other methods. When considering quality, assessments indicated that overall, 26% of studies using AS methods evidenced generalisation compared with 82% of studies following the PCDI-AS method. These results indicate that overall, studies following the PCDI-AS approach were of higher quality than AS using other methods. A comparison of effectiveness revealed that although studies using AS in general were *effective*, the research that incorporated the PCDI-AS approach was *highly effective* and resulted in greater skill generalisation. As prior research had suggested, studies using the two-component procedure using only visual and physical prompts, were more effective than multi-component procedures that incorporated modelling, gestural and/or verbal prompts. A narrative synthesis of AS studies provided an overview of research while considering the quality and effectiveness of studies.

It would seem therefore, that to develop independent play skills in those with severe ID or ASD diagnoses, the PCDI-AS approach would be the most effective, and could result in generalisation. However, since the MacDuff et al. (1993) study, no other study had evidenced increased independent play skills via a PCDI-AS procedure with individuals who had severe ID or ASD. There was limited evidence therefore that the procedure would be effective for this population. There was no evidence that skills acquired in AS sessions would generalise to other play sessions, in the absence of visual cues.

Chapter 5 introduced this study's intervention and participants; pupils presenting with severe ID and ASD characteristics. The main questions asked were these: 1) Can PCDI-AS be used to teach children presenting with ID and ASD within the severe range to engage with play materials independently of adult prompting? And 2) if they can be taught to behave independently with traditional play materials, will these skills generalise to other, child initiated play sessions? As evidenced in Chapters 6, 7 and 8, the answer to both questions was broadly speaking, "yes"; PCDI-AS were used to teach 6 pupils to engage with play materials independently of adult prompting and for 8 of the 9 pupils, it seems that skills acquired during AS training sessions generalised to other child-initiated play sessions.

Six pupils mastered AS following. AS training data for the other 3 pupils indicated they were making progress; the upward trend of their data suggested that had training continued they too might have mastered AS following. Following the start of AS training, for all but one pupil (pupil E), play behaviour was qualitatively more developed following AS training, as demonstrated during AS sessions and more importantly in child-initiated sessions. With the exception of pupil E, play behaviour became more conventional: actions such as stacking, building, lining up, putting in and taking out were observed. Acquisition of these skills provided pupils with a broader, more functional repertoire of behaviour. If a goal of educators is to "widen the range of possible responses the individual can make to his or her environment" (Sheldon, 1995, p.41), then this intervention was a success.

As Cooper, Heron and Heward (2007) pointed out, there is no more challenging or important task than that of "designing, implementing and evaluating interventions that produce behaviour changes that continue after the intervention is terminated, appear in relevant settings and stimulus situations other than those in which the intervention was conducted, and/or spread to other related behaviours that were not taught directly" (p.613). This study has seen the implementation of a PCDI-AS procedure that produced positive behaviour change: the development of independent engagement with play materials. Skills generalised to novel materials and continued 11-months after the intervention terminated. They appeared in relevant settings and stimulus situations, within child-initiated sessions and in settings beyond the school environment. It provided positive, meaningful change in individual repertoires.

Following the intervention, parental approval was clear from both verbal comments made to staff as well as written comments and feedback on the questionnaire, as described in Chapter 9. Several parents/carers commented specifically on increased levels of independence in settings other than school. It seems that independent actions learned within activity schedule training sessions had generalised to other settings and resources, for example opening and closing, filling containers, removing items from containers, getting up and moving to locate items and returning with said items.

A clear example of the impact of AS training came from a parent following a school visit to observe an activity schedule session. She wrote a note to share how pleased she was: "I was astounded at the progress she has made! I have seen great improvement in many things in her home life, but the length of time she was able to sustain focus, and the activities she completed and persisted with within that time, was way beyond what I'd anticipated for this visit" (Parent, Personal Communication, 2013). She also stated that having seen the schedule taking place, "things she's started doing at home now make sense". When asked to explain further, the mother described her daughter following chains of behaviour not previously seen. For example, when accessing food from the kitchen she now signed for the crisp packet to be opened, retrieved a bowl from a cupboard, emptied crisps into the bowl and took them to sit down before eating them; before this she would have eaten the crisps standing in the kitchen, as soon as the packet was opened. The mother reported progress with getting changed before bed and getting changed for swimming, again following long chains of behaviour that previously did not exist. This behaviour had also been noticed at her grandparents' house indicating that skills had generalised across multiple environments.

AS training resulted in important outcomes for the specific children involved, as summarised and discussed within Chapter 10. However, the findings of this study have wider implications. All children have a right to learn how to play.

Independent play was defined in Chapter 2 as "to occupy oneself in leisure activities without being under the control of someone else or needing their help". A contribution to research has been made, by evidencing that children with a severe diagnosis can learn, via PCDI-AS procedures, to engage with play materials independently of adult prompting. Furthermore, it reveals that skills acquired during AS training sessions can generalise to other child-initiated sessions. These findings are significant for the families and educators of children with similar diagnoses. Rather than being ‘stuck’, with the right approach, children diagnosed with intellectual disabilities and ASD within the severe range can learn to play independently.

Recommendations for Research

Comparatively little research in the UK is targeted towards identifying effective services for individuals diagnosed with ASD (Pellicano, Dinsmore & Charman, 2014). During the period 2007-2011, of the 106 autism research funding awards made in the UK, most targeted the areas of biology, brain and cognition with only 18% targeting practical interventions (Pellicano et al., 2014). Yet, within a review of research priorities, all stakeholders consulted “prioritised research into issues of immediate practical concern” and “wanted ‘to see real change and real things happening’ for themselves, their families and for the people they work for” (Pellicano et al., 2014, p.760). There seems, therefore, to be a discrepancy between areas to which funding is allocated and areas that stakeholders prioritise as important.

In Pellicano et al.’s (2014) study, parents and adults diagnosed with autism highlighted in particular the “importance of *developing skills to manage in day-to-day life*” (p.761). The activity schedule is a teaching strategy that has potential to fulfil this need: As discussed in Chapter 4, activity schedules have been effective for developing a wide range of practical skills that are required on a day-to-day basis. The current study has provided further evidence that activity schedules can develop independent engagement skills in those presenting with severe ID and ASD. However, in the course of the study, ideas for further research have been generated.

Compare time taken to acquire skills via different methods. The current study has provided evidence that the PCDI-AS approach is of higher quality and is more effective that AS using other methods. However, it has also been acknowledged that studies implementing AS using other methods have been highly effective within some studies. As noted in Chapter 2, although a MTL procedure is thought to be more effective than LTM for those with severe diagnoses (Libby et al.. 2008; Fentress & Lerman, 2012; Cengher et al.,2015), for those with more mild diagnoses who acquire skills more rapidly, LTM can be more efficient (Bancroft et al., 2011). A comparison of studies implementing PCDI-AS with studies implementing AS using other methods that include verbal and/or gestural prompts would be an interesting area for future research. Perhaps, for those with more mild diagnoses, the addition of further prompts may increase the rate of skill acquisition.

Identify the impact of basic skill training on schedule following skill acquisition. McClannahan and Krantz (2010) state that progress in AS training is more rapid if the 'pre-requisite' or basic skills have first been acquired. However, the literature search did not reveal any comparison of schedule following skill acquisition with or without basic skills being embedded within individual repertoires prior to training. No identified studies explicitly stated that pupils had not acquired the basic skills prior to training. Nor did any studies indicate how many sessions were required to teach the three basic skills. Therefore, there is a paucity of empirical evidence to suggest a) how quickly these skills can be acquired, b) the most effective teaching methods to promote basic skill acquisition and c) if AS following can be acquired without having first demonstrated the three basic skills. Further research into these areas of basic skill training would be beneficial to those planning an activity schedule intervention.

Comparison of teaching methods for basic skill acquisition. Teaching methods embedded within the activity schedule procedures were, in part, designed for those individuals for whom other teaching methods were not successful. As discussed in Chapter 3, teaching methods such as discrete trial teaching (DTT) can produce prompt dependency resulting in learners passively waiting for instruction and reinforcement. The activity schedule was specifically designed by MacDuff, Krantz and McClannahan (1993) to increase independence and limit dependency on adult prompting. Yet the teaching methods described for developing the basic ‘pre-requisite’ skills involved DTT methods. These contrasting teaching techniques, designed within the same intervention package, create a paradox. No studies have compared time taken to acquire the basic skills with DTT or AS manual guidance teaching methods. Although beyond the aims of this study, a comparison of teaching techniques to occasion the three basic skills prior to AS training could make an interesting topic for future research.

Measure skill acquisition using objects of reference. Some suggestions have been made that activity schedules could include objects of reference rather than use of photographs, words or symbols (Wheeler & Carter, 1988; McClannahan & Krantz, 2010). However, no research could be found that used objects as SDs for schedule following. This could be due to a presumption that mastery of AS following requires a minimum level of symbol understanding, and experience of 2-dimensional images representing 3-dimensional objects (Koyama & Wang, 2011). This study however has provided some evidence to suggest that independent schedule following skills can be increased in those who have not yet fully acquired picture-object matching skills. Therefore, some research in this area could be interesting. A comparison of AS following using 3-dimensional objects versus 2-dimensional images could inform future practitioners on which materials promote faster skill acquisition.

Evaluate impact of including choice within AS procedures. Some research has found that by introducing choice, engagement with leisure activities can increase for adults diagnosed with intellectual disabilities (Wilson, Reid & Green, 2006; Watanabe & Sturmey, 2003). Providing children diagnosed with disabilities with more ways of making choices when they are younger has positive connotations for life, as they grow older. This is particularly relevant given the low rate of engagement noted in adults diagnosed with learning disabilities (Fence, 1991). The present study has not made a comparison between rates of engagement with choice of activities or without, however it has provided evidence that choice can be embedded within schedules. It has been suggested that future research could focus on comparison of teacher-choice versus child-choice of play activities embedded within activity schedules (Banda & Grimmett, 2008). Findings of the present study support this suggestion.

Evaluate AS training for individuals diagnosed with Fragile X syndrome. Finally, it was noted that one pupil in the current study (pupil H) had Fragile X Syndrome (FXS) and ASD. High states of "arousal" and "anxiety" are said to be part of the FXS condition which manifests in behaviour such as SIB, aggression and attempts to escape (Morris, Kondratenko & Griffiths, 2014). Problematic behaviour is seen as a response to heightened sensitivities; social interactions tend to be challenging and making eye contact is often avoided. Many individuals with FXS experience difficulties with processing sensory input and may overreact to certain stimuli. In addition, those diagnosed with ASD and FXS have particular impairments in receptive and expressive communication. Yet, typical face-to-face learning situations within the classroom include a requirement to look at the trainer while simultaneously listening to verbal instructions and engaging with educational materials. In contrast, the PCDI-AS procedure precludes face-to-face learning; no eye contact or verbal instructions are included within the strategy. Morris et al. (2014) point to the underlying causes of challenging behaviour in those diagnosed with FXS and call for "consideration and accommodation of these causes in intervention design". The PCDI-AS could potentially accommodate these causes by negating the requirement to make eye contact or listen to instructions. Evidence suggested that for pupil H, conditions in AS sessions may have been more conducive to learning than conditions during 'lessons as usual'. Sample size of those with FXS in the current study equates to a single case; however, the evidence suggests that future research in this area could be interesting and potentially beneficial to other individuals with this syndrome.

References

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Anderson, M., Sherman, J., Sheldon, J. & McAdam, D. (1997). Picture activity schedules and engagement of adults with mental retardation in a group home. *Research in Developmental Disabilities, 18* (4), 231-150.

Bancroft, S., Weiss, J., Libby, M. & Ahearn, W. (2011). A comparison of procedural variations in teaching behaviour chains: manual guidance, trainer completion and no completion of untrained steps. *Journal of Applied Behaviour Analysis, 44* (2), 559-569.

Baron-Cohen, S. (1987). Autism and symbolic play. *British Journal of Developmental Psychology*, *5* (2),139-148.

Banda, D. & Grimmett, E. (2008). Enhancing social and transition behaviours of persons with autism through activity schedules: a review. *Education and Training in Developmental Disabilities, 43*(3), 324-333.

Banda, D. & Thierry, W. (2008). A teacher's guide to meta-analysis. *Teaching Exceptional Children, 41(2)*, 66-71.

Bancroft. S., Weiss, J., Libby, M. & Ahearn, W. (2011). A comparison of procedural variations in teaching behaviour chains: manual guidance, trainer completion and no completion of untrained steps. *Journal of Applied Behaviour Analysis, 44, 559-569.*

Bannerman, D., Sheldon, J., Sherman, J. & Harchik, A. (1990). Balancing the right to facilitation with the right to personal liberties: the rights of people with developmental disabilities to eat too many doughnuts and take a nap. *Journal of Applied Behaviour Analysis, 23*(1) 79-89.

Betz, D., Higbee, T. & Reagan, K. (2008). Using joint activity schedules to promote peer engagement in pre-schoolers with autism. *Journal of Applied Behaviour Analysis, 41*(2), 237-241.

Blum-Dimaya, A., Reeve, S., Reeve, K. & Hoch, H. (2010). Teaching children with autism to play a video game using activity schedules and game-embedded simultaneous video modelling. *Education and Treatment of Children, 33*(3), 351-370.

Bevill, A., Gast, D., Maguire, A. & Vail. (2001). Increasing engagement of preschoolers with disabilities through correspondence training and picture cues. *Journal of Early Intervention, 24* (2), 129-145.

Bijou, S., Peterson, R. & Ault, M. (1968). A method to integrate descriptive and experimental field studies at the level of data and empirical concepts. *Journal of Applied Behaviour Analysis, 1 (2) 175-191.*

Bopp, K., Brown, K. & Mirenda, P. (2004). Speech-language pathologists' roles in the delivery of positive behaviour support for individuals with developmental disabilities. *American Journal of Speech-Language, 13*(1) 5-19.

Bloom, L., Hood, L. & Lightbrown, P. (1991). Imitation in language development: if, when and why. In Bloom, L. (Ed.) *Language Development from Two to Three, 399-432*. New York: Cambridge University.

British Institute of Learning Disabilities (2011). Factsheet: Learning Disabilities. Retrieved from http://www.bild.org.uk

Brodhead, M., Higbee, T., Pollard, J., Akers, J. & Gerencser, K. (2014). The use of linked activity schedules to teach children with autism to play hide-and-seek. *Journal of Applied Behaviour Analysis, 47,* 1-6.

Brooks, B., Floyd, F., Robins, D. & Chan, W. (2015). Extracurricular activities and the development of social skills in children with intellectual and specific learning disabilities. *Journal of Intellectual Disability Research, 59* (7), 678-687. doi: 10.1111/jir.12171

Browder, D. & Minarovic, T. (2000). Utilizing sight words in self-instruction training for employees with moderate mental retardation in competitive jobs. *Education and Training in Mental Retardation and Developmental Disabilities, 35,* 78-89.

