Effects of visual supports with and without systematic instruction on the acquisition of daily living skills for students with autism spectrum disorder and intellectual disability

by

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Abstract

Ensuring students with autism spectrum disorder (ASD) and intellectual disability (ID) receive evidence-based instruction as part of their schooling curriculum is pivotal for ensuring lifelong potential is maximised. Much research exists that highlights the benefits of visual supports for teaching students with ASD and ID; however much of this research includes additional forms of instruction calling for a need to validate if visual supports in isolation truly is an appropriate evidence-based practice or whether a combination of visual supports plus systematic instruction is a more effective pedagogical approach.

This study investigated the effect of visual supports plus systematic instruction in comparison to visual supports in isolation on the acquisition of daily living skills for students with ASD and ID. Eight students with a diagnosis of ASD and ID, aged between 6.8 to 14.10 years old from two South Australian special school settings participated in the study. Using a novel multiple-baseline comparative-intervention (Ferron & Levin, 2014) design, participants were randomly paired into four units, assigned an intervention within their pair (i.e., within a pair, one participant receiving visual supports plus systematic instruction and the other receiving visual supports in isolation), and a pair intervention start point. Across a cumulative total of 22 sessions, all participants were engaged in baseline (5-8 sessions), intervention (12-15 sessions) and maintenance phases (2 sessions). Four participants in the visual supports plus systematic instruction condition received graduated guidance plus system of least prompts in addition to visual supports mapped to their visual comprehension ability to target a parent-selected daily living skill. Meanwhile, the four participants in the visual

supports in isolation condition received only sequences of visual supports matched to their visual comprehension level to teach their parent-selected daily living skill. To socially validate the study data, teachers and teacher aides were engaged in a social validation questionnaire.

Data collected as part of the multiple-baseline comparative-intervention design were analysed using the Excel Package of Randomization Tests (version 3.1; Levin, Evmenova, & Gafurov, 2014) while social validation data was analysed thematically. Results revealed that visual supports plus systematic instruction was significantly effective ($p = 0.04$) with effect size ranging from medium to large in increasing the percentage of independent steps completed in a daily living skill for all four participants in the visual supports plus systematic instruction condition. In the visual supports condition, out of the four participants, only one participant's percentage of independent steps in daily living skills improved. Effect sizes for three participants in the visual supports in isolation condition were negative to small, however one participant demonstrated a large effect size and positive change being able to complete his targeted daily living skill. Analysis of significance for the visual supports only condition revealed an overall statistically significant improvement ($p = 0.04$), however when one participant's data was removed, overall statistical significance for the visual supports only condition was not achieved ($p = 0.08$). Social validation data revealed that educators rated the visual supports plus systematic instruction condition as more effective than the visual supports in isolation condition.

The results from this study indicate that visual supports in isolation is a comparatively less effective approach to teaching daily living skills compared to visual

supports plus systematic instruction, although individual variation does exist. The implications of avoiding the presumptions that students with ASD and ID are predisposed to learning visually without the mediating effect of systematic instruction are highlighted. In addition, the repercussions for teacher education, classroom practice, school leadership and policy direction regarding the importance of understanding which components of evidence-based practice are most useful in classroom contexts are discussed.

Declaration

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university and that to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed

Raj Brij

Dated 29 October 2018

Dedication

Above all, to God, for His providence, abundant love and immense support around me.

\./ Sri Krishna Sharanam Mamah \./ Sri Krishna Vande Jagat Guru \./

To my mother Devaki Shibram, for her unconditional love, support and prayers throughout this journey. You've taught me that God always prevails for those who strive to reach for the stars.

My wife Nazrana, for always encouraging me to stay positive and for holding the fort singularly on many occasions in my 'absence'. You have been my strength throughout this time. My son and daughter, Kirtan and Shreya, for their reminders to believe, and their encouragement during the most tiring moments, that small progress is still progress. Your gestures of understanding, kindness and affection made all the difference. Together, the three of you are the light of my life.

My friend, Zhihua for his 'reprimands'—'Don't think too much'. You've always helped me bounce back into positivity. This journey would have also not been possible without your help. I am very thankful.

Without all your love, belief in me and strength, the headwinds I experienced in this journey would have been impossible to navigate. I am eternally grateful.

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Finally, my thanks to Associate Professor Kerry Bissaker, who in the winter of 1999, invited and encouraged me when I was her student, despite my nerves, to present a topic to my classmates. That single experience made me realise that I wanted to become a special education teacher educator. Your constant encouragement keeps me going in the very challenging field of ASD and ID—20 years since!

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List of Abbreviations

AAC	Augmentative and alternative communication
ABA	Applied behaviour analysis
ASD	Autism spectrum disorder
CTM	Comprehensive treatment models
EBP	Evidence-based practice
ExPRT	Excel Package of Randomization Test
FIP	Focused intervention practice
ID	Intellectual disability
IEP	Individual education plan
IOA	Inter-observer agreement
IQ	Intelligence quotient
MBCI	Multiple-baseline comparative-intervention
MBD	Multiple-baseline design
PAS	Picture activity schedule
TEACCH	Treatment and Education of Autistic and Communication Handicapped Children
VS	Visual supports in isolation
VS+SI	Visual supports plus systematic instruction

Chapter 1: Introduction

In the current educational landscape, in both inclusive and special school settings, teachers are expected to manage a diverse group of students. One such group consists of students with autism spectrum disorders (ASD), owing to substantial increased identification and prevalence of ASD.

1.1 Autism Spectrum Disorder

Autism spectrum disorder is commonly referred to as ASD. The nuances of ASD characteristics expressed variably across individuals have led to its emphasis as a 'spectrum' disorder to reflect the heterogeneity of the developmental disability. ASD is mainly characterised by persistent deficits in social communication and social interaction in addition to restricted interest and repetitive behaviours. The Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5; American Psychiatric Association [APA], 2013) classifies ASD on three severity levels with associated support descriptors, namely, Level 1, 'Requiring support', Level 2, 'Requiring substantial support' and Level 3, 'Requiring very substantial support' (p. 52).

ASD is commonly accompanied by concomitant intellectual disability (ID) (Hurley & Levitas, 2007; Kimhi, 2014; Matson & Shoemaker, 2009) and may occur with language impairment. In addition, ASD may co-occur with other neurodevelopmental disorders, such as mental or behavioural disorders and medical or genetic factors. ASD may also be present with catatonia, which is characterised by either decreased motor activity and engagement or excessive and peculiar motor activity, manifested as marked unresponsiveness and marked agitation (APA, 2013). A detailed description of ASD and its severity levels is presented in Chapter 3, the literature review.

Given these characteristics, ASD is a complex disorder. With an upsurge in prevalence of ASD and better identification and diagnosis, teachers are likely to encounter students with ASD and ID in their classrooms, be it in inclusive or self-contained classrooms, at some point in their teaching career.

1.1.1 Prevalence of ASD. The prevalence of ASD has increased significantly in the past decade. Latest available data for Australia estimates the current prevalence rate of ASD at one in 100 (Australian Bureau of Statistics, 2014). In addition, between 2009 and 2012, there was a 79% increase in ASD, effectively a prevalence of 0.7% of the Australian population. The prevalence rate in the United States is estimated to be one in 59 (Centers for Disease Control and Prevention, 2018). The Asian and European prevalence is estimated to be 1% (Centers for Disease Control and Prevention, 2018). In the latest publication of the DSM-5, the APA (2013) stated that within and outside the United States, prevalence of ASD has reached 1% of the population in both child and adult samples.

1.1.2 Implications for classroom practice. The implications of increased prevalence of ASD and its accompanying learning complexities necessitate that teachers expand their pedagogical practices to include not only practices that work for typically developing students but also those classified as evidence-based practices (EBPs) for teaching students with ASD and ID. The latter practices may suit the educational characteristics of students with ASD and ID and increase the likelihood that they will engage, learn and thrive in the classroom and wider community (Weiss & Burnham-Riosa, 2015).

To this end, it is critical to note that if teachers are not current with ASD-specific EBPs, which are thus pedagogically suited to the complex learning styles of students with ASD and ID, the impact on learning, cognitive and behavioural prognosis may be

diminished (National Research Council, 2001), or in the worst cases negated. Research-validated pedagogy is necessary when working with these students.

1.1.3 Individuals with ASD and ID. This study is concerned with students diagnosed with ASD and concomitant ID, currently diagnosed and classified as being at Level 3 for both behaviour and social communication on the severity scale (APA, 2013). While prevalence rates differ according to different studies (Charman et al., 2011), ASD and ID are reported to be a common co-occurrence (Matson & Shoemaker, 2009), with the severity of one of these conditions affecting the other. That is, if one condition is mild, it is likely that the other condition is mild, and similarly if one condition is severe the other condition is likely to be severe. Hurley and Levitas (2007) caution that it is critical to recognise the concomitant occurrence of ASD and ID; if overlooked, these students are at greater risk for poorer future outcomes.

From this point onwards, in the writing and reporting of this study, students with ASD and concomitant ID, will be referred to as students with ASD and ID.

1.2 Establishing Evidence-Based Practices in Autism spectrum disorder

The National Autism Center (NAC, 2015) and the National Professional Development Center on Autism Spectrum Disorder (NPDC, 2014) have both published reports detailing interventions that are classified as evidence-based, describing approaches that have demonstrated effectiveness and thus bestowed the evidence-based status. In the lists of EBPs described in the NPDC report, salient components of interventions from two leading paradigms in ASD intervention, structured teaching[1], from Treatment and

[1] For consistency, this study will use the term structured teaching to refer to the TEACCH approach.

Education of Autistic and Communication Handicapped Children (TEACCH), commonly referred to as the TEACCH approach, and applied behaviour analysis (ABA) have been listed. Structured teaching relies heavily on the use of visual supports, such as activity schedules (Knight, Sartini, & Spriggs, 2015; Mesibov, Shea, & McCaskill, 2012; Mesibov, Shea, & Schopler, 2006) while prompting systems are instructional components that rely on systematically teaching skills (Collins, 2012; Cooper, Heron, & Heward, 2007). These salient components of larger intervention models listed in the NPDC report, visual supports (i.e., a large component of structured teaching) and prompting systems (i.e., a large component of ABA) are referred to as focused intervention practices (FIPs), defined later in this chapter. While both the NPDC and NAC have listed visual supports and systematic instruction as EBPs, both use different terms to refer to them. Table 1.1 lists the different terminologies used by the NPDC and NAC.

Table 1.1

NPDC and NAC Evidence-Based Classification System

Authority	**Intervention**	
NPDC	Visual supports	Prompting systems
NAC	Schedules*	Behavioural interventions

Note: NPDC: National Professional Development Center on Autism Spectrum Disorder; NAC: National Autism Center.

* The NAC defines schedules as visually represented activities that must be completed, such as ‘social interaction, self-care and housekeeping tasks’ (2015, p.61).

In this study, the NPDC term is adopted (i.e., not schedules) for visual supports while prompting systems are referred to as systematic instruction. Visual supports and systematic instruction are the two EBPs examined in this study. Two terms from the NPDC

report, comprehensive treatment models (CTMs) and FIPs, are defined since they are relevant to the discussion in this study.

CTMs are programmes designed to improve learning and developmental outcomes for core deficit areas in ASD. CTMs are characterised as having several features, namely, (a) organisation around a conceptual framework, (b) manualised procedures, (c) intensity of the intervention, (d) longevity of the programmes and (e) focus on multiple outcomes in domains such as communication and behaviour (NPDC, 2014). The NPDC lists UCLA Young ASD Program and TEACCH as examples of CTMs.

FIPs are smaller but salient features of CTMs (Odom, Hume, Boyd, & Stabel, 2012) that are research-validated EBPs designed to achieve specific and targeted skills in students with ASD—for example, single daily living skills, such as washing the face. FIPs are identified by several features, that is, they (a) are operationally defined, (b) address specific outcomes and (c) occur over a shorter period when compared with CTMs (NPDC, 2014). Visual supports and prompting systems are examples of FIPs listed by the NPDC, among 27 other FIPs.

1.3 Research Gap

Limited information is available regarding whether using visual supports alone or using visual supports with systematic instruction is more effective in increasing the ability of an individual with ASD to acquire daily living skills. Knight et al. (2015) investigated the effectiveness of visual supports from TEACCH (referred to as visual activity schedules in their study) as an established EBP. They highlight that out of 16 studies, the 14 that produced evidence for visual supports as an effective teaching approach had also incorporated systematic instruction as a training component. These components ranged

from verbal, gesture and physical prompts to operationalized prompting systems, such as graduated guidance and the system of least prompts. Thus, it may be argued that it remains inconclusive if visual supports alone are effective in supporting students with ASD and ID to learn. Given that systematic instruction was frequently used in conjunction with visual supports, it is essential to determine if visual supports alone are effective in teaching students with ASD and ID. Investigating this research gap is important for several reasons as discussed below.

1.3.1 Lack of comparison of visual supports with and without systematic instruction.

To date, no studies are known to have directly compared visual supports with and without systematic instruction and their impact on teaching and learning for students with ASD and ID, specifically in daily living skills. To ensure classroom teachers can implement visual support strategies effectively, evidence must be gathered that visual supports alone have the potential to improve learning and independence (Knight et al., 2015). The masked mediating effects of systematic instruction in many reported studies and the effects of visual supports alone need to be examined. Until such time when visual supports can be singularly validated as effecting teaching and learning for students with ASD and ID, it should be used judiciously. Matson et al. (2012) stress that effectiveness of interventions must be evaluated by direct comparisons through systematic studies, which is currently lacking for visual supports with and without systematic instruction. It is important to understand if visual supports in isolation are effective or if there is a need to supplement this approach with systematic instruction. Understanding this may have implications for practice, especially in preservice teacher education and in-service teacher professional learning. Visual supports are simple to implement and not

methodologically technical whereas systematic instruction is, thus including it in teacher education and professional learning may have a positive impact on outcomes for students with ASD and ID.

1.3.2 Widespread but limited empirical use of visual supports individually. Knight et al. (2015) state that because visual supports, 'originating from the Treatment and Education and Communication Handicapped Children (TEACCH) model' (Mesibov, as cited in Knight et al., 2015, p. 157) are a 'common practice in classrooms and other settings for ASD, practitioners should know whether they are effective' (p. 158). Given the global reach of structured teaching, Kliemann (2014) states that there is 'the phenomena that exists with the high use and acceptance of the implementation of the TEACCH model by practitioners and the lack of acceptance it has as an effective practice by researchers in the field' (2014, p. 13). Structured teaching experts themselves have also stated that 'More refined research is needed because the individual contributions of these mechanisms and their sub-components have not been studied' (Mesibov & Shea, 2010, p. 572). Further, Howley (2015) states that structured teaching promotes learning behaviour and it is less known if it promotes meaningful learning per se and similarly calls for the examination of the sub-components of structured teaching. Visual supports, a major component of the structured teaching approach, was one of the sub-components examined in the present study.

1.3.3 Questions about visual learning in ASD. Recent studies (Erdődi, Lajiness O'Neill, & Schmitt, 2013; Preis, 2006; Trembath, Vivanti, Iacono, & Dissanayake, 2015), have raised questions regarding visual strengths in ASD. Trembath et al. (2015) attribute assertions of visual strengths to three sources (a) reports from people with ASD, (b) outcomes of picture-based studies and (c) from studies demonstrating that students with

ASD perform better in tasks with visual as opposed to auditory information. However, their study revealed that students with ASD did not demonstrate relative strengths in visual learning and cautions that the 'findings call into question that assertion that children with ASD have a propensity for visual learning over auditory learning' (p. 3286). In addition, Erdődi et al. (2013) report that when students with ASD were presented with visual stimuli, they demonstrated weakness in visual learning compared with children with attention deficit hyperactivity disorder and typically developing children; in other words, there was no improved learning with visual stimuli. Moreover, in an earlier study, Preis (2006) found that there was no difference in the performance of children with ASD under the experimental control of speech alone and speech plus pictures.

These studies challenge the predominant assertion that visual learning is a strength in students with ASD. This provides context for the present study to add to the literature identifying whether or not students with ASD and ID have a propensity for visual learning and whether in an education setting, visual learning can enhance their ability to complete daily living skills through the use of visual supports alone, without the need for systematic instruction.

1.3.4 Professional development of evidence-based practices. Given the interaction of ASD and its limiting effects on adaptive behaviours and independent living (Matson & Shoemaker, 2009) it is essential that effective intervention models be identified since these have important implications for future outcomes. There is ample literature to inform educators on EBPs. However, while there is substantial instruction on what is evidence-based, teacher education is deficient in developing skills for selecting and applying FIPs. As such, specifically for students with ASD, 'This is not for the lack of instruction on what are evidence-based intervention, but rather the absence of a model for

applying them in an educational context" (West, McCollow, Umbarger, Kidwell, & Cote, 2013, p. 449). In addition, teachers receive limited professional development in evidence-based behavioural interventions (Begeny & Martens, 2006; Simonsen, Myers, & DeLuca, 2010). Thus, unacquainted with EBPs, teachers may blend any number of approaches learned briefly or because of simplicity of implementation. Further, a lack of understanding of the different EBPs and inadequate professional development may lead to implementation of interventions that are ineffective. Inconsistent selection and application of intervention is well known to reduce the effect of the intervention, thus resulting in poor learning outcomes for students (Collier-Meek, Fallon, Sanetti, & Maggin, 2013; Noell, 2014). Identifying if visual supports are effective only with systematic instruction may highlight the need for professional development on implementation of technical FIPs, such as systematic instruction for students with ASD and ID.