Brugha T., Cooper S.A., McManus S., Purdon S., Smith J., Scott F.J., Spiers N. & Tyrer F. (2012). *Estimating the prevalence of Autism Spectrum Conditions in adults: extending the 2007 adult psychiatric morbidity survey.* The Health and Social Care Information Centre; University of Leicester, the

Leicestershire Partnership NHS Trust, the National Centre for Social Research, and the University of Glasgow. Retrieved from http://www.hscic.gov.uk/.../esti-prev-auti-ext-07-psyc-morb-surv-rep.pd

Bryan, L. & Gast, D. (2000). Teaching on-task and on-schedule behaviours to high functioning children with autism via picture activity schedules. *Journal of Autism and Developmental Disorders, 30* (6), 553-567.

Buschbacker, Fox & Clarke (2004) Recapturing desired family routines: a parent-professional behavioural collaboration. *Research and Practice for Persons with Severe Disabilities*, *29* (1), 25-39.

Carlile, K., Reeve, S., Reeve, K. & DeBar, R. (2013). Using activity schedules on the iPod touch to teach leisure skills to children with autism. *Education and Treatment of Children*, *36* (2), 33-57.

Carothers & Taylor (2004). How teachers and parents can work together to teach daily living skills to children with autism. *Focus on Autism and other developmental disabilities, 19* (2), 102-104.

Carr, E. G. (1983). Behavioural approaches to language and communication. In E. S Schopler & G. Mesibov (Eds.), *Current issues in autism, volume III: Communication problems in autism* (pp. 37-57). New York: Plenum Publishers.

Carr, E. & Durand, M. (1985). Reducing challenging behaviour problems through functional communication training. *Journal of Applied Behaviour Analysis 16, 111-126*

Carson, K., Gast, D. & Ayres, K. (2008). *European Journal of Special Needs Education, 23*(3), 269-279.

Casby, M. (2003). Developmental assessment of play: a model for early intervention. *Communication Disorders Quarterly, 24*(4), 175-183.

Charlop-Christy, M. & Carpenter, M. (2000). Modified incidental teaching sessions: a procedure for parents to increase spontaneous speech in their children with autism. *Journal of Positive Behaviour Interventions, 2(*2), 98-112.

Charlop-Christy, M., LeBlanc, L. & Carpenter, M. (1999). Naturalistic teaching strategies (NATS) to teach speech to children with autism: historical perspective, development, and current practice. *The California School Psychologist, 4*(1), 30-46.

Cengher, M., Shamoun, K., Moss, P., Roll, D., Feliciano, G. & Fienup, D. (2016). A comparison of the effects of two prompt-fading strategies on skill acquisition in children with autism spectrum disorders. *Behaviour Analysis in Practice*, 9(2), 115-125.

Cihak, D. (2011). Comparing pictorial and video-modelling activity schedules during transitions for students with autism spectrum disorders. *Research in Autism Spectrum Disorders, 5*, 433-441.

Clarke, S., Dunlap, G. & Vaughn, B. (1999). Family-centred, assessment-based intervention to improve behaviour during an early morning routine. *Journal of Positive Behaviour Interventions*, 1, 235-241.

Connis, R. (1979). The effects of sequential pictorial cues, self-recording and praise on the job task sequencing of retarded adults. *Journal of Applied Behaviour Analysis*, *12,* 355-361.

Copland, R. & Rubin, K. (1998). Exploring and assessing non-social play in the preschool: the development and validation of the preschool play behaviour scale. *Social Development*, *7*(1). Blackwell Publishers Ltd, Oxford UK & Malden USA.

Cooper, J., Heron, T. & Heward, W. (2007). *Applied Behaviour Analysis*. Pearson Education International, New Jersey.

Cramer, M., Hirano, S., Tentori, M., Yeaning, M. & Hayes, G. (2011). Classroom-based assistive technology: collective use of interactive visual schedules by students with autism. doi: 10.1145/1978942.1978944

Crosland, K. & Dunlap, G. (2012). Effective strategies for the inclusion of children with autism in general education classrooms. *Behaviour Modification*, 36 (3), 251-269.

Cuhadar, S. & Diken, I. (2011). Effectiveness of instruction performed through activity schedules on leisure skills of children with autism. *Education and Training in Autism and Developmental Disabilities*, 46 (3), 386-398.

Cunningham, A. & Schreibman, L. (2008). Stereotypy in Autism: the importance of function. *Research into Autistic Spectrum Disorders*, 2(3), 469-479.

Cuvo, A., Leaf, R. & Borakove, L. (1978). Teaching janitorial skills to the mentally retarded: acquisition, generalisation and maintenance. *Journal of Applied Behaviour Analysis, 11*(3), 345-355.

Dauphin, M., Kinney, E. & Stromer, R. (2004). Using video-enhanced activity schedules and matrix training to teach sociodramatic play to a child with autism. *Journal of Positive Behaviour Interventions, 6* (4), 238-250.

DeLeon, I. & Iwata, B. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Behaviour Analysis, 29 (4) 519-533.*

Dettmer, S., Simpson, R., Myles, B., & Ganz, J. (2000). The use of visual supports to facilitate transitions of students with autism. *Focus on Autism and Other Developmental Disabilities, 15*(3),163-169.

Dib, N. & Sturmey, P. (2007). Reducing student stereotypy by improving teachers' implementation of discrete-trial teaching. *Journal of Applied Behaviour Analysis*, *40,* 339-343.

Dooley, P., Wilczenski, F. & Torem, C. (2001). Using an activity schedule to smooth school transitions. *Journal of Positive Behaviour Interventions, 3*(1), 57-61.

Dunlap. G. & Fox, L. (1999). A demonstration of behavioural support for young children with autism. *Journal of Positive Behaviour Interventions, 1*(2), 77-87.

Dunlap, G, DePerczel, M., Clarke, S., Wilson, D., Wright, S., White, R. & Gomez, A. (1994). Choice making to promote adaptive behaviour for students with emotional and behavioural challenges. *Journal of Applied Behaviour Analysis, 27,* 505-51.

Duttlinger, C., Ayres, K., Bevill-Davis, A. & Douglas, K. (2012). The effects of a picture activity schedule for students with intellectual disability to complete a sequence of tasks following verbal directions. *Focus on Autism and Other Developmental Disabilities, 28*(1), 32-43.

Elliot, S & Van Brock, M (1991). The behaviour intervention rating scale: development and validation of a pre-treatment acceptability and effectiveness measure. *Journal of School Psychology, 29,*43-51.

Eikeseth, S., Smith, T., Jahr, E. & Edevik, S. (2002). Intensive behavioural treatment at school for 4-7 year old children with autism: A 1-year comparison controlled study. *Behaviour Modification,* 49-68.

Emerson, E. & Heslop, P. (2010) A working definition of learning disabilities. Improving Health and Lives: Learning Disabilities Observatory. Retrieved from http:// www.improvinghealthandlives.org.uk

Emerson, E., Hatton, C., Robertson, J., Roberts, H., Baines, S., Evison, F. & Glover, G. (2011). *People with Learning Disabilities in England, 2011: Services and Supports*. Improving Health and Lives: Learning Disabilities Observatory. Retrieved from: http.//www.base-uk.org

Equality Act (2010*). Legislation.gov.uk*. Retrieved on 11 Jan, 2015.

Felce, D (1991). Using behavioural principles in the development of effective housing services for adults with severe or profound handicap, in *The Challenge of Severe Mental Handicap: A Behaviour Analytic Approach* (Ed B. Remington) Chichester: John Wiley & Sons.

Fentress, G. & Lerman, D. (2012). A comparison of two prompting procedures for teaching basic skills to children with autism. *Research in Autism Spectrum Disorders*, 6(3), 1083-1090.

Fisher, W., Piazza, C., Bowman, L., Hagopian, L., Owens, J. & Slevin, I. (2013*).* A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behaviour Analysis, 25* (2), 491-498.

Fletcher, J. (1992). The validity of distinguishing children with language and learning disabilities according to discrepancies with IQ: introduction to the special series. *Journal of Learning Disabilities, 25*(9), 546-548.

Foster, S. & Mash, E. (1999). Assessing social validity in clinical treatment research, issues and procedures. *Journal of Consulting and Clinical Psychology*, *67*(3), 308-319

Frank, A., Wacker, D., Berg, W. & McMahon, C. (1985). Teaching selected microcomputer skills to retarded students via picture prompts. *Journal of Applied Behaviour Analysis, 18*(2) 179-185.

Frost, L. & Bondy, A. (2002). *The picture exchange communication system training* *manual.* Pyramid Educational Products Inc. Newark, USA.

Gadby, S., Gast, D., Wolery, M. (1987). A comparison of time delay and system of least prompts in teaching object identification. *Research in Developmental Disabilities*, *8*(2), 283-305.

Ganz, J. & Flores, M. (2008). Effects of the use of visual strategies in play groups for children with autism spectrum disorders and their peers. *Journal of Developmental Disorders 38,* 926-940

Ghezzi, P. (2007). Discrete Trial Teaching. *Psychology in the Schools, 44*(7), 667- 679.

Graham, S. & Harris, K. (2001). The relevance of IQ in the determination of learning disabilities: abandoning scores as decision makers. *Journal of Learning Disabilities, 22*(8) 500-503.

Gresham, F.M. & Lopez, N.F. (1996). Social validation: a unifying concept for school-based consultation research and practice. *Schools Psychology Quarterly*, *11*, 204-227.

Green, G. (2001). Behaviour analytic instruction for learners with autism: advances in stimulus control technology. *Focus on Autism and Other Developmental Disabilities*, *16*(2), 72-85.

Griffiths, R. (1996). *The Griffiths Mental Development Scales – Revised: Birth to two years.* Henley: Research in Infant and Child Development, Test Agency.

Hall, L., McClannahan L. & Krantz, P.(1995). Promoting independence in integrated classrooms by teaching aides to use activity schedules and decreased prompts. *Education and Training in Mental Retardation and Developmental Disabilities, Sep,* 208-216.

Halle, J., Marshall, A. & Spradlin, J. (1979). Time delay: a technique to increase language use and facilitate generalisation in retarded children. *Journal of Applied Behaviour Analysis,12,* 431-439.

Handleman, J. & Harris, S. (Eds.) (2008). *Preschool Education Programs for Children with Autism*. Pro-Ed, Inc.

Hart, B. & Risley, T. (1975). Incidental teaching of language in the pre-school. *Journal of Applied Behaviour Analysis, 4,* 411-420.

Hart, B., & Risley, T. R. (1982). *How to use incidental teaching for elaborating* *language* (Vol. 22). Pro-Ed.

Harvey, M., May, M. & Kennedy. C. (2004). Nonconcurrent multiple baseline designs and the evaluation of educational systems. *Journal of Behavioral Education, 13 (4) 267-276.*

Hawkins, R. & Dotson, V. (1973). Reliable scores that delude: an Alice in Wonderland trip through the misleading characters its of inter-observer agreement scores on internal recording. DOCUMENT RESUME.

Hedges, J., Adolph, K., Amos, D., Bavelier, D., Fiez, J., Krubitzer, L., McAuley, D., Newcombe, N., Fitzpatrick, S. & Ghajar, J. (2013). Play, attention, and learning: how do play and timing shape the development of attention and influence classroom learning? *Annals of the New York Academy of Sciences. Issue: Annals reports*. Wiley Periodicals Inc. Ann. N.Y. Acad. Sci. ISSN 0077-8923.

Higbee, T., Carr J. & Harrison, C. (2000). Further evaluation of the multiple-stimulus preference assessment. *Research in Developmental Disabilities, 21 (1) 61-73.*

Horner, R., Carr, E., Strain, P., Todd, Q. & Reed, H. (2002). Problem behaviour Interventions for children with autism: a research synthesis. *Journal of Autism and Developmental Disorders, 32* (5) 423-446.

Holmes, E. & Willoughby, T. (2005). Play behaviour of children with autism spectrum disorders. *Journal of Intellectual and Developmental Disability, 30*(3), 156-164.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single subject research to identify evidence-based practice in special education. *Exceptional Children, 71,* 165-180.

Horner, R. D., & Keilitz, I. (1975). Training mentally retarded adolescents to brush their teeth. *Journal of Applied Behaviour Analysis,* 8, 301-309.

Howard, J., Sparkman, C., Cohen, H., Green, G. & Stanislaw, H. (2005). A comparison of intensive behaviour analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities, 26,* 359-383.

Hume, K. & Odom, S. (2007). Effects of an individual work system on the independent functioning of students with autism. *Journal of Autism and Developmental Disorders, 37*,1166-1180.

Irvine, A. B., Singer, G. H., Erickson, A. M., & Stahlberg, D. (1992). A coordinated program to transfer self-management skills from school to home. *Education & Training in Mental Retardation*, 27, 251-254.

Johnson, B. & Cuvo, A. (1981). Teaching mentally retarded adults to cook. *Behaviour Modification*, 5, 187-202.

Jung, S. & Sainato (2013). Teaching play skills to young children with autism. *Journal of Intellectual and Developmental Disability* 38 (1): 74-90

Kennedy, C. (2005) *Single-case designs for educational research.* Allyn and Bacon, Pearson Education.

Kennedy, C., Meyer, Kim., Knowles, T. & Shukla, S. (2000). Analyzing the multiple functions of stereotypical behaviour for students with autism: implications for assessment and treatment. *Journal of Applied Behaviour Analysis, 3*3, 559-571.

Kevan, F. (2003). Challenging behaviour and communication difficulties. *British Journal of Learning Disabilities, 75-80.*

Kimball, J., Kinney, E., Taylor, B. & Stromer, R. (2003). Lights, camera, action! Using engaging computer-cued activity schedules. *Teaching Exceptional Children, 36* (1), 40-45.

Kishida, Y. & Kemp, C. (2006). A measure of engagement for children with intellectual disabilities in early childhood settings: a preliminary study. *Journal of Intellectual & Developmental Disability*, *31* (2),101-114.

Knight, V., Sartini, E. & Spriggs, A. (2015). Evaluating visual activity schedules as evidence-based practice for individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 45,* 157-178.

Koegel, R., O'Dell, M. & Koegel, L. (1987). A natural language teaching paradigm for nonverbal autistic children. *Journal of Autism and Developmental Disorders, 17*(2), 187-200.

Koyama, T. & Wang, H. (2011). Use of activity schedule to promote independent performance of individuals with autism and other intellectual disabilities: a review. *Research in Developmental Disabilities, 32, 2235-2242.*

Krantz, P., MacDuff, G. & McClannahan, L., (1993). Programming participation in family activities for children with autism: parents' use of photographic activity schedules. *Journal of the Applied Behaviour Analysis, 26*, 137-138.