Given the above issues and consistent with the call by Knight et al. (2015) to examine the extent to which visual supports alone improve behaviour and the call by Mesibov and Shea (2010) and Howley (2015) to study the sub-components of the structured teaching approach, this study aims to compare the effectiveness of visual supports in isolation with visual supports combined with systematic instruction on the acquisition of daily living skills for students with ASD and ID.

It is important to establish the effectiveness of visual supports with and without systematic instruction since there may be implications for practice for educators, such as time efficiency for teaching, resource allocation, programming for teacher preparation and professional development for practicing teachers. To address the research gap, four questions are investigated in this study.

1.4 Research Questions

1. When visual supports plus systematic instructions are used, what are the effects on the acquisition of daily living skills for students with ASD and ID?
2. When visual supports are used in isolation, what are the effects on the acquisition of daily living skills for students with ASD and ID?
3. Is the use of visual supports plus systematic instruction or of visual supports in isolation more effective for the acquisition of daily living skills for students with ASD and ID?
4. What are teacher perceptions of the effect of visual supports in isolation and combined visual supports and systematic instruction on skill acquisition for students with ASD and ID?
    i. What, if any, do teachers perceive as the benefits of combining visual supports and systematic instruction?
    ii. What do teachers perceive as barriers to combining visual supports and systematic instruction?

These research questions are investigated and addressed in the six chapters in this thesis. This chapter discussed the research gap that this study aims to address. Chapter 2 illuminates' theoretical frameworks within which the design of the study was conceptualised. Chapter 3 provides a detailed review of the literature surrounding ASD and EBPs, specifically systematic instruction and visual supports. Chapter 4 describes the methodology employed in this study. Chapter 5 presents the results of this study and Chapter 6 discusses significant observations, implications, limitations, future directions and draws conclusions of this study.

Chapter 2: Theoretical Framework

In conceptualising and formulating research processes, orienting to a theoretical framework is important. The philosophical underpinnings of a theoretical framework, espoused by a researcher, inform the researcher when forming broad assumptions about the research as well as set the stage for designing, implementing and evaluating the overall research plan. These theoretical frameworks and worldviews as they relate to the current study are discussed. Creswell and Creswell (2018) state that the framework for research comprises three significant but interrelated approaches, namely, philosophical worldviews, designs and research methods. Different researchers have referred to worldviews as paradigms (Lincoln, Lynham, & Guba, 2011), epistemology (i.e., how do we know what we know) and ontology (i.e., what do we believe about reality; Crotty, 1998), which basically refer to the orientation and nature of research. In addition, the philosophical orientation and nature of research consist of four distinct worldviews, namely, postpositivism, constructivism, transformative and pragmatism (Creswell & Creswell, 2018).

Postpositivism evolved as a term after positivism to challenge the notion of absolute truth held by positivist, arguing that claims and truths cannot be absolutely determined when studying behaviour (Phillips & Burbules, 2000). Postpositivist philosophy is couched in determining and reducing ideas into simple and discrete sets to examine such as variables in hypotheses and research questions.

Constructivism espouses that individuals try and make meaning of their world based on their experiences. Thus, constructivism is not reductionist and attempts to construct meaning in cultural and social context while appreciating historical norms, typically

through discussions and interactions (Crotty, 1998). Hence it is also referred to as social constructivism (Creswell & Creswell, 2018).

The transformative worldview places importance in examining the experiences of diverse groups that are marginalised, such as gender, disability and sexual orientation, linking these with specific political and social issues (Creswell & Creswell, 2018; Mertens, 2010). Thus, in transformative worldviews, constructivist do not adequately address agendas and actions for the marginalized in society because of its deterministic and reductionist emphasis.

Finally, the pragmatic worldview, concerned with solutions for problems that works. Thus, pragmatists hold that researchers have a choice in research methods, technic and procedures to meet their needs. Essentially, pragmatist researchers "look to the what and how-to research based on intended consequences" (Creswell & Creswell, 2018, pp.11).

2.1 Postpositivist Worldviews

Quantitative research procedures, as is adopted in this research, are posited in the post positivism worldview and therefore emphasise the search for objective truths through the process of observations and measurements of the phenomena being examined. In this research, specifically, the phenomena being observed and measured are visual supports in isolation and visual supports plus systematic instruction on the acquisition of daily living skills for students with ASD and ID (i.e., careful observation, recording and measurement of visual supports and systematic instruction and their effects on the learning of students with ASD and ID).

In the postpositivist tradition, this research compares, through experimentation, to verify the effectiveness of two FIPs in ASD interventions, visual supports and systematic

instruction combined with visual supports. These phenomena are studied to facilitate predictions about causal links. The data obtained ‘speak’ to the researcher and inform about the effectiveness of the FIPs and subsequently allow the researcher to offer conclusions through this objective lens. The theoretical framework can be applied in the overall research in several ways. It provides a rationale for the study, justifies its aims and derives the research questions and data collection, generation, analysis and interpretation. This approach affects overall rigour, relevance and impact of the research as a consequence (Stewart & Klein, 2016). A discussion of learning theories for visual supports and systematic instruction follows, which supports the justification of the conceptual framework adopted in this study.

2.2 Learning Theories Underpinning Visual Supports and Systematic Instruction

Visual supports and systematic instruction, the two FIPs examined in this study, are related to CTMs with behavioural paradigm origins. However, there is a divergence in the paradigm between visual supports and systematic instruction within components of this CTM. As such, both have their basis in different theories of learning. The first approach, visual supports, although posited in the behavioural paradigm has been ‘expanded through cognitive-social learning theory’ (Mesibov et al., 2006, p. 55) while systematic instruction, is posited in the behavioural paradigm. A discussion of each of these theories follows, which supports the justification for the conceptual framework adopted in this study.

2.2.1 Cognitive-social learning theory. Cognitive theory postulates that an individual’s perception and metacognition, which are internal processes of the mind, influences the individual’s thoughts and beliefs and consequently behaviour (Mesibov,

Shea & Schopler, 2006). Reinforcements are important but not primary motivators of behaviour, but rather, perceptions fundamentally affect behaviour. Social learning theory postulates that learning occurs in a social, ecological context because of reciprocal interaction between a person, his or her environment and his or her behaviour. The triadic interplay of the person's thoughts, expectations and understanding, the environment and, consequently behaviour translates an individual's experiences and expectations which in turn facilitate the desire to engage in such behaviour (Bandura & Walters, 1963). Observational learning is thus an aspect of social learning theory, also referred to as behaviour modelling (Madewell, 2011). Four essential factors of this theory are: (a) attention, or the ability and extent of attention, to a behaviour and is correlated to retention, (b) retention, the ability to digest the cognitive information and retrieve it at a later time, (c) encoding the behaviour attended to for reproduction, and (d) motivation, which are dependent on the earlier three processes described for activation into behaviour (Madewell, 2011).

While these are also similar to Vygotskian (i.e., social cognitive theory) concepts of interaction with the world to trigger learning, such approaches require an essential feature, that is, "to structure learning environments and activities to help students construct knowledge" and allowing students to "interact with the content" (Killen, 2016, p. 41). The Vygotskian postulation that learning is socially mediated based on the students Zone of Proximal Development (ZPD), which is the zone in which a student requires guidance in order to develop new skills. This is also important to consider for students with ASD and ID as it implies understanding of what a student can do without guidance, and the need to start teaching where the student needs guidance – that is, their ZPD. Further, in this approach teachers do not give information but rather facilitate learning (Dart, as cited in

Killen, 2016); thus, the seeking of knowledge and learning is the responsibility of and assumed to be a competency inherently present within students. In other words, cognitive-social learning theories assume at least three competencies for learning: (a) individuals have the cognitive capacity to create cognitive maps to plan learning, (b) they have a degree of social and intrinsic motivation based on their past experience that has been reinforced and therefore serves as a mediator to engage in a future behaviour, (c) they have a high degree of competence in managing past and present expectations and behaviour.

2.2.2 Behaviourism. The three branches of behaviour analysis comprise of theorist (i.e., philosophy of science of behaviour), experimental analysis of behaviour (i.e., research as a premise of analysing behaviour) and ABA (i.e., developing tactics to improve behaviour; Cooper et al., 2007). Systematic instruction, one component of ABA is the emphasis in this study.

ABA is a science employed to arrange environmental antecedents so that behaviours that are desired are more likely to be reinforced and thus emitted and behaviours that are not reinforced are less likely to be emitted. Essentially, individuals operate within an environment and behaviour is a conditioned response to arranged stimuli that precede and follow behaviour (Alberto & Troutman, 2013). Learning is thus an interaction of stimulus and response that sets the basis for future occurrence of behaviour. Internal processes and social interaction are not dependent on internal variables such as perception and cognition, and nor are these dependent on social-ecological interaction between an individual, the environment and behaviour (Alberto & Troutman, 2013; Fisher, Groff & Roane, 2011). ABA acknowledges that experience influences behaviour but does not dictate the future outcome or response. Thus, the focus is on manipulating environmental variables (social and environmental) to change behaviour.

An important distinction of ABA is its emphasis to ensure that socially valid behaviour and practices should be the outcomes (Wolf, 1978) of the phenomena being studied. Social validity "refers to the extent to which target behaviours are appropriate, intervention procedures are acceptable, and important and significant changes in target and collateral behaviour are produced" (Cooper et al., 2007, p. 704). According to Wolf (1978), social validity can be assessed in three way: (a) significance of the goals of the behaviour (i.e., is it what the society wants), (b) appropriateness of the procedures of the study (i.e., ethical applications of the procedures and methods of the study and if the participants and caregivers consider it acceptable), (c) the social importance of the results (i.e., the appreciation of the predicted and unpredicted behavior change by the consumer receiving the procedure). Wolf (1978) described the relevance of these processes in that, "we have come to refer to these as judgements of social validity. It seems to us that by giving the same status to social validity that we now give to objective measurement and its reliability we will bring the consumer, that is society, into our science, soften our image, and make more sure our pursuit of social relevance" (Wolf, 1978, p. 207).

Assessment of social validity may be assessed by asking direct consumers of a program, for example, the participants in the present study or by asking indirect consumers of the study, for example, the teachers and teacher aides in the present study (Cooper et al., 2007; Kennedy, 2002). In addition, Kennedy (2002) states that a significant indicator of social validity should be the adoption of maintenance measures to verify that the behaviour has endured over time and made an impact on the life of the individual, without which the phenomena being examined is useless.

In summary, in ABA, the importance is not on the student's innate characteristics and propensity to learn but rather the ability of antecedents (i.e., teaching systematically in

behaviourism) and postcedents (i.e., consequences in behaviourism) to shape meaningful and socially valid behaviours that effect learning. The propensity to seek out knowledge actively within environments is important but not a prerequisite for learning since the behaviourist assumes reinforcement, intrinsic or extrinsic, shapes behaviour towards achieving significant outcomes.

2.2.3 Implications for students with ASD and ID. The theories postulated above exist on a continuum that can be conceptualised as being constructivist and therefore places a premium on self-motivated learning (i.e., an internal locus of control) to mechanistic, which places a premium on responsiveness to methodical delivery and reinforcements (i.e., an external locus of control) of socially and ecologically valued behaviours.

Reconciling these learning theories with learning characteristics in ASD, specifically with reference to levels of severity in ASD, it appears that that students with ASD may require interventions anywhere along the continuum of these learning theories—for example, students with Level 1 ASD may have great propensity to seek out and create their knowledge. However, it is likely that students with Levels 2 and 3 severities of ASD with a concomitant ID may benefit from a more methodical, systematic approach to instruction so that learning occurs in the targeted direction.

2.3 Conceptual Framework of This Study

Based on the discussion of learning theories relevant to the different instructional approaches outlined above, behavioural analysis, specifically, principles of ABA guide the methodology in this study. The ABA theory designates that application of stimuli systematically preceding and following the behaviour leads to reinforcement, and thus, it is likely that the behaviour will occur again in the future. Hence, it is expected that the

independent variable will be influenced by the intervening variable (i.e., systematic instruction or no systematic instruction) to influence the dependent variable (i.e., the acquisition of daily living skills).

Evidently, the theory plays a significant role in influencing the research design and informs the researcher's orientation. However, importantly, while theory guides these processes, a thorough search of the literature guides the selection and examination of a phenomenon to enable offering a novel contribution the existing literature. The next chapter discusses the literature as it pertains to ASD, systematic instruction, and visual supports for school-aged children.

Chapter 3: Literature Review

This chapter provides a review of current issues for individuals with ASD and ID. This includes defining characteristics and diagnostic indicators of ASD, the relationship between ASD and ID as well as research evidence surrounding the two evidence-based teaching strategies for supporting students with ASD and ID, which are the foci of this study: visual supports and systematic instruction, classified as FIPs by the NPDC (2014). This is achieved by synthesising the research literature into two key areas.

In the first section, current knowledge about ASD, that is social communication, social interaction, restricted and repetitive behaviours, sensory behaviours and cognitive characteristics specifically, theory of mind, executive function, weak central coherence and its implications for associated learning challenges are discussed. This is followed by a brief discussion on ASD and ID.

The second section discusses systematic instruction and visual supports after which, it discusses studies presenting the effectiveness of each approach. Since the skills taught in this study are life skills, a discussion on the justification for teaching adaptive behaviours is also presented. The literature review concludes by situating the current study within the established research gap.

The sources of the literature considered in this study are several scientific databases: ProQuest, ERIC, Academic Search Complete and Education Full Text. Publication year was not limited. The key words searched were: Autism spectrum disorder, Autism spectrum disorder and Intellectual Disabilities, ASD, Intellectual Disability, Cognitive characteristics in ASD, ABA, Systematic Instruction, Treatment and Education of Autistic and Related Communication Handicapped Children, TEACCH, Structured Teaching, Visual Supports,

Picture Activity Schedules, Visual Activity Schedules, Approaches in ASD Intervention, Comprehensive Treatment Models, Evidence-based Practices, and Focused Intervention Practices.

Key words excluded were work systems, independent work systems, comic strip conversations and social stories. Although these approaches have some visual dimensions as part of the intervention, they may be considered significantly different from EBPs such as visual supports and systematic instruction in terms of their practical applications. While independent work systems—which focus on systems of task organisation and task completion answer four questions, namely (a) what work to do, (b) how much work to do, (c) how much progress is made and (d) what is next—have a visual dimension, they are different from visual supports. In addition, independent work systems have been removed from the NPDC review since while these had some empirical support, they did not meet the criteria owing to "insufficient evidence" (NPDC, 2014, p. 25). Comic strip conversations and social stories focus on social-emotional management, which is not the focus of this study. Thus, independent work systems and comic strip conversations were excluded.

3.1 Autism spectrum disorder

Manifested by persistent and pervasive deficits in social communication–social interaction and accompanied by restricted and repetitive behaviours, autism is also frequently referred to as ASD. A lifelong neurodevelopmental disability with increased visibility as a result of the dramatic upsurge in the number of children being identified (Jensen & Spannagel, 2011), ASD is presently considered the fastest growing developmental disability (Jensen & Spannagel, 2011; Loiacono & Allen, 2008). ASD is diagnosed primarily through observation for behavioural indicators (Wiggins, Piazza, &

Robins, 2014) in social communication–social interaction patterns and restricted, repetitive behaviours. No biological markers are presently available for detecting the presence of ASD.

While social interaction–social communication patterns and restricted, repetitive behaviours are main behavioural indicators of ASD, individuals with ASD have idiosyncratic manifestation in all three areas meaning that no two individuals are alike. The expression of ASD is expansively different across individuals (NRC, 2001). Cognitive characteristics vary greatly, and while latest figures indicate a rise in the proportion of children with ASD and higher intelligence quotient, according to the Centers for Disease Control (2018), in the United States, intellectual functioning has generally ranged from severely challenged to average intelligence. Some individuals are affected to a lesser extent requiring minimal and intermittent support, while others may be affected in all major domains of life requiring extensive lifelong support in cognitive and adaptive behaviours (Wiggins et al., 2014).

Providing a dual framework for understanding needs, challenges and interventions for individuals with ASD, Jensen and Spannagel (2011) illustrate support levels for individuals with ASD. They reference cognitive function and severity levels of ASD, according to symptoms, deficits, challenges and potential levels of interventions for individuals across the spectrum. This framework is effective for understanding the correspondence between functioning levels and setting and support. It suggests that depending on support needs, individuals with ASD may require highly individualised to less individualised educational programming. It also suggests the investment of time and support levels required by individuals with ASD and ID.

3.1.1 Significance of a single diagnostic label. Prior to 2013, ASD was a group of

five disorders consisting of Autistic Disorder, Asperger's Disorder, Rett's Disorder, Childhood Disintegrative Disorder and Pervasive Developmental Disorders–Not Otherwise Specified, characterised by triadic impairments in areas of social communication, social interaction and repetitive behaviours. Since mid-2013, the APA (2013) in its fifth edition, the DSM-5, has classified the umbrella term of ASD as a single disorder. The reclassification of ASD as a single disorder has resulted in the reconceptualisation of the triad of ASD, commonly referred to as the Wing and Gould Triad of impairment (Wing, 1997; Wing, Gould, & Gillberg, 2011), into a dyad consisting of combined social communication–social interaction challenges and restricted, repetitive patterns of behaviour. In addition, three distinct levels of behaviour and social communication severity and corresponding support levels were introduced and defined in the DSM-5 (i.e., 'Level 3: Requiring very substantial support', 'Level 2: Requiring substantial support' and 'Level 1: Requiring Support'; APA, 2013, p. 52). These support levels were applied across social communication–social interaction and restricted, repetitive behaviours according to symptomology and intellectual functioning and may differ within individuals with ASD (i.e.,, an individual may be at level 1 for social communication and level 3 for behaviour. Further, the DSM-5 (APA, 2013) acknowledges that the support levels depend on context and may change over time. There is also the specification clause to indicate whether there is accompanying intellectual and language impairment, genetic, medical, neurodevelopmental, mental disorder and the presence of catatonia.

The reconceptualisation of ASD as a single diagnostic label is significant, since in place of five developmental disabilities used in the past, one term of reference, ASD with support levels, has been introduced. Significantly, accompanying the support levels are support descriptors, which more accurately reflect the environmental and pedagogical

aspects of service provisions that should be provided to students with ASD in terms of accommodations and modifications to enhance overall quality of life. This approach is a departure from a deficit-within-individual model to a supports-based system to mitigate challenges experienced by individuals with ASD and ID and inherently implies that educational systems need to respond to the individual. High, moderate and low supports have essentially replaced the notion of high, moderate to low functioning.

However, the older terms of reference of ‘functioning levels’ are still widely used in educational settings, which suggests that reference to within-child deficit and consideration of intelligence quotient (IQ) persist. These terms of reference are unhelpful since these suggest that individuals with ASD have an unyielding, permanent functioning, instead of correctly emphasising factors beyond the individual’s characteristics, such as the environment and pedagogy, which can be improved to promote better outcomes. Further, environment and pedagogy, which are pliant to change, should be the mainstay of intervention to support individuals with ASD as opposed to labelling the ‘functioning’ of ASD. Changing the environment and adopting effective evidence-based pedagogy may improve future prognosis for students with ASD (NRC, 2001).

3.1.2 Social communication and social interaction. The first area described in the DSM-5 (APA, 2013), deficits in social communication–social interaction, are observed in students with ASD, typically in the way these individuals interact with the social environment. A continuum of extreme to less extreme social communication–social interaction behaviours, across the four ASD phenotypes (Wing, 1997) that can be observed include: (a) abnormal social approach, ranging from pedantic, formal speech to touching and sniffing others, (b) poor pragmatic language to no responsiveness when called or spoken to, (c) one-sided speech to failure to initiate conversations, (d) perseverative

conversations of interest to the extent of disregard for others and lack of sharing attention, (e) problems of initiating and sharing joint attention, (f) lack of pleasure in social interactions, unless for help, and typically using others as objects to obtain a desired need, (g) lack of empathy with failure to respond to, or provide comfort, (h) aversion, or extreme seeking, of physical contact and affection, (i) odd social use of eye contact and postures, (j) failure to use and understand gestures, (k) odd prosody of speech in volume, speed and intonation, (l) abnormal understanding of sending and receiving affect, (m) difficulty with relationships, and play and imagination and (n) general lack of interest towards others (APA, 2013; Lord, Elsabbagh, Baird, & Veenstra-Venderweele, 2018; Mesibov et al., 2006; Volkmar, 1997; Wing, 1997).

3.1.3 Restricted, repetitive patterns of behaviour, interest or activities. Also reflected as a major area of deficit in the DSM-5, restricted repetitive patterns of behaviour may manifest as stereotypical, motoric behaviour and speech as well as self-stimulatory behaviours (APA, 2013). Similar to the social communication–social interaction characteristics described above, a continuum of extreme to less extreme across the phenotypes, repetitive behaviour examples that may be observed include: (a) repetitive speech or echolalia, which may be immediate or delayed, (b) idiosyncratic or rote language, (c) odd vocalisations and humming, (d) repetitive hand movements, flapping and finger flicking, (e) stereotypical body movements, rocking and balancing weight on one side of body, (f) body tensing and grimacing, (g) non-functional play and lining up objects of fascinations, (h) extreme need for routine to a point of distress and (i) fixated interest in objects and sensation seeking (APA, 2013; Lord et al., 2018; Mesibov et al., 2006; Volkmar, 1997; Wing, 1997).

Wing (1997) succinctly describes four phenotypes of ASD that continue to remain relevant at present: aloof; passive; active but odd; and overformal. They may be described as follows:

1. The aloof child is largely in an individual sphere with low reciprocal interaction with the outer world.
2. The passive child may reciprocate interactions but is easily disengaged and retracts to his or her own world.
3. The active but odd child may initiate reciprocal interactions, but these are limited and terminate frequently owing to the inability to persist with the reciprocation.
4. The overformal child is pedantic and appears superior in knowledge with little social-emotional empathy towards others, especially pertaining to knowledge.

It is important to state though, that ASD being a spectrum disorder implies that while these characteristic phenotypes may be observed, within each phenotype variation may exist.

3.1.3.1 Sensory behaviours. Sensory behaviours are also very common in students with ASD. According to Mesibov et al. (2012), sensory behaviours are usually driven by a student's hyposensitivity or hypersensitivity to sensory input. There are seven categories of sensory behaviours, manifested as either preferences or avoidance: (a) visual, related to vision, such as following the flow of lava lamps, (b) auditory, related to hearing, usually sensitivity to certain sounds, such as the background hum of the air conditioner, (c) olfactory, related to smell, such as sniffing a person, (d) gustatory, related to taste, such as seeking or avoiding certain textures of food, and even pica, consuming inedible substances, (e) tactile, related to touch, such as feeling and avoiding some surfaces in the environment,

(f) vestibular, related to balance and movement, such as rocking and (g) proprioception, related to deep pressure, such as seeking deep pressure from others (Bogdashina, 2016).

Interrupting these behaviours may result in challenging behaviour, which may result in occasionally requiring sustained recovery periods later. According to Dunn (1997), sensory modulation is the core problem in ASD, primarily because of either low threshold to sensory input resulting in sensation sensitivity and sensation avoidance or high threshold to sensory input resulting in low registration and thus sensation seeking.

However, it must be noted that the support level identified and whether the student has an accompanying ID play a significant part in terms of the extent and magnitude of all the above characteristics (Rao, Raman, Thomas, & Ashok, 2015). That is, individuals with ASD with Level 1 supports will likely have a less-nuanced expression of these characteristics compared with someone with Level 3 ASD, who has concomitant ID. To illustrate this difference in manifestation, using social communication–social interaction behaviours as an example, the DSM-5 states:

- ‘Level 3: Requiring very substantial support’ – “severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others”
- ‘Level 2: Requiring substantial support’ – “marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal social overtures from others”

- ‘Level 1: Requiring support’ – “without supports in place, deficits in social impairments cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful responses to social overtures of others. May appear to have decreased interest in social interactions” (APA, 2013, p. 52).

In addition to social communication–social interaction and restricted repetitive behaviours, individuals with ASD may experience challenges with information processing or cognitive traits: theory of mind, executive function and weak central coherence (Rajendran & Mitchell, 2007).

3.1.3.2 Information processing. Information processing situated in the field of cognitive psychology assumes that information in the environment is perceived and processed through attention, perception and short-term memory. Theories that are inclusive of how information is processed include theory of mind, executive functioning and weak central coherence. These processes allow individuals to respond, store and retrieve information in a meaningful and functional way that can be applied to lived experiences. However, individuals with ASD may have deficits in these processes (Rajendran & Mitchell, 2007), which may affect their ability to engage in learning and access the curriculum and may require adaptations to teaching, such as visual supports and systematic instruction.

3.1.3.3 Theory of mind. Theory of mind is the ability to infer and attribute the mental states, such as beliefs, desires and thoughts, of others. For example, asking someone whether it is time to leave may be sarcasm and not always literally asking for information about the time. Students with ASD are said to have difficulty in theory of mind or to experience mindblindness (Baron-Cohen, 1995). According to Baron-Cohen (1995),

children with ASD have difficulties distinguishing between appearance and reality. These difficulties result in observed behaviours, such as lack of understanding of metaphors, sarcasm and irony, and the pragmatics of language. While research into theory of mind has waned, Rajendran and Mitchell (2007) state that unquestionably, individuals with ASD have difficulties comprehending their own minds and those of others. The implication of this finding is that when interacting with these individuals, clarity in delivering the message must be considered and the communicator must always be cognizant that students with ASD may struggle with inferring the internal states of others.

3.1.3.4 Executive functioning Executive function is an umbrella term for cognitive functions that are responsible for receiving, categorising, sustaining and executing mental functions as well as inhibitory control. Executive functions allow one to engage in multiple cognitive processes simultaneously, shifting between mental processes at the forefront and in the background effortlessly (Diamond, 2014; Selcuk, Yavuz, Etel, Harma, & Ruffman, 2018). For example, a student may plan for a test by reading the topic content, differentiating the main ideas from the detailed facts and monitoring learning progress. In short, executive function is a higher-order skill that allows one to successfully plan, organise, prioritise and self-monitor towards a goal (Meltzer, 2018). In students with ASD, challenges with executive function can be observed by traits such as insistence for sameness, perseveration, difficulty in inhibiting behaviours and switching attention between tasks and situations, sometimes manifested as restricted, repetitive behaviour (Lopez, Lincoln, Ozonoff, & Lai, 2005).

3.1.3.5 Weak central coherence. Whereas typically developing individuals process information by its overall or global meaning, the theory of weak central coherence postulates that students with ASD have a propensity to process things in a very detailed and

therefore piecemeal manner, missing its overall gist (Rajendran & Mitchell, 2007). This propensity results in the latter having exceptional strengths in certain tasks that rely on strong local processing domains in the brain but becomes maladaptive when small changes in the environment may trigger severe distress (Barnett & Cleary, 2015; Charman et al., 2011; Ereny & Raghavan, 2012; Happe & Frith, 2006; Happe, Ronald, & Plomin, 2006; Lai, Lombardo, & Baron-Cohen, 2014; Pellicano, Maybery, Durkin, & Maley, 2006; Rogers & Williams, 2006). An example may be perseverating on small parts of a task but missing the salient features of what needs to be completed. Indeed, it is common for students with ASD to rearrange their environments in the exact manner that they have originally experienced it and attempts to interfere with this behaviour cause significant distress. Happe and Frith (2006) quote Kanner's original description to corroborate their theory of weak central coherence: "A situation, a performance, a sentence is not regarded as complete if it is not made up of exactly the same elements that were present at the time the child was first confronted with it. If the slightest ingredient is altered or removed, the total situation is no longer the same and therefore is not accepted as such" (p. 5).

3.1.3.6 Multiple cognitive capabilities/deficits. Despite the theory of mind, executive functioning and weak central coherence theories to support understanding of information processing in individuals with ASD, it is important to note that each one of these theories remains unproven and while characteristics in students with ASD do suggest the presence of behaviours suggested by each of these cognitive theories, to date, the research remains inconclusive (Rajendran & Mitchell, 2007). It is likely that the extent and interaction of each of these cognitive theories is unique to the individual with ASD and there is no universality in how theory of mind, executive function, and weak central coherence (Happe & Frith, 2006; Happe et al., 2006; Rajendran & Mitchell, 2007) are

expressed in individuals with ASD as a cohort. In addition to the above challenges, it is common for individuals with ASD to have a concomitant ID.

3.2 Autism spectrum disorder and Intellectual Disability

It is estimated that about 75% of students with ASD also have an accompanying ID that will require substantial support in social communication and educational domains (Feero, Guttmacher, Mefford, Batshaw, & Hoffman, 2012; Rao et al., 2015). ID is characterised by limitations in both intellectual functioning and adaptive behaviours. Individuals with an ID typically have an IQ of 70 or below. In addition to deficits in IQ, the individual must experience difficulties in adaptive functioning, that is, conceptual, social and practical life skills (Mefford, Batshaw, & Hoffman, 2012). ID may occur before the age of 18. While an individual may have an ID, regardless of its level of severity, it often coexists with individual characteristic strengths (Niemiec, Shogren, & Wehmeyer, 2017). Individuals with an ID often require personalised support to have an improved quality of life (Schalock, Verdugo, Gomez, & Reinders, 2016). ID may exist with or without concomitant ASD, although Rao et al. (2015) state that IQ, rather than the severity of ASD, is a better indicator of future outcomes in students with ASD and ID.

Matson and Shoemaker (2009) state that ASD and ID co-vary greatly and that the intensity of the two are linked, that is, if one is mild it is likely that the other is mild and similarly if one is severe the other too is likely to be severe. Hurley and Levitas (2007) caution that it is critical that the comorbidity of ASD in students with ID is recognised since it may be overlooked, (i.e., diagnostic overshadowing). Diagnostic overshadowing is the situation in which the behaviour, signs and symptoms experienced by a person with a disability is attributed to the primary diagnosis and the signs and symptoms of a concurrent

condition are overlooked, thus posing a greater risk for poorer future outcomes. Intensive interventions may moderate the complex needs of students with ASD and ID in terms of learning academic skills, acquiring adaptive skills and reducing challenging behaviours (Leaf & McEachin, 1999).

The totality of, first, the characteristic expressions of social communication–social interaction and repetitive restricted behaviours in ASD, second, information processing or cognitive behaviours and third, the presence or absence of an ID, makes every individual with ASD unique in terms of strengths and limitations. These combinations and interplay of social communication–social interaction, restricted and repetitive behaviour, sensory behaviours, information processing challenges and ID mean that individuals with ASD may present as having learning disabilities, limitations in adaptive skills and behavioural excesses and/or behavioural deficits. Consequently, these behavioural excesses or deficits may be interfering behaviours that impede teaching and learning.

Thus, it is important to consider the extent of expression of the ASD when planning for intervention supports so that they are matched to the needs of the individual. The challenge remains to respond to these unique needs to ensure that every student with ASD and ID is provided with the best education possible, using approaches that are evidence-based. This would facilitate progress in academic, social and adaptive domains so that the individual's potential limitation is lowered as much as possible, while promoting protective factors that allow the individual to thrive. At a time in education that fittingly emphasises accountability, teaching and learning of students with ASD and ID should be economical, defined as in terms of (a) effectiveness of strategies selected, that is, that it works and (b) that it is adequately simple to implement and demonstrates rapidity in results (Cooper et al., 2007).

3.3 Significance of Adaptive Behaviour

Students with ASD and ID have overall lower performance in adaptive behaviours (Kraijer, 2000) compared with neurotypical peers. Adaptive behaviours consist of communication, daily living skills, socialisation and motor skills. According to the American Association of Intellectual and Developmental Disabilities (2018), three broad areas of intelligence, namely, conceptual, social and practical intelligence, are important for everyday functioning. Conceptual intelligence consists of numeracy, literacy and functional skills, such as those related to time and money, while social intelligence includes interpersonal skills, social problem-solving, following rules and avoiding victimisation. Practical intelligence consists of personal care, occupational routines, functional use of money and time and the ability to travel. These three intelligences are essential for independent functioning in daily life and successful inclusion into the family and community at large (American Association of Intellectual and Developmental Disabilities, 2018). It allows one to be part of, and contribute to, family and community and manage a lifestyle based on the stability of a paid job.

Yet, daily living skills (although to a lesser extent when compared with socialisation) are challenging learning areas for some students with ASD (Kanne et al., 2011). Fundamentally, this implies that selection of daily living skills for individuals with ASD is paramount if they are to be successful and as independent as possible in this area. Extensive instruction and support are essential components for the success of the individual with ASD (Carothers & Taylor, 2004) in acquiring daily living skills. Further, educational services should focus on the intensity of supports that need to be provided to individuals so that the mismatch between a person’s competencies and the requirements of the

environment is reduced (Luckasson & Schalock, 2013). Understanding this need to reduce mismatch and increase support is important for students with ASD and ID. Hence this study is aimed at identifying the more effective approach to teaching life skills for students with ASD. Equally important to naming, defining, diagnosing and classifying are planning supports for the individual (Schalock & Luckasson, 2013), without which there may be significant stigma and limitations in daily functioning. Continuing education in daily living skills prepares individuals with ASD to apply life skills at home (Crosby, 2009) and eventually leads to better functional life outcomes (Gerlach-McDonald, 2017).

3.4 Evidence-Based Practices for Students with ASD and ID

More recently, EBPs have been identified through rigorous criteria by both the NPDC (2015) and NAC (2015). EBPs are approaches supported by rigorous research to verify that an approach is indeed effective in the skills it intends to improve. Iovannone, Dunlap, Huber and Kincaid (2003) describe the core components of EBPs as comprising six characteristics. These are: (a) individualised supports for students and their families, (b) delivery of systematic instruction, (c) provision of structured and comprehensible environments, (d) emphasis on specialised curriculum, (e) functional approach to behaviour and (f) respectful family involvement.

While the NAC lists EBPs on a continuum of strength classification from established to emerging to unestablished, the NPDC distinguishes EBPs as CTMs and FIPs. Systematic instruction and visual supports are two leading FIPs. Systematic instruction, in its various forms, comprises teaching techniques derived from the field of ABA. Conversely, visual supports are a salient feature of TEACCH. FIPs are salient features of CTMs that are designed to achieve smaller goals in the short term.

3.5 Systematic Instruction: Focused Intervention Practice from Applied Behaviour Analysis

ABA is a science devoted to demonstrating positive change in behaviour, using the principles of operant conditioning (Cooper et al., 2007). ABA emphasises seven critical dimensions:

1. It is applied and thus concerned with immediate social utility.
2. It is behavioural in focus, emphasising observable behaviour to demonstrate change.
3. It is analytical, meaning there must be a functional relation between procedures implemented and behaviour change.
4. It is technological, that is, there is a degree of specificity in the description of procedures adopted.
5. It is conceptual, and thus allows a common language to explain procedures.
6. It is effective, implying it produces socially significant behaviour reliably.
7. It emphasises generality, that is, behaviour is observed in novel settings, outside the teaching environment (Bailey & Burch, 2002; Cooper et al., 2007).

Based on the principles of ABA, systematic instruction relies on delivery of planned attentional cues, antecedent stimuli and the organised instruction with prompts that shape behaviours, using small approximations usually achieved through the provision of error correction and reinforcement procedures. Ultimately, the goal of systematic instruction is to provide the most assistive prompts until responses from the learner are transferred to other discriminative stimuli to elicit behaviour. Systematic instruction can be used to teach imitation, verbalisations, spontaneous communication, academic and independent

behaviours, reduction of challenging behaviours, self-care, vocational skills and task persistence (Leaf & McEachin, 1999; Snell & Brown, 2011).