Krantz, P & McClannahan, L (1998) Social interaction skills for children with autism: a script fading procedure for beginning readers. *Journal of Applied Behaviour Analysis*, 31(2), 191-202.

Krantz, P & McClannahan, L, (1993) Teaching children with autism to initiate to peers: effects of a script-fading procedure. *Journal of the Applied Behaviour Analysis* 26, 121-132.

Kratochwill, T., Hitchcock, J., Horner, R., Levin, J., Odom, S., Rindskopf, D & Shadish, W. (2010). Single-case designs technical documentation. Retrieved from What Works Clearinghouse website: http://iess.ed.gov/ncee/wwc/pdf/wwc_scd.pdf

Lalli, J., Casey, S., Goh, H. & Merlino, J. (1994). Treatment of escape-maintained aberrant behaviour with escape extinction and predictable routines. *Journal of Applied Behaviour Analysis, 27* (4), 705-714.

Lang, R., Kuriakose, A., Lyons, G., Mulloy, A., Boutot, A., Britt, C., Caruthers, S., Ortega, L., O'Reilly, M. & Lancioni, G. (2011). Use of school recess time in the education and treatment of children with autism spectrum disorders: a systematic review. *Research in Autism Spectrum Disorders, 5,* 1296-1305.

Lequia, J., Machelicek, W. & Rispoli, M. (2012). Effects of activity schedules on challenging behaviour exhibited in children with autism spectrum disorders: a systematic review. *Research in Autism Spectrum Disorders, 6,* 480-492.

Libby, M., Weiss, J., Bancroft, S. & Ahearn, W. (2008). A comparison of most-to-least and least-to-most prompting on the acquisition of solitary play skills. *Behaviour Analysis in Practice, 1*(1), 37-43.

Likert, R. (1932). A Technique for the Measurement of Attitudes. *Archives of Psychology, 22*(140), 5-55. New York.

Lillard, A. (1998) Playing with a theory of mind. In Saracho, O. and Spodek, B. (Eds.), *Multiple perspectives on play in early childhood education.* State University of New York Press, Albany.

Liu, T. & Breslin, C. (2013). The effect of a picture activity schedule on performance of the MABC-2 for children with autism spectrum disorder. *Research Quarterly for Exercise and Sport*, *84,* 206-212.

Lovaas, I., Newsom, C, Hickman, C (1987). Self-stimulatory behaviour and perceptual reinforcement. *Journal of Applied Behaviour Analysis*, *20,* 45-68.

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

Lyon, G. (1989). IQ is irrelevant to the definition of learning disabilities: a position in search of logic and data. *Journal of Learning Disabilities*, *8,* 504-512.

MacDuff, G., Krantz, P. & McClannahan, L. (2001). Prompts and prompt-fading strategies for people with autism. In Maurice, C., Green, G. & Foxx, R. (Eds.), *Making a Difference: Behavioural Interventions for Autism*. Austin, TX:PRO-ED.

MacDuff G., Krantz, P. & McClannahan, L., (1993). Teaching children with autism to use photographic activity schedules: maintenance and generalisation of complex response chains. *Journal of the Applied Behaviour Analysis, 26* (1), 89-97.

Machalicek, W., O'Reilly, M., Beretvas, N., Sigafoos, J. & Lancioni, G. (2007). A review of interventions to reduce challenging behaviour in school settings for students with autism spectrum disorders. *Research in Autism Spectrum Disorders, 1*, 229-246.

Machalicek, W., Shogren, K., Lang, R., Rispoli, M., O'Reilly, M., Franco, J. & Sigafoos, J. (2009). Increasing play and decreasing the challenging behaviour of children with autism during recess with activity schedules and task correspondence training. *Research in Autism Spectrum Disorders, 3*(2), 547-555.

Manolov, R. & Solanas, A. (2009). Percentage of nonoverlapping corrected data. *Behaviour Research Methods*, 41(4):1262-71.

Mansell, J. (2010). Raising our sights: services for adults with profound intellectual and multiple disabilities. *Tizard Learning Disability Review*, *15*(3), 5-12.

Martin, J., Rusch, F., James, V., Decker, P. & Trtol, K. (1982). The use of picture cues to establish self-control in the preparation of complex meals by mentally retarded adults. *Applied Research in Mental Retardation*, *3*(2), 105-119.

Massey, N. & Wheeler, J. (2000). Acquisition and generalisation of activity schedules and their effects on task engagement in a young child with autism in an inclusive pre-school classroom. *Education and Training in Mental Retardation and Developmental Disabilities*, *35*(3), 326-335.

Matson, J., Kozlowski, A., Worley, J., Shoemaker, M., Sipes, M. & Horovitz, M. (2011). What is the evidence for environmental causes of challenging behaviours in persons with intellectual disabilities and autism spectrum disorders? *Research in Developmental Disabilities, 32*, 693-698.

McClannahan, L. & Krantz, P. (2010). *Activity Schedules for Children with Autism; Teaching Independent Behaviour*. Woodbine House, Inc, USA.

McClannahan, L. & Krantz, P. (2006). Behaviour analysis and intervention for school-age children at the Princeton child development institute. In Handleman, J. & Harris, S. (Eds.), *School-Age Education Programs for Children with Autism* (pp.143-160). Pro-ed Publisher.

McGee, G, Krantz, P, Mason, D & McClannahan, (1983). A modified incidental teaching procedure for autistic youth – acquisition and generalisation of receptive object labels. *Journal of Applied Behaviour Analysis, 16* (3), 329-338.

McGee, G, Krantz, P, Mason, D & McClannahan, (1985). The facilitative effects of incidental teaching on preposition use by autistic children. *Journal of Applied Behaviour Analysis*, 18(1):17-31.

Mechling, L., Gast, D. & Seid, N. (2009). Using a personal digital assistant to increase independent task completion by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 39*(10), 1420-1434.

Mechling, L. & Gustafson, M. (2009). Comparison of the effects of static picture and video prompting on completion of cooking related tasks by students with moderate intellectual disabilities. *Exceptionality, 17*:103-116

Mechling, L. & Gustafson, M. (2008). Comparison of static picture and video prompting on the performance of cooking related tasks by students with autism. *Journal of Special Education Technology, 23*(3), 31-45.

Mechling. L. & Savidge, E. (2010). Using a personal digital assistant to increase completion of novel tasks and independent transitioning by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 41,* 687-704.

Mesibov, G., Browder, D. & Kirkland, C. (2002). Using individualised schedules as a component of positive behavioural support for students with developmental disabilities. *Journal of Positive Behaviour Interventions,* Vol. 4, 2, 73-79.

Miguel, C., Yang, H., Finn, H. & Ahearn, W. (2009). Establishing derived textual control in activity schedules with children with autism. *Journal of Applied Behaviour Analysis, 42* (3), 703-709.

Milley, A. & Machalicek, W. (2012). Decreasing students reliance on adults: a strategic guide for teachers of students with autism spectrum disorders. *Intervention in School and Clinic*, *48* (2), 67-75.

Miranda-Linne, F & Melin, L (1992) Acquisition, Generalisation, and Spontaneous Use of Colour Adjectives: A comparison of Incidental Teaching and Traditional Discrete-Trial Procedures for Children with Autism *Research in Developmental Disabilities, 133*, 191-210.

Mirenda, P. & Locke, P. (1989). A comparison of symbol transparency in nonspeaking persons with intellectual disabilities. *Journal of Speech and Hearing Disorders*, 54, 131-140.

Morris, A, Kondratenko, D & Griffiths, D, (2014) Fragile X syndrome, implications for applied behaviour analysis. In Griffiths, D., Condillac, R. and Legree, M. (Eds.), *Genetic syndromes and applied behaviour analysis, a handbook for ABA practitioners* (pp.71-110). London: Jessica Kingsley Publishers.

Morrison, M, Sainato, D, Benchaaban, D & Endo, S (2002). Increasing play skills of children with autism using activity schedules and correspondence training. *Journal of Early Intervention, 25*(1), 58-72.

National Health Service (2016). *Autism Spectrum Disorder (ASD).*

Retrieved from http://www.nhs.uk/conditions/autistic-spectrum-disorder

National Institute for Health and Care Excellence (2016). *Mental health problems in people with learning disabilities: prevention, assessment and management.* NICE guideline, published 14 September 2016. Retrieved on 16 September from http://www.nice.org.uk/guidance/ng54

Newman, B., Buffington, D., O'Grady, M., McDonald, M., Poulson, C. & Hemmes, N. (1995). Self-management of schedule following in three teenagers with autism. *Behavioural Disorders, 20*(3), 190-196

Olive, M & Liu, Y. (2005). Social validity of parent and teacher implemented assessment-based interventions for challenging behaviour. *Educational Psychology, 25*(2-3), 305-312.

O'Reilly, M., Sigafoos, J., Lancioni, G., Edrishinha C. & Andrews, C. (2005). An examination of the effects of a classroom activity schedule on levels of self-injury and engagement for a child with severe autism. *Journal of Autism and Developmental Disabilities*, 35, 305-311.

Parker, R., Vannest, K. & Davis, J. (2011). Effect size in single-case research: a review of nine nonoverlap techniques. *Behaviour Modification 35*(4) 303-322

Partington, J. (2008). *The Assessment of Basic Language and Learning Skills-Revised* (The ABLLS-R). Behaviour Analysts, Inc. CA.

Pellicano, E., Dinsmore, A. & Charman, T. (2014). What should autism research focus upon? Community views and priorities from the United Kingdom. *Autism, 18*(7) 756-770. doi: 10.1177/1362361314529627.

Pierce, K. & Shreibman, L. (1994). Teaching daily living skills to children with autism in unsupervised settings through pictorial self-management. *Journal of Applied Behaviour Analysis, 27* (3), 471-48.

Pierce, J., Spriggs, A., Gast, D. & Luscre, D. (2013). Effects of visual activity schedules on independent classroom transitions for students with autism. *International Journal of Disability, Development and Education, 60*(3), 253-269.

Raver, S., Hester, P. Machalicek, A., Cho, D. & Anthony, N. (2013). Impact of an activity mini-schedule on the inattention of preschoolers with cochlear implants during a group activity. *Education and Treatment of Children, 36*,(2), 15-32.

Rehfeldt, R. (2002). A review of McClannahan and Krantz's activity schedules for children with autism: teaching independent behaviour: toward the inclusion and integration of children with disabilities. *The Behaviour Analyst, 25* (1), 103-108.

Restall, G. & Magill-Evans, J. (1994). Play and preschool children with autism. *The American Journal of Occupational Therapy*, 48, 113-120.

Rogers, S. & Williams, J. (2006) Imitation in autism, findings and controversies. Chapter 12 in Rogers, S. & Williams, J. (2006) (Eds.) *Imitation and the social mind, autism and typical development.* Guilford Publications, New York.

Rogers, S., Young, G., Cook, I., Giolzetti, A. & Ozonoff, S. (2010). Imitating actions
on objects in early-onset and regressive autism: effects and implications of task characteristics on performance. *Developmental Psychopathology*; 22 (1): 71-85. Doi: 10.1017/S0954579409990277. Cambridge University Press.

Saracho, O. and Spodek, B. (1998) (Eds.). *Multiple perspectives on play in early childhood education.* State University of New York Press, Albany.

Scruggs, T. & Mastropieri, M. (2013). PND at 25: Past, present and future trends in summarizing single-subject research. *Remedial and Special Education 34*(1), 9-19.

Schlosser, R., Lee, D. & Wendt, O. (2008). Application of the percentage of non-overlapping data (PND) in the systematic reviews and meta-analyses: A systematic review of reporting characteristics. *Evidence-Based Communication Assessment and Intervention, 2:3*, 163-187.

Schmit, J., Alper, S., Raschke, D. & Ryndak, D. (2000). Effects of using a photographic cueing package during routine school transitions with a child who has autism. *Mental Retardation, 38* (2), 131-137.

Schopler, E., Mesibov, G. & Hearsey, K. (1994). Structured teaching in the TEACCH system, 243- In E. Schopler et al. (Eds), *Learning and Cognition* *in Autism*. Springer Science & Business Media: New York.

Scott, J., Clark, C. & Brady, M. (2000). *Students with autism: characteristics and instruction programming for special educators.* San Diego, CA: Singular Publishing Group.

Sheldon, B. (1995). *Cognitive Behavioural Therapy: Research, practice and philosophy.* London & New York: Routledge.

Sidman, M. (1994). *Equivalence Relations and Behaviour: a Research Story.* Boston, MA, US: Authors Cooperative.

Siegel, L. (1989). IQ is irrelevant to the definition of learning disabilities. *Journal of Learning Disabilities, 22* (8), 469-478. Sage Publications.

Sigafoos, J. (2000). Communication development and aberrant behaviour in children with developmental disabilities. *Education and Training Mental Retardation, 35 (2) 168-176.*

Simon, E., Haas-Givler, B. & Finucane, B. (2014). An introduction to genetic intellectual disability syndromes: basic concepts and applications for applied behaviour analysis professionals. In Griffiths, D., Condillac, R. & Legree, M. (Eds.), *Genetic Syndromes and Applied Behaviour Analysis: A Handbook for ABA Practitioners* (pp.17-38). Jessica Kingsley Publishers, London.

Skinner, B. F. (1957). *Verbal Behaviour.* New York: Appleton-Century-Crofts.

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

Sowers, J., Rusch, F., Connis, R. & Cummings, L. (1980). Teaching mentally retarded adults to time-manage in a vocational setting. *Journal of Applied Behaviour Analysis,13*(1), 119-128.

Sowers, J., Verdi, M., Bourbeau, P. & Sheehan, M. (1985). Teaching job independence and flexibility to mentally retarded students through the use of a self-control package. *Journal of Applied Behaviour Analysis, 18*(1), 81-85.

Spellman, C., DeBriere, T., Jarboe, D., Campbell, S. & Harris, C. (1978). *Pictorial Instructions: Training Daily Living Skills*. Columbus, OH: Merrill.

Soulaga, D., Leaf, J., Taubman, M., McEachin, J. & Leaf, R. (2008). A comparison of flexible prompt fading and constant time delay for five children with autism. *Research in Autism Spectrum Disorders, 2,* *753-765.*

Spriggs, A., Gast, D. & Ayres, K. (2007). Using picture activity schedule books to increase on-schedule and on-task behaviours. *Education and Training in Developmental Disabilities, 2007, 42*(2), 209–223.

Steege, M,. Mace, F., Perry, L. & Longenecker, H. (2007). Applied behaviour analysis: beyond discrete trial teaching. *Wiley Periodicals Inc. Psychology in the Schools*, *44* (1), 91-99.