3.6 Types of Systematic Instruction

Several different types of systematic instruction are discussed in the literature. These include most-to-least prompts, graduated guidance, system of least prompts (also known as least to most prompts), simultaneous prompts and time delay (Collins, 2012). The selection and use of each type of these prompting systems should be carefully guided by learner characteristics (Meadan, Ostrosky, Santos, & Snodgrass, 2013) and the corresponding level of support across the different stages of learning, namely, acquisition, fluency, generalisation and maintenance (Collins, 2012; Cooper et al., 2007). Each type of system has its own procedural protocol and parameters that must be adhered to for correct use and to maintain fidelity. Systematic instruction is considered effective since most types of systematic instruction promote errorless learning, teaching the student before mistakes are made in the learning process (Collins, 2012; Cooper et al., 2007). This allows students to experience increasing success and, more significantly, avoid practising mistakes, which may be common when teaching in the absence of systematic prompts.

3.7 Prompt Hierarchy Versus Systematic Instruction

It is important to differentiate a prompt hierarchy from systematic instruction. Although related, prompting hierarchies and systematic instruction are somewhat different. Prompt hierarchies are an arrangement of prompt levels from the most assistive to the least assistive or in the opposite direction, the least assistive to the most assistive. Prompt hierarchies do not have a ‘manualised’ approach to their use (i.e., these do not consist of specific application plans). In systematic instruction, the prompt hierarchy is carefully

selected and arranged according to assistance levels. Systematic instruction is then applied with specific procedural guidelines, that is, it is 'manualised' (Collins, 2012), thereby transforming prompt hierarchies into a systematic delivery of prompts to shape students' behaviours. Table 3.1 provides a summarised description of a prompt hierarchy.

Table 3.1

Description of Prompt Hierarchy

Prompt Hierarchy	**Description**
Full physical—most assistive and high student dependence	Hand-over-hand adult assistance to the student to enact the desired behaviour Step-by-step instruction Direct verbal prompt provided with physical prompt
Partial physical	Guided adult assistance to the student to enact the desired behaviour Step-by-step instruction Direct or indirect verbal prompt provided with partial physical prompt
Model	Demonstrating the skill step-by-step Enacting the behaviour as a model for the student
Gesture	Pointing or gesturing the 'shape' of the behaviour
Visual or stimulus	Photographic/symbolic/written cues for the enactment of the behaviour
Direct verbal	Direct instructions or verbal prompts that tell the behaviour to be enacted
Indirect verbal—least assistive and more student independence	Questions or verbal prompts that encourage thinking of the behaviour to enact

While it is important to understand what prompt hierarchies are, it is more important for educators to follow the step-by-step application of each type of prompting system systematically. This distinction is important because it implies and allows for the

application of the prompt hierarchy into systematic practice. Table 3.2 summarises the 'manualised' steps in delivering prompting systems systematically.

Table 3.2

Steps for Using Prompting Systems

Systematic Instruction	**Guiding Principles**	**Step 1**	**Step 2**	**Step 3**	**Step 4**
Most-to-least prompts	Select a most-to-least hierarchy, minimum 3 levels Predetermine number of days for each level Probe for mastery before reducing prompt	Attentional cue and/or instructive feedback	Deliver task direction	Prompt with most assistive prompt until criterion met	Correct: Deliver Consequence, paired with praise Incorrect: Controlling prompt for error correction
System of least prompts	Select a least-to-most hierarchy, minimum 3 levels At first error or no response, insert first least assistive prompt, gradually increasing to more assistive prompts, as required Use one or all within each session Probe for mastery before reducing prompt	Attentional cue and/or instructive feedback	Deliver task direction	If no independent response during response interval, prompt with least assistive prompt	Correct: Deliver Consequence, paired with praise Incorrect: Controlling prompt for error correction
Graduated guidance	Physical prompts only Wrist–Forearm–Elbow–Shoulder Fade moment-to-moment or over time	Attentional cue or instructive feedback	Deliver task direction	Physically shadow student, physical assistance, as needed	Correct: Deliver Consequence, paired with praise Incorrect: Controlling

Systematic Instruction	Guiding Principles	Step 1	Step 2	Step 3	Step 4
					prompt for error correction
Simultaneous prompt	Select least assistive prompt 0 seconds latency Probe before every session Teach at first error or no response	Attentional cue or instructive feedback	Deliver task direction	Deliver controlling prompt immediately	Correct: Deliver Consequence, paired with praise Incorrect: Controlling prompt for error correction
Time delay	Select single least assistive prompt throughout all sessions Constant delay: keep latency constant, for example, 3 seconds Progressive delay: increase latency gradually, for example, 3, 5 and 7 seconds	Attentional cue or instructive feedback	Deliver task direction	Immediately prompt during initial session; wait for set delay interval before delivering controlling prompt during subsequent sessions	Correct: Deliver Consequence, paired with praise Incorrect: Controlling prompt for error correction

In the following sections, each prompting system profiled in Table 3.2 is described. A multitude of antecedent interventions, such as high probability request sequencing, noncontingent reinforcement and behavioural assessments have been used to support a broad range of behaviours in students with ASD and ID. These include compliance, toilet training, ritualistic behaviours, transitions and reduction of self-injury. The focus of this study is on evaluating the effect of visual supports with and without systematic instruction on the acquisition of daily living skills in students with ASD and ID. Hence, the following

section of literature review focuses on studies specifically related with systematic instruction and the ways in which it relates to the research gap this thesis attempts to address.

3.7.1 Most-to-least prompt. The most-to-least prompt (see Table 3.2) relies on a minimum level of three prompts, for example, physical, model and verbal prompts, arranged from most-to-least assistive to shape learner behaviours. Each prompt level is predetermined for use for a set number of days and then delivered as planned (Collins, 2012). Once the learner has mastered the skill at the pre-specified level of assistance, the prompt is reduced to the next pre-established, lower level of assistance (i.e., second most assistive prompt) and so forth until independence is achieved. If the student demonstrates minimal or no progress, the previous level of assistance may be repeated for a set amount of time. Most-to-least prompts is typically used for students who require most assistance in learning a skill, typically student who have higher support needs, for example, students with Level 3 ASD and ID. However, it is also important to assess students baseline performance before selecting a prompting system and to avoid automatically assuming that the greater the extent of the disability, the more assistive prompting that is required. Most-to-least prompts have been investigated with students with ASD and other developmental differences to evaluate the effects on adaptive skills and a range of other skills.

3.7.1.1 Adaptive skills. A defining characteristic for ID includes limitations in intellectual functioning and adaptive behaviours (Feero et al., 2012). The most-to-least prompts have been investigated for their effectiveness in teaching a range of adaptive skills to individuals with ASD and other developmental differences, such as cooking, (Aykut, 2012), bagging lunch (McConville, Hantula, & Axelrod, 998), road crossing (Harriage, Blair, & Miltenberger, 2016) and internet use (Jerome, Frantino, & Sturmey, 2007).

In a study by Aykut (2012), four participants with ID were taught daily living skills of cooking readymade soup and sewing using an alternating treatments design, comparing constant time delay and most-to-least prompts. The results showed that when instructional time, instructional time to error criterion and number of trials until criterion achieved were considered, both approaches were effective, however, most-to-least prompts were more effective than constant time delay in teaching daily living skills.

The role of naturally occurring discriminative stimuli is an important one since the goal of all interventions is to transfer learning to naturally occurring stimuli rather than manufactured stimuli. McConville et al. (1998) noted that when prompts were matched to naturally occurring stimuli, there were higher chances of success for the learner. In this case, most-to-least prompts were effective for teaching bagging lunch and a matching game, resulting in maintenance of the skills. This was in comparison to teaching social questions and ordering food, in simulated settings, which were dissimilar from the student's real experience. McConville et al. (1998) add that while learner characteristics possibly play an important role in selection of prompts, the implications of stimulus variables cannot be underestimated, and teaching stimulus must be evaluated carefully if maximum opportunity for learning is to be gained.

Parents and paraeducators have also been reported to be effective in using the most-to-least prompts as a teaching strategy. Harriage et al. (2016) taught parents to teach road crossing effectively using the most-to-least prompts procedure. Further, in a study by Lindsey et al. (2013) four paraeducators were taught how to use task direction, time delay, most-to-least prompts and error correction to support a pair of students with moderate to severe disabilities. In follow-up generalisation probes, all four paraeducators were able to generalise the application of the learned skills to a novel context.

Jerome et al. (2007) taught three adults with developmental disabilities how to use the internet using most-to-least prompts as an errorless strategy. Post teaching, all adults could complete the steps in the task analysis. In another study, three students with ASD learned Orff music, which comprises singing, dancing and acting with percussion instruments. Most-to-least prompts were implemented following a predetermined sequence of five sessions of full physical prompt, partial physical prompts and modelling (Eren, Deniz, & Düzkantar, 2013). Overall results indicate that when the most-to-least prompts were embedded in the teaching session all three participants learned Orff music. The authors reported that the students also maintained the targeted skill/s and generalised to different settings, people and materials. Weiss and Bunham-Riosa (2015) stated that adaptive behaviours, such as socio-communicative ability and home, school and community participation, support students with ASD to thrive, therefore teaching strategies, such as most-to-least prompts to promote learning in the classroom is critical.

The aforementioned studies highlight the teaching of adaptive skills and the subsequent impact on learning activities of daily living. These studies demonstrate that this form of systematic instruction, most-to-least prompts, is effective in teaching adaptive behaviour. However, none of these studies evaluated most-to-least prompts paired with visual supports to support the acquisition of daily living skills for students with ASD and ID.

3.7.1.2 Other skills taught using most-to-least prompts. In addition to adaptive domains, the most-to-least prompting system has been evaluated for efficiency with other skills. Researchers have evaluated the use of most-to-least prompts to teach academic skills, such as expressive and receptive language. Expressive and receptive language are important milestones for students with ASD and ID; the sooner the intervention begins using

systematic procedures, the better, since the early years are critical for future outcomes (Leaf and McEachin, 2015).

Several studies have demonstrated the effectiveness of most-to-least prompts to teach receptive and expressive language (Boulware, 2001). Most-to-least prompts were found to be effective in teaching toddlers how to receptively identify pictures (Boulware, 2001). While this study compared most-to-least prompts with simultaneous prompts, it demonstrated that most-to-least prompts were as effective as simultaneous prompts. Boulware (2001) reported that in follow-up maintenance probes, two out of the five toddlers maintained a higher number of the words learned from the most-to-least prompts procedure. This finding demonstrated that most-to-least prompts worked for some toddlers in this study.

Four children, between the ages of six to seven were taught expressive labelling using most-to-least prompts or a flexible prompt fading strategy (Leaf et al., 2016). Using a parallel treatment design, Leaf et al. (2016) report that while both procedures were effective in teaching to criterion, the flexible prompt fading procedure was more efficient for three out of the four children while most-to-least prompts were effective for one child. However, they suggested that future studies should examine the impact of these procedures by less-experienced teachers and in group settings as opposed to highly trained clinicians within a one-to-one setting. This study provides some evidence that most-to-least prompts can be supportive in teaching receptive labelling and requires further investigation with a larger sample size and real educational contexts.

Fentress and Lerman (2012) demonstrated the effectiveness of ‘No-No’ prompt compared with the most-to-least prompts in teaching basic skills to students with ASD. Students made rapid gains in mastery with the ‘No-No’ prompt because of the greater

opportunity to respond. However, all four participants learned with fewer errors and maintained skills in the most-to-least prompts in follow-up probes. Importantly, none of the above studies accompanied the systematic instruction with visual supports to deliver the teaching and thus little is known of the effects of this combination on skill acquisition.

3.7.2 Graduated guidance. Another form of systematic instruction graduated guidance (see Table 3.2), has been investigated with students with ASD and ID and other forms of developmental delay, and relies on physical prompts to shape the learner behaviours. Unlike most-to-least prompts, procedural parameters for graduated guidance rely on a single physical prompt, instead of a range of assistive prompts. The single physical prompt is used in a systematic manner, with the teacher providing assistive prompts, in the form of first, physical prompts, second, partial physical prompts and finally, 'shadowing' (i.e., following the movement of the student without touching). Prompts are provided progressively, beginning at the learner's wrist, progressing to the learner's forearm, elbow and shoulder, essentially reducing the intensity of the prompts provided to the learner as the skill is learned (Collins, 2012; Eliçin & Tunalı, 2016). The reduction of each level of prompt is established by student performance prior to each 'graduation' from one level of assistance to the next level, with the aim of transferring control to the natural discriminative stimuli present. Unlike most-to-least prompts, which uses each prompt level for a predetermined number of days, in graduated guidance the teacher may use all levels of assistance within a single session or use each level of assistance for a predetermined number of days. This flexibility and use of a single physical prompt make graduated guidance a simple procedure to adopt. Graduated guidance is suitable for students who have some skills and thus do not require high levels of assistance. This allows the educator to make judgements and adjusts the levels of support depending on how the student performs.

Graduated guidance has been investigated with students with ASD and other developmental differences to evaluate the effects on adaptive skills and a range of other skills. Daily living skills (Gardner, 2014; Denny et al., 2000; Gruber & Poulson, 2016), a key focus in this study, and parent-delivered yoga have been taught using graduated guidance as described below.

3.7.2.1 Adaptive behaviour. Using video-based instruction, Gardner (2014) taught four adolescents dish washing skills employing graduated guidance. In the multiple-baseline design (MBD) study, three of the four students acquired the skill and two of the four students maintained the skill when maintenance probes were conducted three weeks after the intervention. However, a limitation of the study was that one participant had higher adaptive behaviour scores prior to the study (Gardner, 2014), thus it was difficult to ascertain if this had an impact on his overall performance.

Denny et al. (2000) investigated the effects of parent-taught functional life skills for a 2.5-year-old child, diagnosed with Cri Du Chat Syndrome. The study demonstrated that graduated guidance was an effective way for parents to teach two important life skills, eating and rolling of a ball. Parental involvement in using graduated guidance was also effective in teaching three children with developmental delays to learn yoga (Gruber & Poulson, 2016). These studies by Denny at al. (2000) and Gruber and Poulson (2016) suggest that parents can learn graduated guidance as a systematic method to teach their children. Given that students with ASD and ID have difficulties in generalising skills, parental involvement can be useful to support students in acquiring life skills if they are trained in not-too-technical terms (Rehfeldt, 2002). Although parents were not the focus of the current study, awareness that systematic instruction such as graduated guidance can be successfully taught to and implemented by non-expert, such as parents, is a positive

indication of its potential to be taught to teachers as a tool to support adaptive behaviours such as daily living skills in the classroom.

Overall, these studies provide an evidence base for the use of graduated guidance as a systematic instruction method; however, little is understood regarding the use of graduated guidance with visual supports to support the acquisition of daily living skills in students with ASD and ID.

3.7.2.2 Other skills taught with graduated guidance. Graduated guidance has also proved efficient in promoting independent academic skills (Pelios, MacDuff, & Axelrod, 2003), use of tablets (Eliçin & Tunalı, 2016), on-task and on-schedule behaviours (Bryan & Gast, 2000) and in responding to lures of strangers (Akmanoglu & Tekin-Iftar, 2011).

For example, in a study by Eliçin and Tunali (2016) three young children with ASD were taught the use of a tablet-based schedule using graduated guidance. All three participants acquired, generalised and maintained the skill. In the follow-up survey, teachers reported that tablet schedules were easy to implement but the drawback was the affordability thus potentially limiting accessibility to students from lower socio-economic backgrounds. However, several studies have corroborated the effectiveness of both traditional and low-tech versions of picture activity schedules (PAS) (Buffington, Krantz, McClannahan, & Poulson, 1998; Krantz, MacDuff, & McClannahan, 1993).

Further, graduated guidance was used to teach three children with ASD how to respond to the lures of strangers (Akmanoglu & Tekin-Iftar, 2011). Using a multiple-probe design and teaching in a community-based setting, the students made gains in generalising and maintaining the learned skills. Parents reported satisfaction in the skills that their children learned. This is important for children with ASD because difficulties with inferring mental states and the intentions of others may limit their ability to perceive risks and

dangerous situations. Using systematic instruction methods, such as graduated guidance, may help ensure children with ASD can evaluate others and dangerous situations more independently.

Combinations of prompts have also been used with graduated guidance to teach skills of on-task and on-schedule behaviour. Using a combination of verbal and manual prompts, Pelios et al. (2003) demonstrated that three students diagnosed with ASD in a classroom setting, between the ages of five to nine, made gains in on-task and on-schedule skills. All three participants were able to generalise the skills in novel settings and with novel materials. Two participants maintained the skills after the termination of the study. However, a third participant could not be assessed for maintenance because the academic year had ended.

The aforementioned studies reveal that parents and teachers can use graduated guidance effectively to teach students with ASD and other developmental differences skills in multiple domains. However, again these studies have not evaluated graduated guidance paired with visual supports to teach the acquisition of daily living skills.