Stephens, C., Pear, J., Wray, L. & Jackson, G. (1975). Some effects of reinforcement schedule of teaching picture names to retarded children. *Journal of Applied Behaviour Analysis, 8 (4), 435-447.*

Sulzer-Azaroff, B. & Mayer, G. (1991). *Behaviour Analysis for Lasting Change.* Wadsworth Thomson Learning.

Tate, R., McDonald, S., Perdices, M., Togher, L., Schultz, R. & Savage, S. (2008). Rating the methodological quality of single-subject designs and n-of-1trials: introducing the single case experimental design (SCED) scale. *Neuropsychological Rehabilitation, 18:4*, 385-401.

Tate, R., Perdices, M., Rosenkoetter, U., Wakim, D., Godbee, K. & Togher, L. (2013). Revision of a method quality rating scale for single-case experimental designs and N-of-1 trials: The 15-item risk of bias in N-of-1 trials (RoBiNT) Scale. *Neuropsychological Rehabilitation 23(5)*: 619-38.

Thineson P. & Bryan, A. (1981). The use of sequential picture cues in the initiation and maintenance of grooming behaviours with mentally retarded adults. *Mental Retardation, 14*, 246-250.

Thomson, C., Homber, M. & Bower, D. (1974). A brief report on a comparison of time-sampling procedures. *Journal of Behaviour Analysis, 1 (4): 623-626.*

Thurm, A., Lord, C., Lee, L. & Newschaffer, C. (2007). Predictors of language acquisition in preschool children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 37: 1721-1734*.

Van Bercklaer-Onnes (2003). Promoting early play. Sage Publications and The National Autistic Society. Vol. 7(4) 415-423; 0381921362-3613(200312)7:4

Van der Wissel, A. & Zegers, F. (1985). Reading retardation revisited. *British Journal of Developmental Psychology*, 3 (1), 3-9.

Van Houten, R., Bailey, J., Axelrod, S., Favell, J., Foxx, R., Iwata, B. & Lovaas, O. (1988). The right to effective behavioural treatment. *Journal of Applied Behaviour Analysis*, *21*(4), 381-384.

Van Laarhoven, T., Kraus, E., Karpman, K., Nizzi, R. & Valentino, J. (2010). A comparison of picture and video prompts to teach daily living skills to individuals with autism. *Focus on Autism and Other Developmental Disabilities*, *25*(4), 195-208.

Wacker, D. & Berg, W. (1983). Effect of picture prompts on the acquisition of complex vocational tasks by mentally retarded adolescents. *Journal of Applied Behaviour Analysis*, *16* (4) 417- 433.

Wacker, F., Berg, D. & McMahon, C. (1985). Teaching selected microcomputer skills to retarded students via picture prompts. *Journal of Applied Behaviour Analysis.* 1985 Summer; 18(2):179–185.

Wacker, D., Berg, W., Berrie, P. & Swatta, P. (1985). Generalisation and maintenance of complex skills by severely handicapped adolescents following picture prompt training. *Journal of Applied Behaviour Analysis*, *18* (4), 329-336.

Watanabe, M. & Sturmey, P. (2003). The effect of choice-making opportunities during activity schedules on task engagement of adults with autism. *Journal of Autism and Developmental Disorders*, *33*(5), 535-538.

Waters, M., Lerman D. & Hovanetz, A. (2009). Separate and combined effects of visual schedules and extinction plus differential reinforcement on problem behaviour occasioned by transitions. *Journal of Applied Behaviour Analysis*, *42*(2): 309-313.

Watson, J. & McDougall, W. (1928). *The Battle of Behaviorism*. Psyche miniatures, general series no. 19. London: Kegan Paul, Trench, Trubner & Co., Ltd, Broadway House, Carter lane, E. C.

West, E. & Billingsley, F. (2005). Improving the system of least prompts: a comparison of procedural variations. *Education and Training in Developmental Disabilities*, *40*(2), 131-144.

Wheeler, J. & Carter, S. (1998). Using visual cues in the classroom for learners with autism as a method for promoting positive behaviour. *Journal of Special Education*, *21*(3), 64-73.

Wetherby, A. (2006). Understanding and measuring social communications in children with autism spectrum disorders. In Charman, T. & Stone, W. (Eds.) *Social and Communication Development in Autism Spectrum Disorders, 3-35.* Guilford Publications.

White, E., Hoffman, B., Hoch, H. & Taylor, B. (2011). Teaching teamwork to adolescent with autism: the cooperative use of activity schedules. *Behaviour Analysis in Practice*, *4* (1), 27-35.

White, W., Keonig, K. & Scahill, L. (2006). Social skills development in children with autism spectrum disorders: a review of the intervention disorders. *Journal of Autism and Developmental Disorders*, *37*(10), 1858-1868.

Williams, E., Reddy, V. & Costall, A. (2001). Taking a closer look at functional play in children with autism. *Journal of Autism and Developmental Disorders*, *31*(1), 67-77.

White, S., Keonig, K. & Scahill, L. (2007). Social skills development in children with autism spectrum disorders: a review of the intervention research. *Journal of Autism and Developmental Disorders,* 37,1858-1868.

Wilson, P., Reid, D. & Green, C. (2006). Evaluating and increasing in-home leisure activity among adults with severe disabilities in supported independent living. *Research in Developmental Disabilities*, *27*, 95-107.

Witt. J. & Martens, B. (1983). Assessing the acceptability of behavioural interventions used in classrooms. *Psychology in the Schools, 20*(4), 510-517.

Wolf, M. (1978). Social validity: the case for subjective measurement or how applied behaviour analysis is finding its heart. *Journal of Applied Behaviour Analysis, 11*, 203-214

Wong, C. & Kasari, C. (2012). Play and joint attention of children with autism in the preschool special education classroom. *Journal of Autism and Developmental Disorders,* October; 42(10): 2152-2161. Doi: 10.1007/s10803-012-1467-2.

World Health Organisation (1992). *The ICD-10 Classifications of Mental and*

Behavioural Disorder: Clinical Descriptions and Diagnostic Guidelines. Geneva. World Health Organisation.

Wright, R., Brand, R., Dunn, W & Spindler, K. (2007). How to write a systematic review. *Clinical Orthopaedics and Related Research*, 455, 23-29.

Zimmerman, E. (2004). Narrative, interactivity, play and games: four naughty concepts in need of discipline. In Harrigan, P. & Wardrip-Fruin, N. (2004), *First person: New Media as Story, Performance and Game*, 154-163.

Zitelli, D (2007) Literature review: promoting independence: a review of research literature on activity schedules. *Current Dimensions Volume, 3*(2*).* Retrieved June 9th, 2012, from http://www.njaba.org.

Appendix A

Diagnosing Intellectual Disability and Autism Spectrum Disorder

Terms used to describe intellectual impairments vary across English speaking nations and this has the potential to cause confusion. Establishing equivalency of diagnoses is important for making informed choices when planning interventions for specific cohorts of individuals.

This appendix firstly outlines terminology used across the United Kingdom (UK) and the United States of America (USA). Secondly, this information is used along with diagnostic criteria within the DSM-5 (2013) to make an informed estimation regarding the participants in the current study.

Diagnostic Terminology

Definitions for generalised intellectual impairment. Terminology used to describe and measure intellectual disabilities and developmental disorders are complex. With regards to a general impairment of intelligence, the USA terms of *mental retardation* or *intellectual disability* are broadly interchangeable, and refer to a generalised impairment of intelligence. In the UK, the terms *learning difficulty* and *learning disability* are used within education and health and social care services, each with slightly different meanings. Further information can be obtained from the British Institute of Learning Disabilities (BILD) and the National Institute for Health and Care Excellence (NICE|). In summary however, for children in the UK, a generalised impairment of intelligence can be referred to as a *learning disability* when an associated special educational need (SEN) code of *learning difficulty* is also used (Emerson & Heslop, 2010), and is broadly equivalent to the terms used in the US. This information is summarised in Table A1.

Table A.1

Summary of Terminology used in UK and USA

Terms used to describe impairment	**Definitions in the UK**	**Definitions in the USA**	**ICD and DSM terminology**
Learning difficulty	Term used to describe specific learning difficulty that impacts on learning e.g. dyslexia, or difficulties with concentration or behaviour. It is not a significant general impairment in intelligence.	Not used.	Not used.
Special Educational Need (SEN) Codes	Term used to describe generalised intelligence impairment. SEN codes refer to severity of generalised learning difficulty: moderate (MLD), severe (SLD) or profound and multiple learning difficulties (PMLD).	Not used.	Not used.
Learning disability	An individual with a diagnosed specific learning difficulty *and* an educational SEN code can be considered to have a learning disability.	Term used to describe a disorder that impedes the ability to learn or use specific academic skills e.g. dyslexia, or difficulties with concentration or behaviour. It is not a significant general impairment in intelligence.	The DSM-5 refers to *specific learning disabilities* (SLD) that impede ability to learn i.e. a specific disorder that impedes learning such as dyslexia, with the meaning used in the USA.
Mental retardation	Not in current use.	Term used to describe individuals with a general impairment of intelligence. Differences in severity of impairment are referred to as mild, moderate and severe.	In current usage in ICD-10, with the meaning used in the USA.
Intellectual disability	First used in a UK published paper by Mansell (2010) and is becoming interchangeable with the UK term ‘learning disability’.	Is in common usage by US medical and educational professions as well as the lay public and advocacy groups. It is has the same meaning as ‘mental retardation’ and is replacing this term.	Used in the DSM-5 to replace the term *mental retardation.*
Intellectual developmental disorder	Not currently used.	Not currently used.	Term is expected to replace mental retardation in the ICD-11 (due to be published in 2017) and will be equivalent to the DSM-5 term ‘intellectual disability.

Note. ICD terminology is from the World Health Organization ICD publications. DSM terminology is from the American Psychiatric Association DSM publications.

Preferred terminology for generalised intellectual impairment. While there are many terms used to describe a generalised intellectual impairment, the term intellectual disability is in everyday usage within the USA, is growing in usage in English speaking countries (e.g. Australia and Canada) and has begun to be used in the UK (Mansell, 2010). For these reasons, intellectual disability is the preferred term used within this project, however, in subsequent sections and chapters that present a literature review, if referencing a particular article, the specific terms used by the authors are referred to.

Degree of impairment. Degree of generalised impairment is differentiated in both the US and the UK by using prefixes mild, moderate, severe or profound, summarizing how much an individual is affected by their disability, and the degree to which they require support from others.

IQ Scores and Adaptive Functioning Measures

Intelligence quotient (IQ) measurements, as well as adaptive functioning measures, can be used to estimate degree of intellectual impairment. These are described.

IQ scores and degree of impairment. In the UK, the term severe learning difficulties (SLD) is typically defined by an IQ score of less than 50 (BILD, 2010); it includes individuals with both moderate and severe to profound learning disabilities. In contrast, however, in the US, the term severe intellectual disability is used for an individual with an IQ score of less than 35/39, while the profound descriptor is reserved for individuals with an IQ score of below 24/25 (depending on which IQ test provider is used).

The relevance of IQ measurements has been questioned (Fletcher, 1992; Graham & Harris, 2001) and some believe the IQ test to be no longer valid within the field of learning disabilities (Lyon, 1989; Siegel, 1989; Van der Wissel & Zegers, 1985). The British Institute of Learning Disabilities (BILD, 2011) acknowledge the shortcomings of using an IQ based system to measure intelligence as “measurements can vary during a person’s growth and development but more importantly it doesn’t capture the person’s strengths and abilities very well” (p.3-4). Consequently, an IQ measurement is important but "only if it is carried out alongside other assessment and including social functioning and adaptation" (p.4).

Adaptive functioning and degree of impairment. A more meaningful measurement is the diagnostic criteria provided by the DSM-5 (2013), as this summarises the adaptive functioning skills of individuals. As discussed, this emphasises the extent to which impairment impacts on an individual's capacity to function independently and estimates the degree of support an individual will require. Accordingly, the DSM-5 "emphasizes the need to use both clinical assessment and standardized testing of intelligence when diagnosing intellectual disability, with the severity of impairment based on adaptive functioning rather than IQ test scores alone" (APA, 2013, p.1). In particular, IQ measures are considered to be less valid in the lower end of the IQ range (DSM-5), and therefore a consideration of a person's adaptive functioning becomes even more relevant.

Estimating Pupil Impairment

For the pupils in the current study, given the information regarding IQ measurements, their diagnoses of severe to profound learning difficulties, made in the UK, could technically fall into the moderate, severe or profound categories of intellectual disabilities within the USA. In order to estimate some degree of equivalency, statistics on prevalence of severe diagnoses have been considered with information on individual pupil performance; diagnostic measures of adaptive functioning, school progress data, and day-to-day knowledge of pupils. The following conclusions have been made:

1. Reported prevalence rates of severe ID worldwide are consistent with rates of severe LD within the UK. Reported figures for the percentage of individuals with a severe LD diagnosis in England are similar to worldwide figures. According to a government Department of Health report on the prevalence of learning disabilities in England (Emerson, Hatton, Robertson, Roberts, Baines, Ericson & Glover, 2011), an estimated 0.39% of girls and 0.60% of boys aged 7-15 were identified with a primary SEN associated with severe or profound and multiple learning difficulties, representing a combined 0.5%. As having diagnoses of severe to profound learning difficulties is "approximately equivalent to having severe learning disabilities", these results are “consistent with the results of epidemiological studies of the prevalence of learning disabilities in children” (Emerson et al., 2011, p.3). Intellectual disability within the severe range has an approximate overall general population prevalence of 0.6% (DSM-5, 2013); therefore UK figures for severe learning difficulties are broadly equivalent to worldwide figures of a severe intellectual disabilities.

2. Pupils demonstrate characteristics consistent with ID and ASD severe diagnoses (DSM-5, 2013). All pupils in the study, when considered against the criteria for ID within the DSM-5, demonstrate characteristics consistent with a severe to profound diagnosis within each of the three domains. All pupils also demonstrate deficits in social communication and restricted, repetitive behaviours consistent with a level 3 diagnosis of ASD. Each pupil required very substantial support within the home and school environments.

3. Pupil lack of progress indicates a severe ID diagnosis. In addition, for each pupil, over the previous two years, there had been a lack of progress within the core areas of the national curriculum (NC), as demonstrated by the school’s progress data. The pupils had been selected for their class, and to participate in this study, on this basis having been identified by the Head of Education, from across all ages of the school, as having made the least demonstrable progress. This lack of progress constituted a severe educational need and was indicative of a severe to profound ID diagnosis (DSM-5, 2013).

Summary and Conclusion

In summary, the pupils in the current study, while diagnosed with severe learning difficulties, demonstrate deficits consistent with severe to profound intellectual disabilities. Furthermore, while each was diagnosed with ASD or “autistic-like characteristics”, they each demonstrated impairments consistent with a level 3, or most severe, diagnosis. To conclude, there is some parity between the pupils in the current study and pupils within the USA diagnosed with ID and ASD within the severe range. Therefore, interventions that have proven to be affective for individuals with severe ID and/or ASD within the USA might be affective for the pupils in the present study.

Appendix B

Search Criteria from Reviews of Activity Schedule Studies

Year	2004	2007	2008	2011	2012	2015
Authors	Bopp, Brown and Mirenda	Zitelli	Banda & Grimmett	Koyama & Yang	Lequia et al	Knight et al
Search time frame	1993-2000	1979-2002	1993-2004	1993-2008	1990-2010	1993-Oct 2013
Used search terms	Not specified	Not specified	Autism, Asperger, activity schedule, picture schedule, photographic schedule	Activity schedule, visual schedule, picture schedule	Autism + Self management, activity schedules, visual schedules, visual prompts, visual cues, visual supports, challenging behaviour, picture prompts	Visual schedule, picture activity schedules, schedule, picture prompts, visual cues, work system + autism, PDD, Aspergers, ASD
Used search engines	Not specified	Not specified	ERIC, PsycInfo	PsycInfo, Google scholar	ERIC, Medline, PsychInfo Google scholar	PsycInfo, ERIC, Academic File Premier, Master File Premier
Definition of A/S	“An intervention that depicts the sequence of activities, steps, or rules that applies to specific individuals and routines. The primary purpose of a visual schedule is to provide the individual with a way to predict or understand upcoming events”(p.14)	“Sequential visual representations of a set of activities or tasks”	“A string of photographs, images or drawings of daily routines that are sequentially arranged on a display (e.g. wall, computer, folder, desk) for the targeted student to follow” (p.325)	An “instructional strategy to promote independent behaviour and curtail prompt dependency” … “a visual support strategy that uses visual cues such as photographs and written words and teaches a learner to follow a sequence of tasks or	“A sequence of visual supports (e.g. photographs, line drawings) indicating an order of activities to be completed”p.482	Visual activity schedule (VAS) are “any sequence of visual cues (e.g. pictures, written words, objects) used with a student, including work systems with visual prompts for instruction of chained tasks” p.159

				activities independently" (p.2236)		
Inclusion criteria	Not specified other than as a summary of research in this area.	Not specified. Article is a more general discussion. Participant and other details of studies were not tabulated as in other reviews.	4 criteria: a) individuals with autism b) involved some form of activity or picture schedule as intervention c) study was data based d) published in peer-reviewed journal	6 criteria: a) from peer-reviewed journals b) experimental studies c) implement A/S as primary intervention or in combination with other strategies d) use A/S to represent multiple activities e) aim to teach learner to self-manage f) participants were not familiar with A/S	3 criteria: a) included at least 1x 3-18 yr old with ASD diagnosis (autism Asperger's autistic-like characteristics, PDD-NOS), b) published in peer reviewed journal 1990-2010 c) implemented A/S to decrease challenging behaviour	4 criteria: a) used a single case research or group design b) included at least one with ASD diagnosis using DSM-IV or DSM-V C) investigated effects of VAS on specific dependent variable by students with autism d) published in peer-reviewed journal in English prior to 2013
A/S studies preclude	Not specified	Not specified	Not explicitly specified. Studies that did not meet the inclusion criteria.	Studies were not included "if pictures were merely presented to learners as a means to increase behaviour compliance." "Studies that used multiple picture cues to represent tasks within a single activity such as cooking were excluded" p. 2236	Not explicitly specified. Studies that did not meet inclusion criteria.	No articles were found that used a group design. Any studies that did not meet the acceptability rating of Horner et al (2005) were not included
Format of A/S	Photos, line drawings	Photos, written, computer based	Computer based, video, photos, line drawings	Multimedia computer supports, photos	Photographs, line drawings, videos	Photos, line drawings, iPod, computer, video
Reason for review	To summaries research into the use of visual schedules and to provide	To review A/S a) used to increase independence, decrease	To evaluate studies that used A/S to improve social interaction	To derive implications on a) populations for whom A/S could be	To evaluate effects of A/S on challenging behaviour	Used Banda & Grimmett's search up to 2008, also looked at

	suggestions for the roles that speech-language pathologists can play in designing, implementing and assessing interventions	problem behaviour, promote skill acquisition b) embedding choice into A/S c) incorporating self – management into A/S	skills, transition skills and decrease problem behaviours	effective b) symbol types, activities and settings that could be incorporated in the A/S c) major behaviour changes as a result of A/S	Self regulation, independence, transition, play	Lequia et al.'s search then extended it to 2013
Participants	Individuals with ASD diagnoses Participants in included studies ranged from 29 months to 17 years	Individuals diagnosed with autism or developmental disabilities	Only pupils with ASD diagnoses Participants included ranged from 3yr to 40 yr		Included at least 1 participant with ASD diagnosed with DSM-IV, TR or DSM-V criteria (autism, PDD, PDD-NOS, Asperger's)	Included at least 1 participant with ASD diagnosed with DSM-IV, TR or DSM-V criteria (autism, PDD, PDD-NOS, Asperger's)
Number of studies	11	Not specified, but 21 cited	13	23	18	31 considered, 16 included
Number of participants	26	Not specified	31		43	56
Diagnoses of participants, and if SLD	ASD, PDD Asperger syndrome, Levels of LD not specified except in Newman et al (1995): 4 individuals with autism and moderate mental retardation	Not specified	All with ASD	2 "Severe intellectual disabilities" Anderson et al 1997, Wheeler & Carter 1998	4 studies with "severe ASD": Cihak 2011, Machalicek et al 2009, O'Reilly et al 2005, Pierce & Schreibman 1994	2 "with severe ASD", Hume & Odom 2007
Number of participants with severe diagnoses	Not specified	Not specified	Not specified	2	9	2

Appendix C:
All Activity Schedule Studies Correlated with Reviews

Date	Author/s and Title	Reviews
1993	Krantz, P., MacDuff, L. & McClannahan, L. Programming participation in family activities for children with autism: parents' use of photographic activity schedules.	2004 2007 2008 2011 2012 2015
1993	MacDuff, G., Krantz, P. & McClannahan, L. Teaching children with autism to use photographic activity schedules: maintenance and generalisation of complex response chains	2004 2007 2008 2011 2012 2015
1994	Flannery, K. & Horner, R. The relationship between predictability and problem behaviour for students with severe disabilities	2004 2007 2008 2011 2012 2015
1994	Dunlap, G., DePerczel, M., Clarke, S., Wilson, D., Wright, R. Choice making to promote adaptive behaviour for students with emotional and behavioural challenges	2004 2007 2008 2011 2012 2015
1994	Pierce, K. and Schreibman, L. Teaching daily living skills to children with autism in unsupervised settings through pictorial self-management	2004 2007 2008 2011 2012 2015
1994	Lalli, J., Casey, S., Goh, H. and Merlino, J. Treatment of Escape-Maintained Aberrant Behaviour with Escape Extinction and Predictable Routines	2004 2007 2008 2011 2012 2015
1995	Newman, B. Buffington, D., O'Grady, M., McDonald, M., Poulson, C. & Hemmes, N. Self management of schedule following in three teenagers with autism	2004 2007 2008 2011 2012 2015
1995	Hall, L, McClannahan & Krantz, P. Promoting independence in integrated classrooms by teaching aides to use activity schedules and decreased prompts.	2004 2007 2008 2011 2012 2015
1997	Anderson, M., Sherman, J., Sheldon, J & McAdam, D. Picture Activity Schedules and Engagement of Adults with Mental Retardation in a Group Home	2004 2007 2008 2011 2012 2015
1998	Krantz, P. and McClannahan, L. Social Interaction Skills for Children with Autism: a script fading procedure for beginning readers	2004 2007 2008 2011 2012 2015
1998	Wheeler, J. & Carter, S. Using visual cues in the classroom for learners with autism as a method for promoting positive behaviour	2004 2007 2008 2011 2012 2015
1999	Clarke, S., Dunlap, G. & Vaughn, B. Family-centred, assessment-based intervention to improve behaviour during an early morning routine	2004 2007 2008 2011 2012 2015

1999	Dunlap, G. & Fox, L. A demonstration of behavioural support for young children with autism	2004 2008 2007 2011 2012 2015
2000	Browder, D & Minavorik, T. Utilizing sight words in self-instruction training for employees with moderate mental retardation in competitive jobs	2004 2007 2008 2011 2012 2015
2000	Dettmer, S., Simpson, R., Smith Myles, B & Ganz The use of visual supports to facilitate transitions of student with autism	2004 2007 2008 2011 2012 2015
2000	Massey, N. & Wheeler, J. Acquisition and generalisation of activity schedules and their effects on task engagement in a young child with autism in an inclusive pre-school classroom	2004 2007 2008 2011 2012 2015
2000	Schmit, J., Alper, S., Raschke, D. and Ryndak, D. Effects of using a photographic cueing package during routine school transitions with a child who has autism	2004 2007 2008 2011 2012 2015
2000	Bryan, L and Gast, D. Teaching On-Task and On-Schedule Behaviours to High-Functioning Children with Autism via Picture Activity Schedules	2004 2007 2008 2011 2012 2015
2001	Bevill, A., Gast, D., Maguire, A., & Vail, C. Increasing engagement of preschoolers with disabilities through correspondence training and picture cues	2004 2007 2008 2011 2012 2015
2001	Dooley, P., Wilczenski, F., Torem, C. Using an activity schedule to smooth school transitions	2004 2007 2008 2011 2012 2015
2002	Morrison, M., Sainato, D, Benchaaban, D. and Endo, S. Increasing play skills of children with autism using activity schedules and correspondence training	2004 2007 2008 2011 2012 2015
2003	Mari Watanabe and Peter Sturmey The effect of choice-making opportunities during activity schedules on task engagement of adults with autism	2004 2007 2008 2011 2012 2015
2004	Dauphin, M., Kinney, E. and Stromer, R Using video-enhanced activity schedules and matrix training to teach sociodramatic play to a child with autism	2004 2007 2008 2011 2012 2015
2004	Buschbacher, P., Fox, L. & Clarke, S. Recapturing desired family routines: a parent-professional behavioural collaboration	2004 2007 2008 2011 2012 2015
2004	Kimball,J., Kinney, E., Taylor, B., & Stromer, R., Video enhanced activity schedules for children with autism: a promising package for teaching social skills.	2004 2007 2008 2011 2012 2015
2005	O'Reilly, M., Sigafoos, J;, Lancioni, G., Edrisinha, C. and Andrews, A. An examination of the effects of a classroom activity schedule on levels of self-injury and engagement for a child with severe autism	2004 2007 2008 2011 2012 2015

2006	Wilson,P.,Reid, D., and Green, C. Evaluating and increasing in-home leisure activity among adults with severe disabilities in supported independent living	2004 2007 2008 2011 2012 2015
2007	Hume, K. & Odom, S. Effects of an individual work system on the independent functioning of students with autism	2004 2007 2008 2011 2012 2015
2007	Spriggs, A., Gast, D. and Ayres, K. Using picture activity schedule books to increase on-schedule and on-task behaviours	2004 2007 2008 2011 2012 2015
2008	Carson, Gast & Ayres Effects of a photograph activity schedule book on independent task changes by students with intellectual disabilities in community and school job sites	2004 2007 2008 2011 2012 2015
2008	Betz, A., Higbee, T. and Reagon, K. Using Joint Activity Schedules to Promote Peer Engagement in Preschoolers with Autism	2004 2007 2008 2011 2012 2015
2008	Mechling, L. & Gustafson, M. Comparison of static picture and video prompting on the performance of cooking related tasks by students with autism	2004 2007 2008 2011 2012 2015
2009	Mechling, L., Gast, D. & Seid, N. Using a personal digital assistant to increase independent task completion by students with autism spectrum disorder	2004 2007 2008 2011 2012 2015
2009	Waters, M., Lerman, D. and Hovanetz, A. Separate and combined effects of visual schedules and extinction plus differential reinforcement on problem behaviour occasioned by transitions	2004 2007 2008 2011 2012 2015
2009	Machalicek, W., Shogren, K., Lang, R., Rispoli, M., O'Reilly, M., Detlinger Franco, J. & Sigafoos, J. Increasing play and decreasing the challenging behaviour of children with autism during recess with activity schedules and task correspondence training	2004 2007 2008 2011 2012 2015
2010	Blum-Dimaya, A., Reeve, S. & Reeve, K. & Hoch, H. Teaching children with autism to play a video game using activity schedules and game embedded simultaneous video modelling.	2004 2007 2008 2011 2012 2015
2010	Van Laarhoven, T., Kraus, E., Karpman, K., Nizzi, R. & Valentino, J. A comparison of picture and video prompts to teach daily living skills to individuals with autism	2004 2007 2008 2011 2012 2015
2011	Cihak, D. Comparing pictorial and video modelling activity schedules during transitions for students with autism spectrum disorders	2004 2007 2008 2011 2012 2015

2011	Cuhadar, S. & Diken, A. Effectiveness of instruction performed through activity schedules on leisure skills of children with autism	2004 2007 2008 2011 2012 2015
2012	Duttlinger, C, Ayres, K. Bevill-Davis, A. & Douglas, K. The effects of a picture activity schedule for students with intellectual disability to complete a sequence of tasks following verbal directions	2004 2007 2008 2011 2012 2015
2013	Pierce, J., Spriggs, A., Gast, D. & Luscre, D. Effects of Visual Activity Schedules on Independent Classroom Transitions for Students with Autism	2004 2007 2008 2011 2012 2015
2013	Carlile, K., Reeve, S. Reeve, K. & DeBar, R. Using activity schedules on the iPod touch to teach leisure skills to children with autism.	2004 2007 2008 2011 2012 2015

Appendix D

Single Case Experimental Design (SCED) Rating Scale

Rating Scale for Single Participant Designs

For each item, please justify scoring (for both "yes" and "no" responses), by at least mentioning page and paragraph numbers in the field underneath the tick boxes.