3.7.3 System of least prompts. The system of least prompts is similar to that of most-to-least prompts in that a minimum of three levels of assistive prompts is selected for an intervention. However, the system of least prompts functions in the opposite direction, from the least assistive to the most assistive prompts for the student (Collins, 2012). The increase in assistance may be provided from any three levels, for example, verbal, model and physical assistance, and is thus considered less intrusive. Unlike most-to-least prompts, in using the system of least prompts the interventionist may provide all three predetermined levels of assistance within the same session, much like graduated guidance. The aim of this

prompting system is to allow the student to demonstrate skill steps before providing assistance, and therefore, the system of least prompts is sometimes referred to as the prompt with the 'tell–show–help' rule (Collins, 2012). Essentially, the teacher, at the first instance of difficulty exhibited by the student verbally prompts the student and waits for the student to enact the behaviour. If still not correctly enacted, the teacher models the correct behaviour for the student before finally providing physical guidance, sequentially telling, modelling and guiding the student towards enacting the correct behaviour as needed. Before each level of prompt is delivered, a latency period is typically provided to allow the student to respond before a more intrusive prompt is provided. System of least prompts is effective for students who have greater skills and are able to engage in learning tasks with less assistance. This prompting system is effective for students whose baseline performance indicate that many steps of the skill have been mastered and for academic skills that are supported by step-by-step prompts.

3.7.3.1 Adaptive behaviour. The system of least prompts has been evaluated in teaching daily living skills such as telephone skills (Manley, Collins, Stenhoff, & Kleinert, 2008), cooking (Mechling, Gast, & Fields), rolling silverware (Williams, 2013) and participating in faith communities (2008, Slocum).

In a study by Manley and colleagues (2008) teaching to make a telephone call and leave a voice message to three elementary school students was investigated using the system of least prompts procedure. At the end of the study, all three students had learned the skills, demonstrating the effectiveness of this procedure. However, only one student maintained the skills above baseline levels and two students maintained some of the skill steps.

Similarly, Mechling et al. (2008) used a system of least prompts procedure to teach three young adults multistep cooking tasks. The study delivered the use of the system of least prompts via a DVD player, and at the end of the study, the participants maintained the skill. This study is significant since it demonstrated that a prompt system using technology can be an effective means of delivering prompts to teach independent life skills. Enhancing vocational opportunities is important for students with ASD and other developmental disabilities because such opportunities are linked with wellbeing outcomes. Success in developing vocational skills is built from teaching adaptive skills that have been discussed so far. In using a variation of the system of least prompts, Smith et al. (2015) used a video model to deliver the system of least prompts to three high school students with moderate ID. The participants learned office skills of collating and stapling, preparing a letter and organising a binder. An advantage of the system of least prompts being delivered using a video model was that the enactment of the procedure was consistent for all participants and provided the advantage of replaying the video to follow the system of least prompts procedure. At the end of the study, all participants learned the skills successfully, generalised the skills to new settings, and maintained the skills in follow-up probes. Similarly, Williams (2013) investigated the effects of using the system of least prompts with a video prompt delivered through the iPad to teach two students with ID how to learn the skill of rolling silverware. Using the system of least prompts within a video prompt was more effective for skill acquisition compared to video prompting alone and resulted in fewer trials to learn the skill.

Research shows that students with ASD and ID have poorer adaptive behaviour than others, which may hinder effective inclusion and in worst cases contribute to social isolation (Duncan & Bishop, 2015; Gray et al., 2014). The prominence of adaptive

behaviour in the studies described above demonstrates that the system of least prompts was effective in teaching life skills. However, much more is needed to understand the use of systematic instruction such as the system of least prompts when used with visual supports to support the acquisition of daily living skills in students with ASD and ID.

3.7.3.2 Other skills taught with system of least prompts. The system of least prompts have also been used in a range of play and school settings, teaching skills such as conversations to pre-schoolers (Filla, Wolery, & Antony, 1999), promoting pretend play (Barton & Wolery, 2010), comprehension skills and adapted read-aloud (Hudson, Browder, & Jiminez, 2014). Research surrounding the use of the system of least prompts to teach communication, play, compliance and comprehension skills has produced positive results for young students with ASD and other developmental disabilities, as discussed below.

In a study using multiple-baseline design, Filla et al. (1999) employed the system of least prompts to facilitate conversations for nine preschool children, three with a disability and six without a disability, under two conditions, environmental modifications and the system of least prompts. Children with disabilities, ranging in age from 40 months to 57 months, showed an increase in the number of conversational turns and the rate of conversation when the system of least prompts was used to develop these skills.

An extension of communication and conversations, typically occurring in dyads or groups, is pretend play, which is significant for social and emotional development in children as they engage in roles they imagine. Play skills teach socialisation, communication, negotiation and resilience, skills that are necessary in inclusive social situations and ultimately influence future success in these settings. However, children with ASD have play patterns that lack variation and are predominantly centred on preoccupations and fixations, suggesting a lack of social and imaginary play (APA, 2013).

Because children with ASD experience challenges in social and imaginary play, not providing them with support in these areas may exclude them and as such these children "are likely to remain isolated from peers and the consistent interactive play that encourages developmental growth" (Wolfberg, Bottema-Beutel, & DeWitt, 2012, p. 55).

Investigating the effects of the system of least prompts on the pretend play of four children diagnosed with ASD, aged between 30 to 50 months, Barton and Wolery (2010) examined teachers' use of the system of least prompts on imitation and pretend behaviours. This study revealed that the children maintained their pretend play skills in settings without prompts and generalised their skills to an adult that was not their teacher. Barton and Wolery (2010) concluded that systematic instructional procedures can be effective in teaching play to young children with developmental disabilities.

Academic skills have also been targeted for intervention using the system of least prompts procedure. In one study, Mims (2009) taught four students with significant intellectual disabilities text dependent comprehension skills using a system of least prompts procedure that consisted of re-reading, modelling and physical prompting in a shared story setting. The students both increased their comprehension ability immediately following a period of exposure to the system of least prompts procedure and maintained these skills at the two-week follow-up point. One of the four students was also able to generalise to two additional books.

The use of peers to deliver the system of least prompts in improving correct listening comprehension skills has also been investigated. Hudson et al. (2014) conducted a study to investigate use of the system of least prompts on participants with moderate ID using adapted science read-alouds. The study was unique in that the participants themselves directed the amount of assistance by asking for help, as and when they required it, and at

the same time self-monitored their correct responses. At the end of the study, all participants improved in science comprehension. However, intervention effect did not generalise to novel untrained lessons. The value of self-prompting cannot be underestimated because it promotes independence as demonstrated by Hudson et al. (2014).

Cihak et al. (2010) taught four participants with ASD to transition between locations and activities in a school with a video model. The system of least prompts was an indirect component of the study as a part of the packaged intervention using video modelling. When students demonstrated target behaviour versus desired behaviour, the interventionists would prompt the student to engage with the video model using the system of least prompts to redirect the student to engage in desired behaviour. The investigators demonstrated that all participants could transition independently with a video model that was incorporated with the system of least prompts; however, when the video was withdrawn the participants demonstrated a decrease in performance of independent transition skills.

Finally, in the community setting, Slocum (2016) investigated the effects of the system of least prompts within a video model to teach three participants with moderate to severe disabilities to participate in their faith communities. Results revealed that all three participants were successful in increasing the steps in a task analysis and additionally demonstrated the generalisation and maintenance of the skill. The author suggests that presence in faith community is not enough and that for quality of life, people with disabilities must be able to participate too. Studies such as Slocum's (2016) reinforce the need to consider teaching skills in aspects of life beyond life skills since it may broaden the opportunities for people with disabilities.

The studies reviewed above demonstrate that the system of least prompts has been effective in teaching daily living, play, communication and community skills to students with ASD and other developmental disabilities. Nevertheless, none of these studies evaluated the system of least prompts paired with visual supports to support the acquisition of daily living skills for students with ASD and ID.

3.7.4 Simultaneous prompts. The simultaneous prompst procedure consists of two parts that are delivered by the teacher to the student, specifically, a teaching phase in which controlling prompts are used to ensure correct responses followed by a test to assess if the skill has been learned (Collins, 2012). Typically, in the initial sessions, like in all prompting systems, baseline assessments are conducted. Simultaneous prompting begins with a probe for the skill being taught and at the first error that the student makes, the teacher proceeds to the training trial in which a controlling prompt is delivered (Collins, 2012). Simultaneous prompting differs from other prompting systems in that in all subsequent sessions, a test precedes the teaching to determine what the student has mastered so that instruction can be matched to the appropriate level of learning. In early studies, simultaneous prompting has also been referred to as the antecedent prompts and test prompting system (Collins, 2012). Simultaneous prompt may be used for students who learn skills using direct instruction such as naming letters and numbers. Simultaneous prompting is also effective in small group instruction setting.

3.7.4.1 Adaptive behaviour. Batu, Bozkurt and Öncül (2014) studied the effect of four mothers providing simultaneous prompts to teach life skills to their children, all of whom had a diagnosis of ASD. The mothers were trained in using simultaneous prompt via a video on a compact disc that demonstrated the steps involved. Target skills and generalisation skills were different. For example, one participant had a target skill of

buttoning up and in the generalisation condition, the skill of brushing teeth. Overall results demonstrated that the mothers were successful in teaching and that simultaneous prompt were a viable system of prompts that mothers could use. This study supports earlier studies that enlisted parents and families effectively (Denny et al., 2000; Gruber, 2008; Gruber & Poulson, 2016) in teaching with systematic instruction. Such success may suggest that simultaneous prompts can also be effective when used by teachers in classroom contexts.

3.7.4.2 Other skills taught using simultaneous prompts. Simultaneous prompting is another systematic instruction that has been quite extensively compared with other prompting systems. Leaf (2008) compared the 'No-No' prompting system with simultaneous prompting. Boutain (2012) taught three students with ASD receptive labelling using a parallel treatment design that compared simultaneous prompts and graduated guidance. Boutain (2012) reported that graduated guidance was more effective and efficient in teaching receptive labelling with pictures compared with simultaneous prompts. Seward, Schuster, Ault, Collins and Hall (2014) taught leisure skills to five high school students with moderate ID between the ages of 15 to 20 years. Results revealed that four participants acquired the skills for two games using simultaneous prompting and constant time delay, with equal effect.

Further, Brandt, Weinkauf, Zeug and Klatt (2016) compared constant time delay and simultaneous prompt in skill acquisition for seven students with ASD. Both were effective in teaching young students with ASD to master the targeted skills of expressive addition, expressive adverbs and adjectives, receptive picture and object identification and matching associate pictures. Similarly, Kurt and Tekin-Iftar (2008) taught four students with ASD between six to eight years the leisure skills of taking a photograph with a digital camera and turning on a compact disc player. They reported that both simultaneous

prompting and constant time delay were effective in teaching leisure skills to young children with ASD. In another comparison of simultaneous prompt and constant time delay, three students with ASD were taught how to respond to questions about personal information (Akmanoglu, Kurt, & Kapan, 2015). Results indicated that there was no significant difference in either the simultaneous prompting or constant time delay procedure. This was consistent in the acquisition, generalisation and maintenance phases of the study.

Boudreau (2013) compared simultaneous prompting with constant time delay and progressive time delay within an alternating treatments design. Results demonstrated that there was no significant difference between the three prompting systems; all three were effective in teaching Chinese characters. In this study, the author suggested that it was inconclusive to state which of these prompting systems was the more effective and efficient system of prompts.

These studies demonstrate that simultaneous prompts have had an effect in teaching a range of skills, including adaptive behaviour. Yet again, and consistent with the research gap of the current study, visual supports were not evaluated in these studies to support the acquisition of daily living skills for students with ASD and ID.

3.7.5 Time delay. Time delay typically uses a single prompt. The least assistive prompt is selected and delivered when the student is unable to provide the expected response. In the first phase, the instructional phase, a zero-second delay is provided and in subsequent trials a delay interval is introduced, ranging from one to a few seconds decided upon before delivering instruction (Collins, 2012).

There are two types of time delay, constant time delay and progressive time delay. In constant time delay, the delay interval is identical throughout, for example, three

seconds. In the first instance, the instruction and correct response is delivered. Subsequently, after the instruction is delivered, if the student does not respond, the controlling prompt is delivered at three-second intervals. In progressive time delay, the delay interval is progressively increased. After the instruction is delivered, if the student does not respond, the controlling prompt is delivered at three-second intervals. When responding is consistently correct, it is increased to five seconds; next, when responding is consistently correct, the delay is increased to seven seconds and so forth as planned by the interventionist. When the final progressive delay time is reached, the time delay is fixed for all subsequent trials.

However, in selecting and deciding to use the time delay procedure, as an error prevention strategy, the interventionist must ensure that the student has 'wait' behaviour for the controlling prompt when s/he is unsure of the answer, to prevent guessing the response resulting in constant errors (Collins, 2012). In the absence of 'wait' behaviour, the interventionist must teach the student to wait before responding. Without 'wait' behaviour, time delay should not be selected as a systematic instruction of choice since it will result in frequent errors if the student does not wait for the prompt (Collins, 2012). Time delay is effective for use when teaching discrete skills such as naming numbers. Academic skills also lend themselves to the time delay procedure.

3.7.5.1 Adaptive behaviour. Shuster (1987) taught four students with intellectual disabilities three cooking skills of making a sandwich, boiling a boil-in-bag and baking biscuits using a five-second constant time delay procedure. The students were enrolled in an integrated public high school and were taught with a model and verbal controlling prompt. All four students learned and maintained all the cooking skills, maintaining an 85% accuracy rate in a three-month follow-up. The skills also generalised to the home setting

and social validation questionnaires revealed that parents were satisfied with the new skills developed. In addition, parents reported that they would allow the participants to help in meal preparation at home. In a follow-up review of the literature, Shuster et al. (1998) found that constant time delay had been used to teach other cooking skills, such as using a stovetop and making drinks as well as making sandwiches. Shuster et al. (1998) also concluded that practitioners should be confident that constant time delay is an effective and viable instructional strategy.

Parent involvement was also used effectively in teaching the adaptive behaviour of purchasing skills to young adults with disabilities using constant time delay (DiPipi-Hoy & Jitendra, 2004). Three parent-child dyads were recruited for the study and parents were reported to successfully teach using constant time delay, a strategy that is traditionally the domain of educators. This finding is again evidence of the effectiveness of parent-delivered systematic instruction, bolstering the assertion by Rehfeldt (2002) that when parents can see the value of engaging for the benefit of their child and envision positive outcomes, they are willing partners and can be successful in teaching their children with disabilities using systematic instruction (Denny et al., 2000; DiPipi-Hoy & Jitendra, 2004; Gruber, 2008; Gruber & Poulson, 2016; Harriage et al., 2016). Together with studies by scholars such as Shuster et al. (1998), constant time delay can be seen as effective across both schooling, as is the case in the current study, and home environments.

Constant time delay has been used to teach chained tasks (Shuster, 1987), word definitions (Schuster, Stevens, & Doak, 1990), letter naming (Fleming, 1991), sight words (Knight, 2001) and vocabulary (Hughes, 2002). In addition, constant time delay has also been compared with and without instructional feedback (Apple, 2005; Ryan, 1999). Caregivers and parents have also been taught to use the time delay system (DiPipi-Hoy &

Jitendra, 2004; Sartor, 2004; Wall & Gast, 1997). Academic skills and adaptive behaviour using constant time delay are discussed in the next section.

3.7.5.2 Other skills taught with time delay. Literacy skills, such as word definitions (Schuster et al., 1990), letter naming (Fleming, 1991), sight words (Knight, 2001) and vocabulary (Hughes, 2002), have been taught using constant time delay. In all these studies, students made gains when constant time delay was used as a strategy. Mathematical skills were also taught using constant time delay. Students at risk for failure benefitted when constant time delay was paired with feedback as students made more gains in mathematical tasks (Ryan, 1999). Similarly, Apple (2005) states that when constant time delay was used with instructive feedback, students with ASD learned more efficiently, although constant time delay alone was also an effective instructional strategy.

Further, progressive time delay has been used to teach students math, (Mills, 2011; Todd, 2010), how to ask questions in an integrated preschool (Shook, 1999) and literacy skills (Browder, Ahlgrim-Delzell, Spooner, Mims, & Baker, 2009). In addition, progressive time delay has been used effectively to minimise disruptive behaviour during difficult math tasks (Heckaman, 1995), teaching sight words within and across sessions (Casey, 2008), and with and without instructive feedback (Reichow & Wolery, 2011). Delaying gratification in students with ASD to reduce challenging behaviour (Lee, 2014) was also investigated and demonstrated that progressive time delay was effective, although with a token economy system that the authors referred to as a visual cue. In addition, progressive time delay was delivered through an iPod© to students with ASD, students in general education and students with attention difficulties to teach math multiplication facts (Mills, 2011; Todd, 2010). Overall results in both groups of studies demonstrated that progressive time delay was effective, demonstrating large effect.

Reichow and Wolery (2011) compared the effects of progressive time delay with and without instructive feedback to teach three participants with ASD and one participant with developmental delays how to name pictures, name sight words and name colours in Spanish, specific to the participants' goals. Results indicate that instructive feedback was an effective supplement to the progressive time delay procedure and that it is not only effective but also efficient. In a study by Casey (2008), delivery of progressive time delay within and across sessions was also compared among individuals with cognitive delays. Skills included naming staff, words related to activities of daily living and object names. Results showed that the within session time delay was the most effective for the participants.

Progressive time delay has also been compared with other prompting systems. Shook (1999) compared constant time delay and an adapted progressive time delay and concluded that constant time delay was more effective for asking 'what' and 'where' questions. Heckaman, Alber, Hooper and Heward (1998) compared progressive time delay with a least-to-most prompting procedure during instruction of difficult tasks and reported that progressive time delay was more effective in reducing disruptive behaviour.

The above research studies discussed provide an evidence base for the teaching of adaptive behaviours, and a range of other skills, using systematic instructional systems including most-to-least prompts, graduated guidance, system of least prompts, simultaneous prompts and time delay. These studies demonstrate that these forms of systematic instruction are effective in teaching adaptive behaviour and other skills. Importantly, these studies did not compare systematic instruction with and without visual supports, a targeted research gap in the current study, and thus little is yet known about the impact of systematic

instruction when paired with visual supports on the acquisition of daily living skills for students with ASD and ID.