Item	Rater 1: yes	Rater 1: no	Rater 2: yes	Rater 2: no	Consensus: yes	Consensus: no
1. Clinical history was specified. *Must include Age, Sex, Aetiology and Severity.*	☐	☐ specify page & paragraph	☐	☐ specify page & paragraph	☐	☐ specify page & paragraph
2. Target behaviours. Precise and repeatable measures that are operationally defined. *Specify measure of target behaviour.*	☐	☐	☐	☐	☐	☐
3. Design 1: 3 phases. Study must be either A-B-A or multiple baseline	☐	☐	☐	☐	☐	☐
4. Design 2: Baseline (pre-treatment phase). Sufficient sampling was conducted	☐	☐	☐	☐	☐	☐
5. Design 3: Treatment phase. Sufficient sampling was conducted	☐	☐	☐	☐	☐	☐
6. Design 4: Data record. Raw data points were reported	☐	☐	☐	☐	☐	☐
7. Observer bias: Inter-rater reliability was established for at least one measure of target behaviour	☐	☐	☐	☐	☐	☐
8. Independence of assessors	☐	☐	☐	☐	☐	☐
9. Statistical analysis	☐	☐	☐	☐	☐	☐
10. Replication: *either* across subjects, therapists or settings	☐	☐	☐	☐	☐	☐
11. Evidence for generalisation	☐	☐	☐	☐	☐	☐

Single Case Experimental Design (SCED), Scale Tate, McDonald, Perdices, Togher, Schultz & Savage, 2008

Appendix E

Results of Single Case Experimental Design (SCED) Rating Scale

	SCED Indicators											
Articles	1. Clinical history	2. Target behaviours	3. Design 1: phases	4. Design 2: baseline	5. Design 3: treatment	6. Design 4: data record	7. Observer bias	8. Assessor independence	9. Statistical analyses	10.Replication	11. Generalisation	Total indicators met
1993 MacDuff et al.	/	/	/	/	/	/	/	x	x	/	Y	8
1993 Krantz & McClannahan	/	/	/	/	/	/	/	x	x	/	Y	8
1993 Krantz et al.	/	/	/	/	/	/	/	x	x	/	N	8
1994 Dunlap et al.	x	/	/	x	/	/	/	x	x	/	N	6
1994 Flannery & Horner	/	/	/	x	/	/	/	x	x	x	N	6
1994 Lalli et al.	/	/	x	/	/	/	/	x	x	/	N	7
1994 Pierce & Schreibman	/	/	/	/	/	/	/	x	x	/	Y	8
1995 Hall et al.	/	/	/	/	/	/	/	/	x	/	N	9
1995 Newman et al.	x	/	/	/	/	/	/	x	x	/	N	7
1997 Anderson et al.	/	/	/	x	/	/	/	x	x	/	N	7
1998 Krantz & McClannahan	/	/	/	/	/	/	/	x	x	/	Y	8
1998 Wheeler & Carter	/	/	x	/	/	/	x	x	x	x	N	5
1999 Clarke et al.	/	/	/	/	/	/	/	/	x	x	N	8
1999 Dunlap & Fox	x	/	x	x	/	/	/	x	x	/	N	5
2000 Browder & Minarovik	/	/	/	/	x	/	/	x	x	/	N	7
2000 Bryan & Gast	x	/	/	/	/	/	/	x	x	/	Y	7
2000 Dettmer et al.	/	/	/	/	/	/	/	x	x	/	N	8
2000 Massey & Wheeler	x	/	/	/	/	/	/	x	x	/	Y	7
2000 Schmit et al.	/	/	/	/	/	/	x	x	x	/	N	7
2001 Bevill et al.	/	/	/	/	/	/	/	x	x	x	N	7
2001 Dooley et al.	x	x	x	x	/	/	x	x	x	x	N	2
2002 Morrison et al.	/	/	/	/	/	/	/	/	x	/	Y	9
2003 Watanabe & Sturmey	/	/	/	/	/	/	/	x	x	/	N	8

2003 Kimball et al.	x	x	x	x	x	x	x	x	x	/	N	1
2004 Dauphin et al.	x	/	x	x	/	/	/	x	x	x	Y	4
2004 Buschbacker et al.	/	/	/	/	/	/	/	x	x	x	N	7
2005 O'Reilly et al.	/	/	/	x	x	/	/	x	x	x	N	5
2006 Wilson et al.	/	/	/	/	x	/	x	x	x	/	N	5
2007 Hume & Odom	/	/	/	/	/	/	/	/	x	/	N	9
2007 Spriggs et al.	/	/	/	x	/	/	/	x	x	/	Y	7
2008 Carson et al.	x	/	/	/	/	/	/	x	x	/	Y	7
2008 Betz et al.	x	/	/	/	/	/	/	x	x	/	Y	7
2008 Mechling & Gustafson	/	/	/	/	/	/	/	x	x	/	N	8
2009 Machalicek et al.	/	/	/	x	/	/	/	x	x	/	N	6
2009 Miguel et al.	x	/	/	x	/	/	/	x	x	/	Y	6
2009 Mechling et al.	/	/	/	/	x	/	/	x	x	/	N	7
2009 Miguel et al.	x	/	/	x	/	/	/	x	x	/	Y	6
2009 Waters et al.	x	/	x	/	/	/	/	x	x	/	N	6
2010 Blum-Dimaya et al.	x	/	/	/	/	/	/	x	x	/	Y	7
2010 Mechling & Savidge	/	/	/	x	/	/	/	x	x	/	N	7
2010 Van Laarhoven et al.	/	/	/	x	/	/	/	x	/	/	Y	8
2011 Cihak	x	/	x	/	/	/	/	x	x	/	N	6
2011 Cuhadar & Diken	/	/	/	/	/	/	/	x	x	/	Y	8
2011 White et al.	/	/	/	/	x	/	/	x	x	/	N	7
2012 Duttlinger et al.	/	/	/	x	/	/	/	x	x	/	Y	7
2013 Carlile et al.	x	/	/	/	/	/	/	x	x	/	Y	7
2013 Liu & Breslin	x	/	x	x	x	x	x	x	/	/	N	3
2013 Pierce et al.	/	/	/	x	/	/	/	x	x	/	Y	7
2013 Raver et al.	/	/	/	x	x	/	/	x	/	/	N	7
2014 Brodhead et al.	x	/	/	/	/	/	x	x	x	/	Y	6

Appendix F

Percentage of Non-Overlapping Data (PND) Scores

			Effectiveness Score					
Study	Participant	PND %	High 3	Mod 2	Min 1	Not 0	Mean PND %	Mean Score
1993 MacDuff et al.	1	100	√				100%	3
	2	100	√					
	3	100	√					
	4	100	√					
1993 Krantz & McClannahan	1	100	√				97%	3
	2	100	√					
	3	100	√					
	4	89		√				
1993 Krantz et al.	1	100	√				100%	3
	2	100	√					
	3	100	√					
1994 Dunlap et al.	1	100	√				89%	2
	2	67			√			
	3	100	√					
1994 Flannery & Horner	1	36				√	44%	1
	2	52			√			
1994 Lalli et al.	1	100	√				93%	3
	2	80		√				
	3	100	√					
1994 Pierce & Schreibman	1	100	√				100%	3
	2	100	√					
	3	100	√					
1995 Hall et al.	1	100	√				96%	3
	2	100	√					
	3	88		√				
1995 Newman et al.	1	97	√				78%	2
	2	90		√				
	3	50			√			
1997 Anderson et al.	1	100	√				96%	3
	2	100	√					
	3	89		√				
1998 Krantz &McClannahan	1	100	√				100%	3
	2	100	√					

	3	100	√					
1998 Wheeler & Carter	1	100	√				100%	3
1999 Clarke et al.	1	100	√				100%	3
1999 Dunlap & Fox	1	100	√				99%	3
	2	95	√					
	3	100	√					
	4	96	√					
	5	100	√					
	6	100	√					
2000 Browder & Minarovik	1	100	√				100%	3
	2	100	√					
2000 Bryan & Gast	1	100	√				100%	3
	2	100	√					
	3	100	√					
	4	100	√					
2000 Dettmer et al.	1	100	√				100%	3
	2	100	√					
2000 Massey & Wheeler	1	100	√				100%	3
2000 Schmit et al.	1	65			√		65%	1
2001 Bevill et al.	1	0				√	0%	0
	2	0				√		
	3	0				√		
	4	0				√		
2001 Dooley et al.	1	100	√				100%	3
2002 Morrison et al.	1	100				√	100%	3
	2	100				√		
	3	100				√		
	4	100				√		
2003 Watanabe & Sturmey	1	57			√		40%	0
	2	63			√			
	3	0				√		
2003 Kimball et al.	1	x	x	x	x	x	x	x
2004 Dauphin et al.	1	x	x	x	x	x	x	x
2004 Buschbacker et al.	1	87		√			55%	1
	2	78		√				
	3	0				√		
2005 O’Reilly et al.	1	67			√		67%	1
2006 Wilson et al.	1	100	√				100%	3
	2	100	√					
	3	100	√					

2007 Hume & Odom	1	50			√		83%	2
	2	100	√					
	3	100	√					
2007 Spriggs et al.	1	100	√				100%	3
	2	100	√					
	3	100	√					
	4	100	√					
2008 Carson et al.	1	100	√				67%	1
	2	0				√		
	3	100	√					
2008 Betz et al.	1	100	√				97%	3
	2	100	√					
	3	91	√					
2008 Mechling & Gustafson	1	100	√				100%	3
	2	100	√					
	3	100	√					
	4	100	√					
	5	100	√					
	6	100	√					
2009 Machalicek et al.	1	92	√				95%	3
	2	100	√					
	3	90		√				
2009 Miguel et al.	1	100	√				100%	3
	2	100	√					
2009 Mechling et al.	1	100	√				100%	3
	2	100	√					
	3	100	√					
2009 Miguel et al.	1	100	√				100%	3
	2	100	√					
2009 Waters et al.	1	100	√				93%	3
	2	86		√				
2010 Blum-Dimaya et al.	1	100	√				100%	3
	2	100	√					
	3	100	√					
	4	100	√					
2010 Mechling & Savidge	1	100	√				85%	2
	2	100	√					
	3	56			√			
2010 Van Laarhoven et al.	1	100	√				100%	3
	2	100	√					
2011 Cihak	1	94	√				92%	3

	2	84		√				
	3	100	√					
	4	88		√				
2011 Cuhadar & Diken	1	100	√				100%	3
	2	100	√					
	3	100	√					
2011 White et al.	1	100	√				70%	1
	2	20				√		
	3	0				√		
	4	100	√					
	5	100	√					
	6	100	√					
2012 Duttlinger et al.	1	75		√			88%	2
	2	75		√				
	3	100	√					
	4	100	√					
2013 Carlile et al.	1	100	√				100%	3
	2	100	√					
	3	100	√					
	4	100	√					
2013 Liu & Breslin	1	x	x	x	x	x	x	x
2013 Pierce et al.	1	100	√				99%	3
	2	100	√					
	3	100	√					
	4	95	√					
2013 Raver et al.	1	29				√	12%	0
	2	18				√		
	3	0				√		
	4	0				√		
2014 Brodhead et al.	1	100	√				100%	3
	2	100	√					
	3	100	√					
	4	100	√					
	5	100	√					
	6	100	√					

Percentage of Non-overlapping Data (PND), Scruggs, Mastropieri & Casto (1987)

Note. Highly effective score = 91%-100%, moderately effective score =7 1%- 90%, minimally effective score = 50%-70%, not effective score = below 50%

Appendix G

PND Scores for Participants with Severe Diagnoses

Activity Schedule Studies	Total Participants	Participants with SLD	ASD or ID	PND Score
AS Studies				
1994 Flannery & Horner	2	1	ID	36
1994 Pierce & Schreibman	3	1	ID	100
1997 Anderson et al.	3	2	ID	100
			ID	89
1998 Wheeler & Carter	1	1	ID	100
2002 Morrison et al.	4	4	ASD	100
			ASD	100
			ASD	100
			ASD	100
2005 O'Reilly et al.	1	1	ASD	67
2006 Wilson et al.	3	3	ID	100
			ID	100
			ID	100
2007 Hume & Odom	3	1	ASD	50
2009 Machalicek et al.	3	1	ASD	100
2011 Cihak	4	4	ASD	94
	n=28	*n*=19	ASD	84
			ASD	100
			ASD	88
PCDI-AS Studies				
1993 MacDuff et al.	4	4	ID	100
			ID	100
			ID	100
			ID	100
1993 Krantz & McClannahan	4	4	ASD	100
			ASD	100
			ASD	100
			ASD	89
	n=8	*n*=8		

Appendix H

Participant IQs and Diagnoses

Study Year and Authors	Participants & Age	IQ Score if known	Diagnoses	Severe Diagnoses
1993 MacDuff, Krantz & McClannahan	male 9 male 9 male 11 male 14	-	Autism	Y Severe ID
1993 Krantz, P. & McClannahan, L.	female 12 male 12 male 12 male 9	49 49 46 48	Autism (DSM-III-R)	Y – severe ASD
1993 Krantz, P., MacDuff, L. & McClannahan, L.	male 8 male 6 male 7	-	Autism	N
1994 Dunlap, G., DePerczel. M., Clarke, S., Wilson, D. & Wright, R.	male 11 male 11	-	Both described as emotionally handicapped and had ADHD diagnoses	N
1994 Flannery, K. & Horner, R.	male 14 male 17	-	ASD and severe disabilities, ASD and moderate disabilities	Y 1 with severe ID diagnosis
1994 Lalli, J., Casey, S., Goh, H. and Merlino, J.	male 18 male 18	-	Both diagnosed with mild mental retardation	N
1994 Pierce, K. and Schreibman, L.	male 8 male 9 male 9	Not testable 43 (SB) 48 (SB)	All diagnosed with autism and were “moderately to severely retarded with developmental disabilities”	Y 1 pupil with severe ID diagnosis
1995 Hall, L., McClannahan, L. & Krantz, P.	male 8 male 8 male 7	-	Intellectual disability, ataxia, hyperactivity Fragile X syndrome autism	N
1995 Newman, B., Buffington, D., O’Grady, M., McDonald, M., Poulson, C. & Hemmes, N.	male 14 female 16 male 17	-	All diagnosed with autism and mild ID	N
1997 Anderson, M., Sherman, J., Sheldon, J & McAdam, D.	female 22 male 21 female 37	-	Moderate mental retardation, seizure disorders. Severe mental retardation. Severe mental retardation, seizure disorders.	Y 2 with severe ID diagnoses
1998 Krantz, P. and McClannahan, L.	male 5 male 4 male 4	62 (SB) 42 (SB) 36 (SB)	Autism	N