In the next section, studies related to visual supports are discussed. One of the primary emphases of structured teaching is harnessing the visual strength and preference for routines that students with ASD generally demonstrate, by using visuals as an asset in planning for the learning environment. Structured teaching uses the "individuals' relative strengths in visual skills and interest in visual details to supplement relatively weaker skills" (Mesibov & Shea, 2010, p. 572). Visual elements are referred to using several different terms, such as visually structured activities, visually structured tasks, picture activity schedules and some other variations. In this thesis, the umbrella term visual supports are used to refer to the several different variations.

3.8 Visual Supports: Focused Intervention Practice from TEACCH

Visual supports are antecedent materials presented visually to cue a student's behaviour. They are characterised by three essential features: (a) visual instruction, (b) visual organisation and (c) visual clarity. Visual supports help students with ASD use their visual-perceptual skills to understand the actions that they must engage in and to develop flexibility (Mesibov et al., 2006). Visual supports facilitate attention on tasks at hand and reduce cognitive load. Cognitive load is the ability of working memory to work optimally in learning tasks and heavy cognitive loads reduce the amount of attention that can be devoted to completing a task (de Jong, 2010). This will be discussed in further detail later.

3.9 Visual Supports

Visual supports are premised to be effective for students with ASD since they provide a static, non-transient input modality of information to facilitate understanding of

behavioural enactments in school, home and community, typically in areas of daily routines (Mesibov & Shea, 2010). Visual supports are considered to promote skill acquisition, skill maintenance and eventually greater independence (Hodgdon, 2011), thereby reducing reliance on other individuals. Visuals supports can be described in terms of their forms and formats as illuminated below.

3.9.1 Forms of visual supports. Visual supports may be in the form of actual, miniature or partial objects, product logos, packaging logos, digital photos, photos, symbols, line drawings, drawings from software programs and written words. Each form of visual supports can be used by itself or in combination with others, for example, a drawing from a software program with written words below it (Beukelman & Mirenda, 2013). Student learning characteristic is the main consideration in determining the forms of visual supports to be employed. Symbol comprehension should be assessed to ensure that the student links the form of the visual support to its referent. 'Iconicity' is an important factor in using visuals and is defined as the extent to which a symbol, sign or gesture represents its referent. Iconicity is described as existing on a continuum of transparent, translucent and opaque (Koul, Schlosser, & Sancibrian, 2001) with transparent meaning that the symbol clearly represents the referent and is understood, translucent meaning that the symbol is somewhat clear and opaque that the symbol is an abstract representation of the object, action or agent and thus may not be easily understood.

3.9.2 Format of visual supports. Visual supports may be presented in two different formats, 'between' schedules or 'within' schedules (Dalrymple, 1995). 'Between' schedules are temporal in nature and tell students what is happening throughout a day, and in some cases, what is happening in the present moment and what is coming up next (e.g., first and then visual supports). 'Within' schedules tell students what happens within an

activity, that is, the steps in how to engage in an activity (e.g., the steps of teeth brushing), essentially a visual task analysis. 'Within' visually structured activities or tasks are designed to support students with ASD because information is presented in a clear and meaningful step-by-step manner (Mesibov et al., 2006; Mesibov et al., 2012). The strength of visual supports is that they remain static as ever-present scaffolds for students. The emphasis of visual supports is to present information characterised by three criteria, (a) visual information, (b) visual clarity and (c) visual organisation, important for promoting learning and success (Eckenrode, Fennell, & Hearsey, 2004; Howley, 2015; Mesibov et al., 2006; Mesibov et al., 2012).

3.9.3 Visual instruction, visual clarity and visual organisation. Eckenrode et al. (2004) stated that visual instruction is concerned with helping students with ASD understand exactly what is to be done. Resultantly, because it is a system with a visible component it is presumed to promote success in activities. Visual instructions are also used to promote flexibility to help students cope with change, since it is a visually static component that the student can see (Mesibov et al., 2012). Visual organisation refers to the arrangement of visual tasks in a secure and orderly manner to minimise over-stimulation and provide visual structures that reduce complexity of tasks. Visual clarity emphasises highlighting the most important features of a task so that students understand what critical steps to follow and engage in. Eckenrode et al. (2004) have a series of books that visually depict how to complete tasks ranging from sorting and matching to life skills such as putting on sanitary liners to support independent functioning.

Ensuring that the above criteria are met is critical to the success of students with ASD for transitions and task completion. In addition, the steps to implement the use of visual supports must be clearly defined to ensure that a systematic approach is

implemented. Teaching the use of visual supports with fidelity may promote student independence (Banda, Grimmett, & Hart, 2009). The steps elaborated by Banda et al. (2009) are as follows:

1. Define the target transition behaviours for individual students—when behaviours are explicitly defined, teaching can be tailored for the student's needs and according to the ASD classification level of support.
2. Collect baseline data—this serves as a benchmark against which to compare performance as the student masters the skill of using transition visual supports.
3. Decide between or within visual supports—student's existing behavioural repertoires and support needs should be considered when deciding which type of visual supports are prioritised and explicitly taught towards mastery.
4. Mode of presentation—is decided considering the ability of the student in managing the length and type of visual support that the student must manage.
5. Medium of visual supports—the type of visual supports should be matched to the visual comprehension of the student based on a visual assessment.
6. Location of the visual support—for ease of reference and manipulation visual supports may be in a designated place in the classroom or be used as a personal support for the student, especially when the student is initially learning to use the visual support for transition.
7. Train the student—to ensure that the student experiences success with the visual support and experiences the value of using it.
8. Collect intervention data—monitor the progress of the student and provide support as needed, responding to the needs of the student.

9. Add new pictures—expanding the visual support as the student begins to master the skill of using it successfully such that the whole day is eventually predictable through the visual supports.
10. Fade prompts—transferring stimulus control to the visual support, preventing prompt dependence.
11. Fade prominence—make the visual supports as natural to the environment as possible and thereby reduce the attention it may garner.
12. Promote generalisation—ensuring that visual supports are used in every environment that they are needed and not only in the classroom.

Hume, Sreckovic, Snyder and Carnahan (2014) suggest similar steps consisting of identifying problem transition behaviours and times, selecting the appropriate type of transition visual supports from a range of low-tech and high-tech supports, implementing the transition supports and finally collecting data to troubleshoot and improve the chances of success for the student.

Visual supports have been used to teach a range of skills that often underpin successful development of adaptive or daily living skills. These include imitation training (Ganz, Bourgeois, Flores, & Campos, 2008), improving engagement levels and classroom routines (Betz, Higbee, & Reagon, 2008; Danko, 2004; Morrisett, 2015; Watson & Dicarlo, 2016), developing on-task and on-schedule behaviours (Bryan & Gast, 2000; Cirelli, Sidener, Reeve, & Reeve, 2016; G. Lopez, 2015; Spriggs, Gast, & Ayres, 2007), promoting independence (Carson, Gast, & Ayres, 2008; Duttlinger, Ayres, Bevill-Davis, & Douglas, 2013), reducing challenging behaviour (Jaime & Knowlton, 2007; King, 2015; Sanchez, 2004; Zimmerman, Ledford, & Barton, 2017), facilitating transitions (Dettmer, Simpson, Brenda Smith, & Ganz, 2000; Huls, 2017; Lequia, Wilkerson, Kim, & Lyons, 2015; Pierce,

Spriggs, Gast, & Luscre, 2013), promoting social skills (Moody, 2012), enhancing play skills (Brodhead, Higbee, Pollard, Akers, & Gerencser, 2014; Hampshire & Hourcade, 2014), reducing anxiety (Johnson, 2008), and parent training in visual support use and home engagement (Boggs, 2016; Velez, 2016) as well as development other learning areas such as physical education (Fittipaldi-Wert, 2007; Fittipaldi-Wert & Mowling, 2009; Houston-Wilson & Lieberman, 2003; Menear & Neumeier, 2015). However, these studies did not isolate visual supports to examine its effects alone. These are discussed below.

3.9.3.1 Imitation. Imitation is a window to children learning. Indeed, in the early years, through social and imaginary pretend play, children learn by observing others and imitating the behaviours observed in play, thereby facilitating early development (Wolfberg et al., 2012). Yet, it is known that children with ASD have difficulties imitating others and that imitation difficulties may precede diagnosis of ASD (Zweigenbaum et al., as cited in Vanvuchelen, Roeyers, & De Weerdt, 2011). Therefore, children with ASD are potentially at risk for delays in acquiring developmentally appropriate skills that are typically developed through imitation play, including imitating daily living skills. Imitation training is an important emphasis in curriculums such as ‘A Work in Progress’ authored by Leaf and McEachin (1999) targeted towards students with ASD. To address imitation difficulties in students with ASD, Ganz et al., (2008) evaluated the effects of a multicomponent intervention that incorporated a visual support to teach four students with ASD imitation. The visual cue was a necklace worn around the appointed peer leader for the session. The necklace had a picture and text telling students to ‘do as the leader’, who was engaging in preferred activities. The leader would perform two activities and tell his peers what he was doing, and the peer had to imitate. If there was no imitation occurring, a trainer prompted the student. The study used a MBD and is unique in that its participants were elementary-

aged school students with poor imitation skills. Results indicated that three of the four participants made improvements in their imitation skills and trainer prompting was dramatically reduced. Such studies could suggest that using visuals as a tool to support imitation of daily living skills among students with ASD may produce positive outcomes, however it must be acknowledged that in the aforementioned study some prompting was used.

3.9.3.2 Improving engagement and classroom routines. Classroom engagement may be a challenge for students with ASD because of the auditory and visually complex nature of the environment. Therefore, effective strategies must be employed by teachers to ensure that engagement is facilitated as much as possible. Betz et al. (2008) evaluated the effects of joint activity schedules on the play and engagement of three dyads of pre-schoolers with ASD. Using a reversal design, the participants were provided with a joint activity schedule with six activity choices, of which two were pre-chosen. The pre-chosen activity had a designated leader who would initiate the play with a script that was provided with the prompt 'Let's play…'. Baseline results demonstrated that while engagement levels were low, in the teaching phase there was a dramatic increase in the engagement levels of the dyads in play, which persisted at above 80% in the maintenance phase with two of the dyads requiring no prompts and one dyad requiring only one prompt.

Similarly, using a MBD, Danko (2004) evaluated the effects of visual supports on three students with ASD. The participants were between three to five years old and were involved in a routine circle time. Results revealed that overall, the levels of engagement increased compared with baseline and that the quality of the engagement also improved. Teachers could also implement a visual support system in the routines of circle time daily. Further, Carnahan, Musti-Rao and Bailey (2009) examined the effects of visual interactive

materials paired with music to study the effects of engagement levels for six students with ASD between the ages of six and 11. Results revealed that visual supports were effective for two of the six participants, and for four out of the six participants, visuals support was more effective when paired with music.

Finally, Watson and Dicarlo (2016) examined the effects of a visual support on the independent completion of classroom multiple routines for a five-year-old student who had difficulty completing kindergarten routines. Using a MBD across settings, the student's behaviour was observed in the morning, mealtime and an afternoon routine. The student's teacher provided verbal assistance in the initial introduction of the routine with the visual support to ensure that he understood what was happening. At the end of the study, the student's completion rate of routine behaviours increased by 15%, 29% and 23% across morning, mealtime and afternoon routines, respectively. Teacher prompting also reduced significantly from 25% to 3% and no physical prompts were necessary. A limitation of the study was that the latency to begin and duration to complete the task was not measured.

These studies (Betz et al., 2008; Carnahan et al., 2009; Danko, 2004; Watson & Dicarlo, 2016) are important for two reasons. First, engagement in classroom activities allows students to make progress in domains of learning, including acquiring daily living skills. Second, meaningful engagement may discourage perseverative, self-stimulatory and interfering behaviours that affect learning. Thus, emphasis on engagement behaviours should be a priority when working with student with ASD. Goodman and Williams (2007) suggested a range of strategies for increasing engagement of students with ASD, such as auditory, visual, social and physical engagement. The visual engagement strategies recommended include visual schedules and making features of a lesson salient with the use of visual supports, thereby harnessing the visual strength of students with ASD.

3.9.3.3 On-task and on-schedule behaviours. An area of challenge for many students with ASD is to remain on task and on schedule. This may be a result of not knowing what work is to be done, how much is to be done and what comes after when the task is complete. Thus, proponents of visual supports recommend that signals to support remaining on task be provided for students visually (Mesibov et al., 2012). Engagement may be a prerequisite of on-task and on-schedule behaviours. On-schedule behaviour, intended to keep students on task, is an important skill for students with ASD who may have shifting attention. Visual schedules provide an opportunity to redirect the students with additional nonverbal prompts without auditory overload for the student.

Demonstrating the effects of visual supports, Bryan and Gast (2000) studied the use of a graduated guidance (see Table 3.2) procedure to teach four students with ASD to complete classroom assigned tasks and to remain on task following a visual support. Participants were between seven to nine years old and were enrolled in a resource classroom. The visual supports were two-by-two inches and were pictures placed in an album so that at any one time, the present work that the students had to complete across the four centres was visible. The study employed an A-B-A-B design. Results demonstrated that the graduated guidance procedure was effective in teaching the use of visual supports. Importantly, following the graduated guidance condition, the students were successful in engaging and remaining on task when they had their albums with visual supports only. The skills were generalised; however, when the albums were withdrawn, there was a reduction in students' skills. Further, the students' skills also generalised to novel activities with the use of albums. Similar to many other studies, the effects of visual supports in isolation have not been investigated.

Spriggs et al. (2007) demonstrated the effectiveness of visual supports in the form of a book on the work-centre related task of four students with ID. This consisted of the following phases: generalisation, pre-test, no book, schedule instruction, book only and generalisation post-test. The visual supports were implemented using centres focused on literacy, math, computer and individualised work according to the needs of the student. Results revealed that the students' on-task and on-schedule behaviours increased significantly during the visual support condition compared with baseline. Generalisation results were also positive with all four participants generalising to novel settings and materials. In addition, in the withdrawal condition, two participants actively commented that they required the visual support books. The study also utilised graduated guidance, system of least prompts and verbal prompts. The researchers note that it would be interesting for future research to observe the effects of visual supports used only with verbal prompts. In addition, they also state the importance of examining how to fade visual supports to reduce dependence and increase independence. The studies by Bryan and Gast (2000) and Spriggs et al. (2007) both employed a range of systematic instruction procedures and future research would benefit from examining the effects of visual supports in isolation.

Cirelli et al. (2016) studied the effects of visual supports for two students aged seven and nine, diagnosed with attention deficit hyperactivity disorder, and the impact on on-task and on-schedule behaviours. During the training phase of the study, the researcher taught the participants steps to follow on the visual schedule to complete their task. Baseline data and post-teaching data were significantly different in favour of visual supports, with one participant remaining on task 100% of the time and on schedule 96% while the next participant was on task 96.2% and on schedule 100% of the time. Post-study

social validity data indicated that teachers, peers and participants had high acceptability of the intervention. However, the A-B design adopted did not demonstrate withdrawal effects of the independent variable.

Finally, Lopez (2015) examined the effects of visual supports on on-task and on-schedule behaviours for three 11 to 12-year-old students with ASD. The skills selected were activities related to sorting, matching and puzzle tasks. The researcher concluded that three out of four students in the study made significant improvements in on-task and transition behaviours; however, a drawback, as with the Cirelli et al. (2016) study, was that the research design did not include a reversal to baseline conditions and simply interpreted the increase of on-task and on-schedule behaviours as success. The researcher also reported a decrease in verbal prompts that the students received overall. Overall, the aforementioned studies show that visual supports were effective in promoting on-task and on-schedule behaviours, however prompting was used in all studies.

3.9.3.4 Independence. Gaining vocational independence is a significant achievement for any adult and especially so for adults with disabilities since it contributes to economic independence. Carson et al. (2008) evaluated the effects of vocational activity transitions between a school cafeteria and a community setting. Three young adults with ID between the ages of 18 to 20 years were taught vocational skills at a large department store. The withdrawal design utilised a B-A-B-B^1 design. The A phase was no-book condition while the B phase was a book condition and the B^1 phase was a book with a novel photo visual support. As predicted, in the A-phase performance was lower for all three participants than in the B-phase of the study, independent performance decreased. However, the participants were given verbal instruction about the task sequence prior to being given the picture activity schedules, thus, prompts were already provided.

Generalisation was achieved for all three participants with a novel photo for the visual support. Social validity results revealed that managers reported that the participants were independent at work, did not require one-to-one attention, visual supports did not make the participants stand out and the strategy was simple to implement. The study is unique in that it evaluates visual supports in a transition from school to community vocational settings and demonstrates the potential of visual supports in independent community vocational engagement.

Duttlinger et al. (2013) studied the effects of a visual support on four students with ID, between the ages of 11 to 15. The students were provided verbal prompts to create the visual support and then to subsequently complete the task as depicted in the visual support. Performance increased in the visual support condition and the skills were also generalised. In addition, the participants were also able to complete the task in the order in which they were instructed during the creation phase of the visual support. The researchers state that this is significant because some skills have a sequence prerequisite, such as sweeping before mopping, and thus, the study demonstrated that the visual support had been successful in shaping this behaviour in the students. Another advantage of the study, according to the authors, was that the students could learn to self-manage with the visual support and thus increase independence and decrease reliance, promoting self-determination. Extending the utility of activity schedules in younger children, Dugan (2006) demonstrated that schedules could facilitate skill acquisition by students with in the classroom. However, most-to-least prompts and graduated guidance was also provided in the intervention conditions, thus there was prompting involved.