1998 Wheeler, J. & Carter, S.	male 6	36 (WISC)	Autism and severe ID	Y 1 with severe ID diagnosis
1999 Clarke, S., Dunlap, G. & Vaughn, B.	male 10	-	Asperger's syndrome	N
1999 Dunlap, G. & Fox, L.	male 29m male 32m male 37m male 44m male 29m male 33m	-	ASD or pervasive developmental disorder not otherwise specified (PDD-NOS)	N
2000 Browder, D. & Minavorik, T	male 27 male 30 male 31	-	mild mental retardation moderate MR mild MR	N
2000 Bryan, L and Gast, D.	male 8 male 8 male 7 female 8	-	Autism	N
2000 Dettmer, S., Simpson, R. Myles, B. and Ganz, J.	male 7 male 5	-	Autism	N
2000 Massey, N & Wheeler, J	male 4	-	Autism	N
2000 Schmit, J., Alper, S., Raschke, D. and Ryndak, D.	male 6	-	Autism and "high levels of lead in his blood system"	N
2001 Bevill, A., Gast, D., Maguire, A. & Vail, C.	female 5 male 5 male 4 female 5 male 4	-	All diagnosed with mild developmental delays, 1 with autism diagnosis	N
2001 Dooley, P., Wilczenski, F., Torem, C.	male 3	-	Pervasive developmental disorder	N
2002 Morrison, M., Sainato, D, Benchaaban, D. and Endo, S.	male 58 m female 63m male 42 m female 70 m	-	All diagnosed with moderate to severe rating of autism	Y 4 with moderate to severe ASD diagnoses
2003 Watanabe, M. & Sturmey, P.	male 22 male 40 male 30	-	Autism and developmental and behavioural disorders	N
2003 Kimball, J., Kinney, E., Taylor, B & Stromer, R.	male 3 female 6	-	Autism PDD-NOS	N
2004 Dauphin, M., Kinney, E. &	male 3	-	Autism and ADHD	N

Stromer, R.				
2004 Buschbacher, P., Fox, L. & Clarke, S.	male 7	-	Landau Kleffner syndrome and autistic-like characteristics	N
2005 O'Reilly, M., Sigafoos, J;, Lancioni, G., Edrisinha, C. and Andrews, A.	male 12	-	ID and severe autism	Y 1 with severe ASD diagnosis
2006 Wilson, P., Reid, D. & Green, C.	male 25 male 37 male 29	-	All diagnosed with severe intellectual disabilities	Y
2007 Hume, K. & Odom, S. .	male 20 male 6 female 7	64 - -	All diagnosed with moderate disabilities, 1 diagnosed with severe ASD	Y 1 with severe ASD diagnosis
2007 Spriggs, A., Gast, D. and Ayres, K.	female 13 female 13 female 12 female 13	54-60 43-60 46-58 40-46 (WISC/SB)	Moderate intellectual disabilities ADHD - Williams syndrome	N
2008 Carson, Gast & Ayres	male 18 male 20 female 20	47, - 56, 36 - 71 57 - 44 (SB/KB)	Moderate ID ADHD Mod ID Mild ID	N
2008 Betz, A., Higbee, T. and Reagon, K.	5 male, 1 female 4-5 years	-	Autism	N
2008 Mechling, L. & Gustavson, M.	female 20 female 22 male 21 female 19 male 22	46 (KB) 53 (SB) 54 (SB) 52 (KB) 40 (WISC)	Mod ID, ASD Mod ID Mod ID Mod ID Mod ID Mod ID, ASD	N
2009 Machalicek, W., Shogren, K., Lang, R., Rispoli, M., O'Reilly, M., Detlinger Franco, J. & Sigafoos, J.	male 6 male 12 male 7	-	2 with moderate ASD diagnosis, 1 severe	Y 1 with severe ASD diagnosis
2009 Mechling, L., Gast, D. & Seid, N.	male 17 male 16 male 17	51 (WISC) 75 (WISC) 40 (WISC)	Autism - mild to moderate	N
2009 Miguel, C., Yang, H., Finn, H& Ahearn, W.	male 6 male 6	-	Autism	N
2009 Waters, M., Lerman, D. and Hovanetz, A.	male 6 male 6	-	Autism	N
2010 Blum-Dimaya, A., Reeve, Reeve,	female 11 male 11	-	Autism	N

K. & Hoch, H.	male 12 male 9			
2010 Mechling, L. & Savidge, E.	male 14 female 14 male 14	45 (WISC) 47 (WISC) 54 (WISC)	Autism	N
2010 Van Laarhoven, T., Kraus, E., Karpman, K., Nizzi, R. & Valentino, J.	male 13 male 14	39 (SB) 65 (KB)	Autism	N
2011 Cihak, D.	male 13 female 11 male 12 male 13	-	All assessed with severe autism	Y 4 with severe ASD diagnoses
2011 Cuhadar, S. & Diken, A.	male 6 male 5 male 4	-	Autism	N
2011 White, E., Hoffman, B. Hoch, H. & Taylor, B.	male 19 made 19 male 16 male 17 male 17 male 16	-	Autism	N
2012 Duttlinger, C, Ayres, K. Bevill-Davis, A. & Douglas, K.	female 13 female 13 male 14 male 13	70 (DAS) 53 (SB) 53 (SB) 67 (DAS)	Mild ID ASD/mild ID Mild ID Mild ID	N
2013 Carlile, K., Reeve, S. Reeve, K. & DeBar, R.	4 children aged 8-12	-	All had autism diagnoses	N
2013 Liu, T. & Breslin, C.	25 children (20 boys, 5 girls) aged 3-16	-	10=ASD, 6=PDD, 9 =Asperger's Syndrome	N
2013 Pierce, J., Spriggs, A., Gast, D. & Luscre, D.	male 11 male 9 male 10 male 10	-	All with moderate autism diagnoses	N
2013 Raver, S. Hester, P., Machalicek, A., Cho, D. & Anthony, N.	female 4.6 male 4.4 male 4.0 male 2.5	-	All had delayed receptive language skills and were deaf and had received cochlear implants	N
2014 Brodhead, M., Higbee, T., Pollard, J., Akers, J. & Gerencser, K.	male 5 female 5 male 5 female 5 male 3 female 4	-	Autism	N

Appendix I

Research Governance Framework Form

SCREENING FORM FOR ETHICS SUBMISSION

Research title: A Study into how Activity Schedules can be used to Develop Independence Skills and Accelerate Learning in Pupils with Severe Learning Difficulties

Status: (Please circle) Undergraduate/ Postgraduate/Staff

Researcher: Sarah Hedley Dray

Supervisor (for UG/PG students): Dr Mecca Chiesa and Prof. Robert Johnston

1	Is this research going to be subject to NHS Local Research Ethics Committee approval?	Yes No (no need to answer any further questions)
2	Does the research gather information from: • Children (under 16 years)? • Vulnerable adults such as individuals with mental health problems, learning disabilities, prisoners, young offenders, elderly people with dementia • Staff • Carers	 Yes No Yes No Yes No
3	Does the research involve the use of materials or questions that could upset or offend participants? (e.g. asking people to talk about difficult life events)	Yes No

☐ I have answered NO to all the above categories (from q's 1 -3) and do not consider that this project needs to be submitted for more detailed ethical review.

☐ I have answered YES to at least one of the categories and am submitting an application for departmental ethics approval.

If you have answered YES, please complete the Tizard Ethics Checklist on T drive under Info-Ethics and refer to the other documents, which are available for guidance.

Signature (Supervisor/Staff

Mecca Chiesa Date: *24th September, 2012*

Signature (Student)

Sarah Hedley Dray Date *23rd September, 2012*

The purpose of this screening is to ensure that the research will be ethical, maintain confidentiality, anonymity and will not cause harm.

ETHICAL REVIEW CHECKLIST

The Tizard Centre Ethics Committee meets once a year. Any members of staff or students are welcome to attend a meeting when their proposal is being discussed. If you wish to attend the meeting, please inform Ethics secretary at least 2 days prior to the meeting. The outcome of the review of proposals will be announced by email and/or post approximately 3 weeks after the meeting.

Please note that when completing your proposal, you should use the proforma exactly as it is set out below. Please also ensure that your checklist has page numbers and the completed proforma should not exceed 8 pages including the consent letter and should be completed in plain English. Dissertation proposals should not be attached to the proposal.

Section 1 Background including literature review and rational for study ie aims & objectives of the project (no more than 2 pages)

Pupils at Foxwood, a state special school in Kent, have benefitted from the use of Applied Behavior Analysis (ABA) techniques during the last 5 years. The principles of ABA have been used to reduce incidents of undesirable behaviour, increase desirable behaviour and introduce new behaviours into individual repertoires. Through the use of Learning Schedules, where pupils work on a 1:1 basis with an adult, new skills in literacy and numeracy have been taught and further developed. Pupils have, however a limited ability to work or play independently and have become dependent on adult prompts, along with reinforcers, to remain seated and engaged in tasks. They are therefore unable to consolidate skills learned in an independent way.

As MacDuff, Krantz and McClannahan (1993) stated “a goal of behavioural intervention for people with autism is the development of functional skills that maximise engagement in appropriate self-care, work and leisure activities’, however “many intervention packages rely heavily on verbal instructions, modelling and gestures”. As our pupils are prompt dependent they do not, therefore, display target skills when the teachers and prompting procedures are not present. Personal, Social and Health Education (PSHE), which encompasses the ability to work and play independently, is an area of the National Curriculum that our pupils are typically slow or unable to achieve in.

MacDuff, Krantz and McClannahan (1993) used a “graduated guidance procedure” to teach pupils with autism to follow photographic activity schedules. Their aim was to increase on-task behaviour. They found that after acquiring schedule-following skills, pupils with Severe Learning Disabilities (SLD) displayed lengthy response chains that they were able to use in different settings and in the absence of close supervision. In order to develop pupil PSHE skills, I propose to introduce and develop the use of Activity Schedules, using the methods developed by McClannahan and Krantz (2010). My aim is to set up a new class of 10 pupils and to teach each pupil to follow a schedule of tasks independently and, ultimately, without a need for adult presence and then to generalise this skill across different learning environments.

Having established an ability to follow a schedule, the need for adult supervision will be greatly reduced, as pupils will no longer require 1:1 attention to remain on task. Data will be kept throughout the study to measure progress made in PSHE as well as in literacy and numeracy skills. Pupil progress in PSHE will be measured using the Assessment of Basic Language and Learning Skills-Revised (ABLLS-R), designed by Partington (2010) and will be compared with other pupils of a similar age and diagnosis within the UK by using the data system Comparison and Analysis of Special Pupil Attainment (CASPA).

Other studies have shown that once individuals have learned to use picture activity schedules, this skill can be used to introduce and develop other important skills in an individual's repertoire. Betz, Higbee and Reagan (2008) for example, taught pairs of children with autism who had already mastered activity schedules to engage in joint activity schedules; this developed peer collaboration and interaction skills. Meanwhile, Miguel, Yang, Finn and Ahearn's study (2009) established that conditional discrimination training could serve to transfer the control from activity schedule pictures to printed words. Lalli, Casey, Goh and Merlino (1994) reduced the aberrant behaviour rates of 2 individuals by introducing printed activity schedules. Interestingly, the printed schedules "corresponded to lower rates of problem behaviour and higher rates of compliance than the photographic activity schedules".

I aim to add to the body of work that supports the value of using Activity Schedules within the educational setting of a state school. By increasing the rate of pupil attainment in PSHE, I would be further validating and extending the work done by Krantz and McClannahan. This project could transform the way in which our pupils generalise and consolidate their skills and, in addition, provide a procedure through which other valuable and functional skills could be developed. By teaching a pupil to follow a printed schedule, the need for verbal, gestural or modelled interventions would be vastly reduced; I aim for a substantial increase in pupil PSHE development and attainment.

References:

Betz, A., Higbee, T., & Reagan, K. (2008) *Using Joint Activity Schedules to Promote Peer Engagement in Preschoolers with Autism.* Journal of Applied Behaviour Analysis. 41,237-241

Kennedy, C. (2004) *Single Case Designs for Educational Research.* Pearson Education Ltd.

Lalli, J., Casey, S., Goh, H. & Merlino, J. (1994) *Treatment of Escape-Maintained Aberrant Behaviour with Escape Extinction and Predictable Routines.* Journal of Applied Behaviour Analysis. 27, 705-714

MacDuff, G., Krantz, P. & McClannahan, L. (1993) *Teaching Children with Autism to use Photographic Activity Schedules: Maintenance and Generalisation of Complex Response Chains.* Journal of Applied Behaviour Analysis. 26, 89-97

McClannahan, L., & Krantz, P. (2010) *Activity Schedules for Children with Autism: Teaching Independent Behaviour.* Woodbine House Inc, US.

Miguel, C., Yang, H., Finn, H. & Ahearn, W. (2009) *Establishing Derived Textual Control in Activity Schedules with Children with Autism.* Journal of Applied Behaviour Analysis. 42, 703-709

Partington, J.W. (2010) *The Assessment of Basic Language and Learning Skills – Revised (The ABLLS-R).* Behaviour Analysts, Inc.

Section 2

Conduct of Project

a) Location

The study will take place in the usual classrooms and outdoor learning spaces at the school that the pupils attend: Foxwood, Seabrook Road, Hythe, Kent. CT21 5QJ

b) Brief description of participants (and number)

There are 11 participants who are pupils from year 3 to year 8, age range 7-12 years. One participant has, as part of a pilot project, already been taught to follow an Activity Schedule. The other 10 pupils will form a new class in September 2012.

All pupils have a statement of Special Educational Need and have been assessed as having Severe Learning Disabilities (in line with the definition from the Department of Health's Valuing People 2011 White Paper) by General Practitioners, Educational Psychologists and/or other professionals. Pupils were selected following an assessment procedure. School assessment data for all pupils were analysed; those who had lowest achievements in basic learning skills within the National Curriculum subjects of Literacy, Numeracy and PSHE (personal, social and health education), and whose progress was slowest in these areas were identified by, jointly, the student (who is the school's designated ABA specialist) and the Head of Education.

Approximately 12 staff (neuro-typical) will work with the pupils as part of their role as teachers and teaching assistants.

c) Expected start date and duration

The student has enrolled as a part time PhD student and as such the research project has a 5 year duration from March 2012 to March 2017. The main study with the pupils will start in September 2012 and last approximately 2 years.

d) Brief account of methods/techniques (please give summarised account of measures to be used. If using a non-standardised questionnaire, please include an example of it)

The project will take 5 years in total, from research and planning stages through to intervention, recording and completion (please see time lines). As the student continues the literature review, she will make visits to other schools that use an ABA approach to education within the South East. The focus will be on PSHE, pupil attainment and how independence skills are taught in these settings. Information collected so far suggests that there are no schools currently using Activity Schedules within the South East.

Ten pupils within the school who would benefit most from this approach have been identified, as well as staff to work within the new class. Pupils will come from several Key Stage one and two classrooms to form a vertically aged group. The new class will open in September 2012 for the 10 pupils; a new learning environment has been set up with the relevant resources ready to measure specific skills. Pupils will continue to receive an ABA approach to education with frequent opportunities set up for 1:1 sessions using Learning Boxes.

Prior to intervention, baseline measures will be taken from direct observations using the ABLLS assessment; numeracy and literacy skills will be measured, alongside PSHE skills to establish levels of independence. Using behaviour analytic procedures (see Kennedy, 2004), measures will be taken of the type and duration of pupil engagement with play materials prior to intervention. A second observer will make direct observations and view DVD footage of pupil performance for inter-observer agreement to be made. Results will inform curriculum planning and choice of exact independence skills to measure and develop.