3.9.3.5 Challenging behaviour. Challenging behaviours are common in persons

with ASD across the lifespan. Given the social communication characteristics that these students experience, challenging behaviour can be present in many forms, such as aggression, tantrums, self-injury and pica, a condition in which a person develops a taste for edible and inedible substances, such as ice and plastic. Challenging behaviours directed towards oneself present as self-injurious behaviour, ranging from mild to severe, such as mild scab peeling to extreme head banging. Challenging behaviours directed towards others include a range of behaviours, for example, noncompliance, nonengagement, aggression and elopement. In addition, challenging behaviours are usually idiosyncratic to the individual. Chiang (2008) stated that a high proportion of students with ASD use challenging behaviour as an expressive form of communication. Further, challenging behaviour may be present into adulthood (Matson, Sipes, Fodstad, & Fitzgerald, 2011). Thus, it is imperative that challenging behaviour be the target of interventions to prevent self-harm and consequently improve social engagement and prevent social isolation.

Kenville (2014) examined the effects of visual supports on the self-injurious behaviour of a five-year-old student with high-functioning ASD, which were present as striking himself with a forceful slap on the head, running his head into a wall and using objects to strike his head. The study employed an A-B-A-B design to introduce the independent variable of a checklist and video modelling. At the end of the four-week study, baseline rates of self-injurious behaviour (35 per week) reduced to 22 per week. This reduction was not substantial, however, because it was dangerous self-injurious behaviour, such reduction is considered important.

In another study, effects of visual supports were examined on two three-year-old students with ASD (King, 2015). The students engaged in challenging behaviours that included stomping feet, kicking and refusal to move. Baseline data were collected using

partial-interval recording, divided into five-minute intervals for only two days as the behaviours were challenging and impeding progress for the participants. Compared with the baseline phase in which the challenging behaviour was at 45% of intervals for one participant and 100% for the other, with the introduction of the visual support the challenging behaviour reduced to almost nil for both.

Visual activity schedules have also been used to manage the challenging behaviours of young children without disability **(**Zimmerman et al., 2017). Participants in the study were three students between the ages of 43 months to 52 months in two inclusive preschools. The study used an A-B-A-B design and examined the effects of teaching schedules using a constant time delay procedure. In baseline, two participants had a variable rate of challenging behaviour and one participant had challenging behaviour for 10% of the time. Overall, results demonstrated that when the visual support was introduced, the challenging behaviour reduced to near zero. When the visual support was withdrawn, challenging behaviour increased for all participants.

Students with ASD sometimes exhibit challenging behaviours because of their social communication difficulties and anxiety (Hall, 2013). Communication deficits and a lack of predictability have been reported to influence challenging behaviours. Activity schedules have been recommended as a visual support to increase predictability and decrease challenging behaviour. Overall, research has demonstrated visual supports to be effective in behaviour support for students with ASD and other developmental disabilities, and these have been successfully used to facilitate self-regulation, reduce challenging behaviour (Lequia, Machalicek, & Rispoli, 2012; Machalicek et al., 2009) and decrease self-injury (O'Reilly, Sigafoos, Lancioni, Chaturi, & Andrews, 2005).

The studies above demonstrate that one key to addressing behaviour challenges for student with ID is to reduce frustration through increasing comprehension and communication. Comprehension and communication difficulties are often addressed with the use of visual supports. Jaime and Knowlton (2007) elaborate that visual supports play two functions for students, one, for information gathering strategies, for example, the use of schedules to understand what is happening in the day and two, for empowerment strategies, for example, giving students choices, which allow them to have the opportunity for shared control in the classroom space. Ultimately, making choice is an important opportunity that every student should have and be able to experience be it in the home or school since it is an important skill in decision-making in adulthood.

3.9.3.6 Transitions. Several studies have demonstrated the effectiveness of visual supports in transitions. Transition can be a challenging experience for students with ASD and may result in difficult behaviour. Students with ASD may find the unpredictability of changes in routines, places and people difficult to cope with, and thus, the resultant behaviour may be self-injurious behaviour, noncompliance and meltdowns (Schreibman et al., as cited in Banda et al., 2009). Banda et al. (2009) recommend investing time in teaching students with ASD to mitigate behavioural challenges that may occur during transitions.

Research suggests that this can be achieved by employing visual supports. For example, Hul (2017) taught two students with ID, who demonstrated undesired behaviour during transitions and consequently had to often be removed physically, to transition with a visual timer on an iPod and iPad. Using an A-B design, baseline measures indicated that both students had high rates of disruptive behaviours. After the implementation of the intervention, the visual support on an iPod or an iPad, rates of disruptive behaviour reduced

significantly. Transition times also reduced significantly. Although the researcher states that limitations in the study were that a convenience sample was used, and disruptive and undesirable behaviours were less frequent when the upcoming activity was a preferred activity compared with a nonpreferred activity, it demonstrated that visual supports had the potential to mediate transition behaviours. In addition, it also had a positive effect on teachers in that they had to transition with the cue as well and thus had to keep to the schedule of the day.

Further, Dettmer et al. (2000) taught two students with ASD aged five and seven to transition with visual supports in home and community settings. In the study, the participants were given information visually of what was occurring at that moment and when it was going to be over. Then, they were provided with a 'finished' verbal prompt paired with the visual prompt and were subsequently showed visually what was coming up next. Using an A-B-A-B design, the researchers effectively demonstrated that the latency during transitions improved and students were able to transition effectively. Verbal and physical prompts and physical removals for one participant reduced significantly. In fact, when the study returned to baseline, challenging behaviours re-emerged, and both students engaged in tantrums. One parent implemented the visual supports system at home given the success that she had seen in her child's use of the visual support and positive impact on his behaviour.

In a study by Pierce et al. (2013) four students in a self-contained classroom diagnosed with ASD between the ages of nine to 11 were also taught to transition within a classroom between four activities during centre time. Using an A-B-A-B design, the researchers taught the students how to use the visual support, combined with a system of least prompts. Results demonstrated that students not only made significant progress in the

transition behaviour within the centre-scheduled activities but also during the between-activity transitions. In addition, the researchers reported that the participants were also able to generalise the visual support behaviour with novel activities and novel visuals. Horizontal transitions, which are daily movements between programmes, settings and environments, are another challenge for students with ASD. Johnson (2008) examined the effects of visual supports on four students with ASD. All four students made improvements in horizontal transitions with mean anxiety reducing from a baseline level of 24.09% to intervention level of 13.66%.

In a review, Lequia et al. (2015) evaluated 14 studies consisting of a total of 28 participants, ranging from one to four participants per study. The studies investigated the effects of interventions on improving transition behaviours. Of the 14 studies, seven that incorporated visual supports examined whether participants engagement increased, challenging behaviours reduced, and transition behaviours improved, including latency during transitions. In all the studies that incorporated visual supports, there was a positive impact on the range of behaviours, with the exception of one in which the participants did not show improvement in the visual support condition until a differential reinforcement of zero rates of behaviour and extinction protocol was introduced. The authors conclude that the interventions show promising effects. However, it has to be noted that social narratives, video modelling and activity schedules were part of the interventions in the studies examined in this study. In addition, the authors state that of all the studies, those that that used activity schedules did not meet quality standards, and more rigorous evaluations were needed to determine if activity schedules were effective. Thus, whether activity schedules were singularly effective remains unclear and little is yet known if it significantly impacts transition behaviours.

3.9.3.7 Anxiety reduction. There may be a link between anxiety and challenging behaviour, which is common in students with ASD, particularly in novel settings. While most studies of visual supports have been used in school settings, Chebuhar, McCarthy, Bosch and Baker (2013) used picture schedules in a medical setting to relieve anxiety in children with ASD. Each step of the upcoming medical procedure was explained to the children, for example, taking vital signs included showing the picture and instructing the child about the procedure, thus, verbal prompts were used. While, this demonstrates the importance of visual supports beyond the typical classroom and school domains, whether visual supports in itself were effective remains to be known. However, it suggests that professionals outside educational settings may be open to learning techniques that are supportive of students with ASD and ID.

3.9.3.8 Physical education. Exercise is an EBP as listed by the NPDC (2014) since there is increasing evidence that it is beneficial for students with ASD. Interestingly, the use of visual supports in the domain of physical education is an emerging area that has been studied in recent years. Case and Yun (2015) propose two types of visual supports that can be effective for students with ASD, picture task cards and picture activity schedules. Although both picture task cards and picture activity schedules are forms of visual supports, Case and Yun (2015) make a distinction that picture task cards are visual supports that tell students with ASD what actions they need to engage in, such as dancing, skipping, soccer and golfing in the example cited by the authors, while picture activity schedules tell students with ASD what activities to engage in in a sequential manner within an activity, aiding transition from one action to another, for example, jumping jack, basketball and flexibility in their example. Video modelling is another option of visual support according to the authors.

Similarly, previewing is another visual support strategy to support engagement of students with ASD in physical education activities (Grenier & Yeaton, 2011). According to Grenier and Yeaton (2011), physical educators can establish previewing in daily lessons to prepare students with ASD for upcoming physical education, as a successful practice through the following eight steps, namely, "establishing a positive relationship with educators, identifying student abilities, identifying outcomes for each unit and lesson, creating a visual lesson plan, identifying time and location, using related service providers, placing schedules in a visible location and assessing teacher practices" (p. 32).

Breslin (2009) examined the effects of a picture task card and picture activity schedules against the traditional delivery of the Test of Gross Motor Development-2, a widely used physical education assessment in schools in the United States. In the study, 22 students with ASD were identified as participants and were each exposed to each one of the three conditions, (a) traditional condition of verbal instructions and demonstrations, (b) picture tasks, and, (c) picture activity schedules, over three days. In the traditional condition, a standard instruction followed by a model was presented to the participant, as per protocol, in the picture task card, and the researcher instructed and modelled the physical activity paired with a picture task card worn by the researcher on the wrist with a ring binder. Finally, in the picture activity schedule condition, a sequence of activities was presented by the researcher on a vertical schedule board. It was hypothesised that the picture activity schedule would be the most effective adaptation to test students with ASD successfully; however, results revealed that the picture task cards were the most effective in terms of successful student engagement. As hypothesised, the traditional mode of delivery was the least effective.

Students with ASD face several challenges with physical education because of the very nature of ASD (Fittipaldi-Wert & Mowling, 2009). These include characteristics such as minimal cooperative play, desire for sameness, difficulty comprehending spoken language, minimal speech or nonverbal communication and hypersensitivity to sounds and lights, all of which make physical education demanding and may result in self-stimulatory behaviours. Physical education then seems demanding because it incorporates partner activities, constantly changes as regards to tasks and materials, is mostly verbal in nature and results in excessive noise from acoustics. Thus, Fittipaldi-Wert and Mowling (2009) suggest that visual supports in the form of schedules, spots and lines on the floor, visual boundaries on where the task is to be performed, picture task cards and picture activity schedules may be effective strategies that allow students with ASD to engage in physical education activities. In a study conducted in an inclusive elementary school, Fittipaldi-Wert (2007) incorporated concrete boundaries, picture task cards and picture activity schedules to gauge the level of on-task behaviour, off-task behaviour and amount of prompting required. At the end of the study, it was demonstrated that students with ASD were on task 63% of the time, off task 15% of the time and required prompting for 21% of the lesson, concluding that visual supports were effective. However, it was a challenge to determine the specific visual support, picture task cards or picture activity schedules that were effective per se (Fittipaldi-Wert, 2007).

In a survey of current practices and future implications for training physical education teachers, 94% of the survey respondents identified a need to learn specific strategies for teaching students with ASD, such as the TEACCH approach that incorporates visual supports heavily, in addition to the need to learn how to use prompting systems (Healy, Judge, Block, & Kwon, 2016). The need to learn specific strategies were among a

list of 17 competencies listed by experts working with students with ASD. In addition, Menear and Neumeier (2015) support the need to incorporate visual supports into physical education for students with ASD, who traditionally have lower rates of participation and engagement in physical education owing to the challenges experienced by them in these environments, resulting in a more sedentary lifestyle and obesity. Houston-Wilson and Lieberman (2003) state that "the use of visual cues rather than auditory cues allows the student to participate with minimal stress, which results in more compliant behaviour" and concludes that "students with ASD can learn and be quite successful in physical education (p. 44) if teachers make time to learn about these students" characteristics and strategies that work effectively with them.

3.9.3.9 Low-tech versus high-tech support. Visual supports utilising pictures and activity schedules as well as high-tech visuals such as through iPods, iPads and videos have been useful in working with students with ASD. Independence is a challenge for students with ASD, occasionally because of prompt dependence. Alberto, Cihak and Gama (2005) used video modelling, an extension of a visual strategy, in class and community settings to teach two groups of students, with ID and Asperger's Syndrome, to follow classroom rules. Similarly, using video modelling, Lang et al. (2009) demonstrated independence in students during the intervention and in follow-up probes for maintenance. Kagohara, Sigafoos, Achmadi, O'Reilly and Lancioni (2012) demonstrated the effective use of high-tech devices, such as iPods and iPads, to teach students with developmental disabilities.

In addition to high-tech visual supports, low-tech visual supports using activity schedules have demonstrated increased independence of students with ASD and ID. In a systematic review, Koyama and Wang (2011) identified 23 studies that support the use of activity schedules in school and home settings. The 41 participants with ASD in the review

ranged from preschool students to adolescents in vocational programmes and adults living in group homes, all of whom demonstrated increased independence. Finally, in comparing pictorial versus video modelling activity schedules, Cihak (2011) demonstrated that both were effective in helping students with ASD transition. Thus, visual supports may be easily incorporated in technology which has become commonplace in education.

The aforementioned studies that focus on the use of visual supports to develop skills such as imitation, on-task behaviour, transitions, and independence, skills that often underpin the ability to perform daily living skills, are varied in the nature to which visual supports were implemented in isolation or with some level of prompting or systematic instruction. It is therefore difficult to delineate whether visual supports in isolation or visual supports combined with some form of systematic instruction are mediating intervention outcomes. Further, less research has been conducted looking specifically at the acquisition of daily living skills using visual supports only as a mechanism of instruction, thereby presenting a research gap in which the development of daily living skills, or adaptive behaviours, for students with ASD using visual supports in isolation or visual supports with systematic instruction needs to be addressed.

3.10 Accountability in Special Education

In the contemporary era of special education that emphasises accountability through the use of evidenced-based practice, careful selection of interventions for students with ASD and ID is essential to ensure the selected interventions have evidence of effectiveness. Accountability in education refers to an individual or organisation being responsible for students' school performance in terms of educational progress and outcomes, attendance and graduation and is measured by marked improvements in these areas (Ali & Favaro,

2007). Capacity building is important and student outcomes can improve only through improving teacher practice (Ali & Favaro, 2007). Unfortunately, in special education, ASD unlike any other disability, has attracted interventions that have little evidence base (Heflin & Simpson, 1998; Iovannone et al., 2003). While there have been advances in EBPs in special education, regrettably, unproven, disproven and pseudoscientific claims continue to flourish (Travers, 2017), thereby affecting outcomes for students and inadvertently affecting accountability. However, it is important to note that intervention selection may not always be easy for teachers and parents because there seems to be an 'allure of untested interventions and treatments that promise improvements that far exceed more established and tested strategies' and thus give rise to 'unverified strategies' (Simpson, Mundschenk, & Heflin, 2011, p. 11).

In the context of Australia, the Commonwealth of Australia published the Disability Standards for Education in 2005 that outlined the guidelines for enrolment, participation, curriculum development, accreditation and delivery, student support services and elimination of harassment and victimisation for students with disabilities (Commonwealth of Australia, 2005). Specifically, the standards stipulate that reasonable adjustments (the term used in Australia to mean accommodations and modifications) must be made for students with a disability to participate and achieve learning outcomes geared towards achieving independence. This is significant since education providers (early childhood through to tertiary) are obligated to ensure that all reasonable accommodations and modifications are made for students with disabilities. It also implies that schools are accountable to the student, families, state-level education department and federal minister for education to provide effective teaching for student achievement.

3.11 Teacher Professional Learning

Given the importance of accountability in special education, it is important to discuss two issues, pre-service teacher training and in-service professional learning. This is because the quality of teacher training can have a significant impact on teacher practice, student outcomes, and future success for students with ASD and ID in the classroom.

According to research, pre-service teacher education programmes have been less than optimal in training teachers to use evidence-based practices when working with students with ASD in the classroom (Barnhill, 2011; NRC, 2001, Scheuermann et al., 2003, Simpson, 1995; Simpson, 2003; Simpson, 2005). For example, Scheuermann et al., (2003) reported that many educators of students with ASD were unaware of specialist teaching strategies and consequently did not have expertise in these strategies. As such, they were more likely to seek training in a piecemeal manner to resolve specific issues when working with students with ASD instead of attending on-going and supported training aimed at building teaching capacity in EBPs. Even when teachers are certified in working with students with special educational needs, because of the non-categorical nature of such certification and given the highly individualised nature of ASD and academic needs, training does not necessarily translate into being qualified to use a range of EBPs or FIPs to meet the individual needs, including daily living skill needs, of students with ASD (Scheuermann et al, 2003). Hess, Morrier, Heflin and Ivey (2008) indicate that a lack of teacher knowledge on how to best instruct students with ASD can be attributed to a potential limited scope of pre-service training content, preference for a single-theory approach to training which ignores the individuality and diversity of students with ASD, and possibly the most dangerous issue, unproven interventions.