Once routines are established, and steady state responding has been achieved under baseline conditions, the independent variable will be applied to 2 pupils while baseline conditions remain in effect for the other 6 pupils; procedures suggested by McClannahan and Krantz (1999) will be used to introduce and develop each pupil's ability to follow an Activity Schedule independently. Pupils will be taught to identify a picture from a background, match identical objects and match object to picture; pre-requisite skills necessary to following a schedule. Pupils will then be prompted to engage in a series of tasks known as an Activity Schedule – tasks included will be activities such as completing a jigsaw, matching numbers and writing their name. Adult prompting will be gradually reduced until pupils can complete the activity schedule independently. Progress will be measured by recording the number, type and frequency of prompts required for the pupils to succeed.

Data points will be collected to record the prompts each pupil requires to complete their tasks. Prompts will be faded accordingly until pupils are able to complete tasks independently. When criterion-level responding has been attained for these 2 pupils, 2 more pupils will be introduced to Activity Schedules and so on until all 10 have begun to work independently. This will form the basis of a multiple baseline across subjects design.

Measures of pupil engagement with materials will be taken during and following intervention for direct comparison with baseline measures. Inter-observer agreement will be made during intervention and follow up data collection sessions to ensure the validity and reliability of measures

Section 3 Ethical Considerations

1. The rationale for the decision to pay, or not to pay, participants and the likely impact on participation.

   Participants will not be paid for participating in the study. Teaching procedures used will form part of the school curriculum for this class of pupils at Foxwood. Adults will be using the procedures as part of their teaching role.

2. The intended feedback to participants (and, where relevant, to other service users/carers/advocates/services) and how this should be given.

The adults participating in the study (staff who work with the pupils) will have frequent feedback during the study via regular meetings regarding pupil progress. Parents/guardians will have regular feedback regarding progress via the usual staff/parent meetings, and more frequently if requested. At the end of the project, adult participants and parents of pupils will be provided with a copy of the final written study if requested. Pupils will be thanked for participating.

3. Issues relating to confidentiality during the project, and in any subsequent data analysis, conference presentations and publications.

Participants will be assigned an identity name e.g. pupil 1, to ensure anonymity. Data relating to the study will be stored on a laptop computer (researcher's own, which is not connected to the school server). The laptop will be password protected. Consent will be obtained from parents to use DVD footage of pupils outside of the school environment for training or presentation purposes.

4. Explain how you will meet the four main ethical principals of research, namely non-malefience (not causing harm), beneficence (doing good), autonomy (treating people with respect and giving them sufficient information so as to make their own choices) and justice (who will be advantaged/disadvantaged by the research?)

Non maleficence
All pupil participants are used to working on a 1:1 basis with adults and are both familiar and comfortable with the prompting procedures that will be used. The teaching procedures form part of the individualised curriculum that is designed for each pupil to reflect their unique needs and learning styles.

Beneficence
On a short-term basis, pupils will receive praise and other forms of reinforcement for correct responses and increased levels of independence. On a mid-term basis, pupils will become more independent and will be able to engage in meaningful activities for sustained periods of time. On a long-term basis, teaching procedures will be further developed, staff will be trained in these methods and more pupils will have access to this style of teaching.

Autonomy
As with all aspects of the school day, pupils will be free to abstain from planned activities and teaching procedures.

Justice
The teaching procedures have been planned into each pupil's individualised learning plan. These procedures will be used because they are in the pupils' best interests educationally.

5. How the research will pay attention to cultural diversity: e.g. include the experiences of people from Black and minority ethnic communities; be respectful of cultural differences; provide appropriate interpreters, where necessary (NB. researchers should note that this often involves more than simply finding someone who speaks the same language).

Pupils have been selected to participate in this study via data collected on their academic performance; they are all pupils who have a low attainment in Literacy, Numeracy and the social and personal aspects of PSHE. They have been selected regardless of ethnicity, age, cultural background, gender or religion.

Section 6 Consent

1. Is it likely that any participants will lack the capacity to give informed consent?

   Yes – the pupils lack the capacity to give consent. Teaching procedures have been discussed and approved by the school's Head of Education and Executive Head Teacher and form part of the class curriculum. Consent from parents is therefore unnecessary. A meeting has, however, been held with parents and carers of the participants in order to inform them of new procedures and styles of teaching.

2. Procedures for gaining permission from participants who are unable to give informed consent (materials should be described, and where possible, attached) Please see Chapter 5 of the Code of Practice (Mental Capacity Act 1005). Please see document entitled "Capacity to Consent: guidance for students".

   The parents/guardians of pupils have attended a meeting with the student, and the school Head of Education. They have been written to regarding the research project and asked for their consent for the data, including DVD footage, to be collected and, where applicable, shown within the university and for training and presentation purposes. Please see attached letter.

Appendix J

Information Sharing Letter

Dear

It was good to meet all of you at the information sharing meeting, I was pleased at your positive responses!

As discussed, I am studying on a part time basis at the Tizard Centre, which is part of the University of Kent. I am doing a PhD in Applied Psychology; my work is research based and involves using ABA (Applied Behaviour Analysis) methods to develop pupil skills and levels of independence.

Over the next 2 years in Bramble class, we will focus on teaching core skills in numeracy, literacy, ICT and PSHE via methods such as discrete trial teaching. This will be done on a 1:1 basis. I will also be gradually introducing Activity Schedules to the pupils. This involves teaching the pupils to follow a sequence of activities and practical tasks independently, again with 1:1 support which will be reduced as the pupils become able to complete tasks by themselves.

Some of my work with the pupils needs to be recorded using a camcorder so that I can review it later and also share it with my supervisors at university; Dr. Mecca Chiesa who works at the Tizard Centre and is a lecturer in Learning Disability and Professor Robert Johnston, who is a lecturer in Psychology.

All data collected will be kept confidential and names will not be used; pupils will be assigned participant numbers to maintain anonymity. Data collected, including some DVD footage, will be shown to my university tutors, and possibly used for training purposes with staff at school, students at the university and other presentations.

I would be grateful if you would sign and return the consent form. Please feel free to contact me should you wish more information or would like to discuss my project with me.

Thank you for your support.
Yours sincerely,

Sarah Hedley Dray.

I /we as parent/s carers of ____
have read the enclosed information and understand that data collected is confidential. I/we give permission for data, including (where applicable) DVD footage, to be used in presentations and publications.
Signed: ____
Name:
Date:

Appendix K

Questionnaire and Rating Scale – School Staff

This questionnaire is designed to assess the acceptability of activity schedule training and the importance of any effects it has had on pupil behaviour. Please read each of the 15 statements and circle the number that best represents your view. There is space on the following page to note any additional comments or suggestions you may have.		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	*The activity schedule is an acceptable intervention for teaching independence skills*	1	2	3	4	5	6
2	*Most teachers/TAs would find this intervention appropriate for teaching independence skills*	1	2	3	4	5	6
3	*I would suggest the use of this intervention to other teachers/TAs*	1	2	3	4	5	6
4	*I like the procedures used in this intervention*	1	2	3	4	5	6
5	*I would be willing to use this intervention in the classroom setting in the future*	1	2	3	4	5	6
6	*This intervention is practical in the amount of time required for record keeping*	1	2	3	4	5	6
7	*This intervention is practical in the amount of staff required to deliver it*	1	2	3	4	5	6
8	*This intervention requires little training to implement effectively*	1	2	3	4	5	6
9	*This intervention proved effective in teaching independent behaviour*	1	2	3	4	5	6
10	*This intervention was a good way to teach independence*	1	2	3	4	5	6
11	*The intervention produced a lasting improvement in pupil independence*	1	2	3	4	5	6
12	*The intervention improved levels of independence in other settings (eg other classrooms, at home)*	1	2	3	4	5	6
13	*Skills other than independence have been improved by the intervention*	1	2	3	4	5	6
14	*This intervention did not result in negative side-effects for the pupils*	1	2	3	4	5	6
15	*The intervention would be appropriate for a variety of children*	1	2	3	4	5	6

Are there any changes you would make to activity schedule training before recommending it to others as a teaching procedure?
If so, please describe which aspects and why.

If you have agreed with statements 12 and 13, please add further information:

Please add any further comments you may have on the use of activity schedules.
You may want to comment on the procedure as a whole, the effects of activity schedule training on any individual pupils or for pupils overall.

Your feedback is important to me. Thank you very much for sharing your views and comments!

Appendix L

Letter to School Staff

Dear member of staff,

I am writing up the results of my study into Activity Schedules. Although I'm not able to publish the results yet, I'm pleased to say that so far they are very positive. I've enclosed a set of updated graphs to show pupil progress using data from when they started to learn activity schedules up to when the study ended. I know the class has continued to use their activity schedules however any data collected since I left the school is not included on the graphs.

As part of my review, I'd like to find out your individual opinions of activity schedules. I enclose a questionnaire and would really appreciate it if you could complete it and return it to me in the enclosed envelope.

Over the course of the study, information was shared in these ways:

- initial meeting to discuss what activity schedules are
- observations of pupils engaged with their activity schedule training
- data collection during training sessions
- pupil progress updates through morning staff meetings
- progress updates using graphs displayed on the wall

While you were all able to observe pupils engaged with their activity schedules, not all of you were involved with data collection or teaching of activity schedules. So, in case you need a reminder of what activity schedules are and how we teach them, here is a re-cap on the activity schedule materials, teaching procedures and guidance:

<u>The activity schedule folder and materials:</u>
The folder had 4-6 pages inside, each page had a photo of an activity to do such as a jigsaw puzzle, a peg board pattern or an animal matching task. The last page of the folder always had a photo of an item or activity that the child chose such as a biscuit to eat or time on the i-pad.

<u>The activity schedule teaching procedures:</u>
The materials needed for each of the activities were put in see-through wallets, inside a box with the child's name on it. The box was placed on a nearby table. He/she was guided to open the schedule folder, look at the photo, go to the box, pick up the right wallet, take the wallet back to the table and do the activity. When the activity was done (e.g. the jigsaw was finished), the child was guided to put it back in the wallet and take it back to the box. He/she was then guided to return to the schedule folder, turn the page and look at the next photograph.

<u>Guidance towards independence:</u>
The child was guided to complete each of the activities in the schedule. No verbal prompts were used. The adult stayed behind him/her and physically guided wherever necessary. Over time, the adult reduced the prompts given until he/she was doing the activities independently. As activities were mastered, new activities were put into the schedule. Physical prompts were recorded as a way of measuring each child's independence, as shown on the graphs.

All responses are anonymous (unless you'd like to write your name) and will be kept confidential. Your views are an important part of the study, so thank you <u>very</u> much in advance for sharing them with me.
With kind regards,

Sarah Hedley Dray.

Appendix M

Questionnaire and Rating Scale – Parents and Carers

This questionnaire is designed to assess the acceptability of activity schedule training and the importance of any effects it has had on your child. Please read each of the 15 statements and circle the number that best represents your view. There is space on the following page to note any additional comments or suggestions you may have.		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	*My child needed to develop his/her independence skills*	1	2	3	4	5	6
2	*The activity schedule is an acceptable way to teach independence skills*	1	2	3	4	5	6
3	*Most parents/carers would find activity schedule training an appropriate way to develop independence*	1	2	3	4	5	6
4	*I would suggest the use of activity schedules to other parents/carers*	1	2	3	4	5	6
5	*I like the procedures used in teaching activity schedules*	1	2	3	4	5	6
6	*I would be willing for my child to continue to do activity schedules in the future*	1	2	3	4	5	6
7	*Activity schedules proved effective in teaching independent behaviour*	1	2	3	4	5	6
8	*Activity schedule training was a good way to teach independence*	1	2	3	4	5	6
9	*Activity schedule training produced a lasting improvement in my child's independence*	1	2	3	4	5	6
10	*Activity schedule training improved levels of independence in other settings eg home, outside of school*	1	2	3	4	5	6
11	*Skills other than independence have been improved through activity schedules*	1	2	3	4	5	6
12	*Activity schedules did not result in negative side-effects for my child*	1	2	3	4	5	6
13	*Activity schedule training would be appropriate for other children*	1	2	3	4	5	6

If you have agreed with statements 10 and 11, please add further information:

Please add any further comments you may have on the use of activity schedules.

Your feedback is important to me. Thank you very much for sharing your views and comments!

Appendix N

Letter to Parents and Carers

Dear Parents/Carers

I am writing up the results of my study into Activity Schedules. Although I'm not able to publish the results yet, I'm pleased to say that so far they are very positive. I enclose a graph to show your child's progress using data from when he/she started to learn activity schedules up to when the study ended. Of course, the class has continued to use their activity schedules as part of their learning, but information on this is not included on the graphs.

As part of my review, I'd like to find out your individual opinions of activity schedules. I enclose a questionnaire and would really appreciate it if you could return it to school in the enclosed envelope.

Over the course of my study, we kept in touch in these ways:

- initial meeting to discuss what activity schedules are
- letter about activity schedules
- invitation to come and watch your child working
- progress updates through written comments in the home/school books
- progress updates using graphs
- discussion during parent/teacher meetings

Some of you were not able to attend all of the meetings or to come and watch your child. So, in case you need a reminder of what activity schedules are and how we teach them, here is a re-cap on the activity schedule materials, teaching procedures and guidance:

The activity schedule folder and materials:
The folder had 4-6 pages inside, each page had a photo of an activity to do such as a jigsaw puzzle, a peg board pattern or an animal matching task. The last page of the folder always had a photo of an item or activity that your child chose such as a biscuit to eat or time on the i-pad.

The activity schedule teaching procedures:
The materials needed for each of the activities were put in see-through wallets, inside a box with your child's name on it. The box was placed on a nearby table. He/she was guided to open the schedule folder, look at the photo, go to the box, pick up the right wallet, take the wallet back to the table and do the activity. When the activity was done (eg the jigsaw was finished), your child was guided to put it back in the wallet and take it back to the box. He/she was then guided to return to the schedule folder, turn the page and look at the next photograph.

Guidance towards independence:
Your child was guided to complete each of the activities in the schedule. No verbal prompts were used. The adult stayed behind him/her and physically guided wherever necessary. Over time, the adult reduced the prompts given until he/she was doing the activities independently. As activities were mastered, new activities were put into the schedule. Physical prompts were recorded as a way of measuring your child's independence, as shown on the graphs.

All responses are anonymous (unless you'd like to write your name) and will be kept confidential. Your views are an important part of the study, so thank you very much in advance for sharing them with me. Please feel free to contact me via the school if you have any further questions.

With kind regards,
Sarah Hedley Dray.