Increasingly, the pressure on teacher education has been to better equip educators for students with ASD. In response to over two decades of criticisms that institutes of higher education are not sufficiently training teachers, colleges of education have increased pressure to demonstrate effective training for pre-service teachers (Leko, Brownell, Sindelar & Kiely, 2015). Barnhill (2011) examined the training content of institutes of higher education and reported that there were inconsistent expectations of competencies from educators, even though common emphases of training included areas such as characteristics, definition and causes of ASD, assessment, positive behaviour support, functional behaviour assessment and behaviour support plans. While these are important and effective areas, it does suggest though that when it comes to students with ASD, interventions tend to focus on addressing behaviour challenges predominantly as these topics reveal. Additionally, Barnhill (2011) stated that individual participants attending these courses suggested topics in ASD interventions such as discrete teaching trials that are perceived to be important. Despite this, there were significant range in providing specific intervention techniques for educators, underscoring that effective intervention strategies were lesser emphasis than those for behaviour. Thus, teacher education in ASD interventions while important, has had its own limitations. Until such time when teacher education can meet acceptable standards effectively, and deliver balanced behavioural and educational intervention strategies, there will be an increasing need for continued professional learning for educators of students with ASD.

In traditional spheres of education, professional development has been the mainstay of teachers' learning. Professional development typically consisted of seminars, lectures and conferences, usually outside of school hours and separated from authentic teaching and learning environments (Fullan, 2007). While professional development is important and

historically had a role to play in teacher development, Fullan (2007) argues that professional development as a term and practice has run its course. Fullan's (2007) astute observation is important and relevant because traditional professional development structures have been predominantly distant from actual settings and passive in terms of participation and as such "can never be powerful enough to alter the culture of the classroom and school" (p. 35). The link between what is learned and what is to be practiced is disjointed because of the lack of reciprocity between receiving training and applying interventions under direct guidance.

On the contrary, professional learning, the evolution of professional development, proposes a format of teaching and learning practice in authentic settings. This implies that professional learning is site-based, interactive, espouses high standards and consequently promotes expectations of accountability. The reciprocal nature of such professional learning between experts and educators is significant for applying pedagogy that matters. This format of professional learning is more so important for teachers of students with complex needs such as ASD and ID. Traditional professional development may not suit the needs of these students. It is vital that professional learning be a vehicle to change pedagogical practices of educators of students with ASD and ID.

Desimone (2009) argues that rather than the type of teacher professional learning, the critical features of professional learning are more significant. Desimone (2009) defines critical features as "those characteristics of an activity that make it effective for increasing teacher learning and changing practice, and ultimately for improving student learning rather than the type of professional activity" (2009, p. 183). These features are content focus, active learning, coherence, duration and collective participation. Arguably these critical features, are even more important for students with complex needs, such as students with

ASD and ID, because these students require specialised, evidence-based interventions that may not be readily learned by educators. Content focus, active learning, coherence, duration and collective participation can only be facilitated with the support of pedagogy experts, to enhance effective mastery by educators so that they may support behaviour and learning for students with ASD and ID better. Moreover, armed with knowledge and practice, increases the likelihood that trained educators may then co-teach and guide teacher aides effectively. Glashan, Mackay and Grieve (2004) reported that teachers found it difficult to lead class support personnel in working with students with ASD when they themselves had limited knowledge of ASD interventions. In fact, while school personnel tried to accumulate and broaden their knowledge in ASD, the providers of the knowledge themselves did not have experience in ASD. In particular, one reported response revealed that "one-off sessions with specialist teachers and speech and language therapists from the local ASD service often contained too much information and did not have a context to make them meaningful" (p. 58). Kucharczyk et al. (2015) reported that practitioners, parents and key stakeholders revealed a range of issues that affected students with ASD in high school. These were: (a) awareness and knowledge of ASD (b) responding to the challenges of diversity within the ASD, (c) ineffective and inefficient interventions thus affecting the needs of the students and, (d) barriers to professional development such as time constraints, buy in and pressures to address standards. Further, to address these issues, the authors stated that several challenges have to be addressed, specifically, intentional coordinated efforts to address the needs of students with ASD, research-based implementation of practices to avoid a one size fit all approach to intervention and most importantly, professional learning that is effective and promoted the educational and transition needs of students. In ASD intervention, these fit with the findings of Bevan-

Brown et al., (2012) that suggested the effectiveness of ASD professional learning had several characteristics, “team interaction; cultural relevancy; expert facilitation; integration of PD with the child’s intervention; translation of theory into practice; provision of time for reflection, practice and action; and the application of learning to an authentic context” (p. 631).

Taken together, the studies by Bevan-Brown et al., (2012) and Kucharczyk et al., (2015) amplify the urgent need for professional learning to address the problems within educational systems that require a systematic response. These issues need to be addressed so that educators select impactful strategies in teaching students with ASD and ID. Begeny and Martens (2006) reported that while behavioural based interventions were effective for students with ASD, elementary school teachers and special educators reported receiving little training in these areas. In particular, assessment and instructional programmes were most lacking and even though special educators received more training in these areas than general educators, the training was overall still limited. Furthermore, Kratochwill, Volpiansky, Clements and Ball (2008) in discussing the importance of professional development for teachers, assert that teacher variables on student learning is second only to home factors. In short, teacher learning improves student learning. Considering the issues raised (Barnhill, 2011; Begeny & Martens, 2006; Bevan-Brown et al., 2012; Kucharcyzk et al., 2015) the recommendations for personnel preparation by Scheurmann et al. (2003) more than a decade ago continues to remain relevant today: (a) equipping teachers with specialized skills at university teacher training level by incorporating ASD specific knowledge and skills and providing sustained in-service training guided with practice, feedback and follow-up coaching, (b) training teachers in multiple effective approaches that emphasise research e evidence (c) preparing personnel from a range of professions

including allied health professionals, (d) preparing teachers to guide paraprofessionals and in-home trainers whom students with ASD are more likely to spend time with, (e) training parents and providing feedback and on-going coaching, (f) providing on-going technical support to teachers, and, (g) providing leadership and funds for continued personnel preparation. If these recommendations and training practices are adopted, programming educational interventions can be holistic, encompassing multi-level personnel and family within a composite training model, emphasised in principles of ABA..

One approach to this would be to address the issues discussed above and scale up pre-service and in-service teacher training into a mode that is vested in a practice-based model. Characteristics of a practice-based model include tutoring, coursework, field experience, lesson study, peer coaching and a bug-in-ear approach to feedback to teachers (Leko, Brownell, Sindelar & Kiely, 2015). Such high expectations from professional learning, while demanding, may very well be the approach teachers who work with students with ASD and ID require in adopting and practising EBPs such as systematic instruction and visual supports with fidelity.. Furthermore, Leko, Brownell, Sindelar and Kiely (2015) suggest that investing in this competency-based approach would require several facets of reconceptualization in teacher professional learning: (a) practice-based framework for effective teaching, (b) high leverage practices, (c) using science of learning to support this competency-based training (comprising interleaved and distributed practice, authentic content and contexts and self-assessment), and (d) aligning personnel preparation with the science of learning (comprising deliberate scaffolded opportunities for practice, structured tutoring, coursework and field experience with feedback and reflection opportunities and coaching and collaboration). These would move special education personnel preparation away from training in broad areas with little guidance, to specific,

identifiable practices. Educators may then develop mastery in pedagogy from field experience and experienced cumulated over years of practice. In other words, policy and practice changes are needed to professionalise special education and general education collaboration and skills advancement, without which it would be difficult to develop impactful strategies for students with ASD and ID.

Finally, in addition to pre-service teacher training and in-service teacher training challenges, knowledge utilization proponents add that bridging the theory and practice gap may be challenging if the quality, reach and maintenance of a practice is not well executed. Cook and Odom (2013) described the problems of learning EBPs as getting out of the frying pan into the flame because while EBPs have been identified, the research to practice gap remains. Furthermore, Fixsen, Blase, Horner and Sugai (2009) asserted that identifying an EBP is much easier than learning to implement it effectively. This suggests that while there are effective approaches, how it is translated and scaled up for teachers to use as a practice remains a challenge to be addressed. Adopting the multi-tiered systems of support (MTSS) model, in which positive behavior support and response to intervention is blended may be an effective framework that schools can adopt. In this model, the aim of improved student outcomes is achieved through adoption of programs that are effective, efficient, equitable and sustainable, driven by appointed enablers within the school system (McIntosh & Goodman, 2016). While pre-service teacher training and professional learning may improve outcomes in teacher quality, a sustained approach to implementation of learned EBPs by educators may have better outcomes if situated within a tiered framework of prevention, early intervention and intensive support. Collectively, pre-service teacher training, in-service professional learning delivered as a competency-based model and

situated in a MTSS framework may promote accountability in serving students with ASD and ID.

3.12 Selection of Adaptive Behaviours in This Thesis

Adaptive behaviour is a critical factor in independence and social inclusion. Generally referred to as life skills, adaptive behaviours contribute to, and affect one's ability to engage in five broad areas, "self-care and domestic living, recreation and leisure, social interaction, employment and community participation" (Clark, as cited in Chiang, Ni, & Li, 2017, p. 1113). Skills in adaptive behaviour may improve quality of life in general and prevent social isolation. In addition, for parents, it may reduce burden of care and stress.

ID has debilitating effects on adaptive skills (Mouga, Almeida, Café, Duque, & Oliveira, 2015) and this gap exists into adulthood (Kraper, Kenworthy, Popal, Martin, & Wallace, 2017; Matthews et al., 2015), thus requiring lifelong intervention. While it is evident that intellectual functioning is an advantage in adaptive skills, several authors have reiterated the gap between intellectual functioning and adaptive skills in ASD (Duncan & Bishop, 2015; Mouga et al., 2015). Parents have also reported the need for continuous training after leaving high school in the following areas: "using transportation, home care skills, financial issues, self-care skills, relationship skills, parenting skills' and 'self-advocacy" (Chiang et al., 2017, p. 1117).

The literature discussed in this thesis has highlighted the positive influence of various forms of systematic instruction on the development of life skills for students with ASD and other developmental disabilities. Similarly, research on the effectiveness of visual supports, often paired with a form of systematic instruction, to improve life skills has also

been reviewed. Importantly, there is a lack of research evidence, as outlined in this literature review, to effectively ascertain whether visual supports in isolation are sufficient to support the acquisition of life skills, or whether visual supports require systematic instruction to effect the acquisition of life skills for students with ASD and ID.

In this thesis, the life skills selected were daily living skills appropriate for school-aged children with a dual diagnosis of ASD and ID and considered a need by parents and teachers, implying such skills are important for developing independence of the students by their support network. Increasing independence with daily living skills through the use of visual supports or visual supports plus systematic instruction has important implications not only for students with ASD and ID but also functional curriculum implementation within special education environments.

3.13 Summary of the Literature

In the aforementioned literature it is clear that an important research gap exists. That is, many of the studies that have examined visual supports have also employed some form of systematic instruction, making delineation of whether visual supports in isolation an effective instruction strategy on are their own, particularly in classroom contexts, unclear. In addition, many studies that have focused on daily living skills, or adaptive behaviours, using various forms of systematic instruction have generated positive results for students with ASD and other developmental disabilities. Less is known about whether visual supports only can generate similar positive results. Similarly, Knight et al. (2015) has also called for the examination of the use of visual supports without systematic instruction to determine its effects on skill acquisition. This is particularly important for students with ASD who have ID and may require either moderate (level 2) to extensive

(level 3) supports. The discussion of the literature so far has established that systematic instruction has been effective in teaching a range of skills to students across ages from early childhood to young adulthood, in multiple domains, such as communication, play, academic skills, adaptive behaviour and vocational skills. Thus, it may well be argued that systematic instruction may have a mediating impact on the skills of students with ASD and ID and the extent of the effectiveness of visual supports in the studies must be interpreted judiciously. In addition, as Howley (2015) states, it is evident that most studies that discuss the use of visual supports, have focused on learning behaviour such as on-task, on-schedule and transition behaviours predominantly and have failed to examine its impact on learning other skills.

This study aims to address a gap in the literature by being one of the first studies to evaluate the effect of visual supports in isolation and visual supports plus systematic instruction on the acquisition of daily living skills for school-aged students with ASD and ID. Understanding whether visual supports alone, or whether a form of systematic instruction is needed to accompany visual supports, is important for understanding how FIPs need to be arranged within classroom and school curriculums to support students with ASD and ID.

Chapter 4: Methodology

This chapter discusses the methodology employed in this study, specifically research design, participant recruitment and description, settings, daily living skills selected, materials, research procedures, randomisation procedures, data and statistical analysis.

4.1 Research Design

A multiple-baseline comparative-intervention (MBCI) design (Ferron & Levin, 2014) was employed in this thesis to evaluate the effect of visual supports in isolation and in comparison, to visual supports plus systematic instruction (i.e., the independent variables) on the acquisition of a daily living skill (i.e., dependent variable), as measured by the percentage of steps completed independently when performing daily living skills. The eight participants in this thesis either received visual supports in isolation (VS) or visual supports plus systematic instruction (VS+SI) to teach the acquisition of daily living skills. From here on, the two intervention conditions will be referred to as VS and VS+SI.

The MBCI design is used in single-case intervention research in which experimental control is demonstrated within the participant who receives both the control and experiment conditions (Bailey & Burch, 2002; Kennedy, 2005). Experimental control is demonstrated if change is observed during intervention conditions with no change observed during baseline conditions. Ferron and Levin (2014) state that the MBCI design possesses “high scientific credibility” (p.180) and should be an attractive option for researchers. The MBCI design was selected as it allowed for comparison between two interventions and incorporated randomisation and randomisation tests to strengthen the internal validity of the study.

While comparative designs, such as the alternating treatments design (ATD), were considered and would have allowed a comparison of two interventions within the same participant, it was difficult to find two different adaptive skills of similar difficulty level across several individual participants which is necessary for the ATD.

With the MBCI design rather than alternating treatments within each participant, each treatment is randomly assigned to a participant within a unit for comparison. In the MBCI design used for this thesis, participants were grouped as units (i.e., two students per unit) with each participant in the unit being exposed to a different independent variable (i.e., VS or VS+SI). In doing so, the MBCI design allowed a demonstration of the effects between VS versus VS+ SI. This design would enable the research questions in this thesis to be addressed, in particular, which condition, VS or VS + SI, was more effective in the acquisition of daily living skills for students with ASD and ID, or whether no notable difference existed between the two interventions. This is a key research gap in the ASD literature. It also incorporated three types of randomisation, intervention start point randomisation, intervention randomisation and case randomisation, and allowed for statistical analysis (Levin et al., 2014). From the eight participants recruited for the study, four units (two participants per unit) were created. The unit pairs were matched based on the skills selected for intervention and participant performance during the baseline phase. This ensured that each participant in the unit had similar baseline skill levels. Once the units were created, the Excel Package of Randomization Test (ExPRT, version 2.1; Levin et al., 2014) software, the earlier version available at the time, was used to ensure randomisation of intervention start points. ExPRT is a Microsoft Excel package that consists of macros conducting randomisation tests for statistical analysis, and it calculates effect sizes and provides graphs for visual analysis for single-case experimental designs.

Using the MBCI design, several methodological phases were undertaken including participant recruitment, establishing inclusion criteria for participants, identifying the study setting, selecting daily living skills and study materials, justification for the experimental design and associated independent and dependent variables, selecting intervention procedures and data collection methods, inter-observer agreement, ensuring procedural fidelity and finally, selecting a data analysis methodology. These are described in the following sections.

4.2 Recruitment

Prior to recruitment, the study was approved by the Flinders University Social and Behavioural Research Ethics Committee (Appendix A) and the South Australia Department for Education and Child Development (Appendix B). Two special schools in South Australia that support students with ASD and ID were identified as potential sites for this study. The principals from these two special schools were approached to seek their interest in being involved in the study. Following initial contact via email, a face-to-face meeting was arranged. During this meeting, research processes, researcher commitment and school commitment were explained to the school principals and heads of department. They were provided an opportunity for questions and answers to clarify any questions and also comment on any proposed research process. When verbal ‘in-principle’ approval was obtained, official letters with introduction of the researcher (Appendix C), study information sheet (Appendix D) and participant consent forms were sent to the principal (Appendices E and F).These were distributed by the principal to the staff and subsequently teachers and teacher aides who consented to participate returned the forms to the researcher through the head of departments from each school.

4.3 Participants

Two groups of participants were recruited for this study, namely, the students receiving the intervention and the teaching staff. The teaching staff comprised teachers and teacher aides who taught and supported the participants daily. In both special school settings, classroom teachers were the same across the week; however, several teacher aides were present across the week in each classroom to support these teachers. Teacher aides varied across the school according to the needs in classrooms and variations in employment fractions.

In addition, some students required the support of specific teacher aides for specific activities, and thus, the classroom would have several teacher aides. All teacher aides were briefed by the teachers on the daily curriculum in the classroom and were very familiar with the classroom and the type of supports to be provided. Supports were provided either inside or outside the classroom, depending on student needs.

A total of eight student participants were recruited for this study. The participants were selected from among students with a range of special education needs. Inclusion criteria for the students were as follows: (a) age between five to 21 years, (b) a diagnosis of autism, (c) concomitant ID, (d) ability to communicate intentionally and (e) ability to use symbolic communication. Specifically, results of the visual comprehension assessment to determine the level of symbolic communication was used to determine whether participants met this inclusion criterion. The results of the visual comprehension assessment are described in the pre-baseline section further below (p.111).

Based on these inclusion criteria, all teachers were asked to recommend students with a diagnosis of ASD and ID to participate in the study. The teachers from the two

schools nominated a total of nine students. Four participants were nominated from one setting and five participants were nominated from the other setting, recommended based on the teachers' prior knowledge of the participants daily living skills and their belief that these students would benefit from the study to investigate pedagogy for improving daily living skills. Following these nominations, parental consent was sought resulting in a final participant size of eight. The letter of introduction, information sheet for the study and parent and teacher consent forms are attached as Appendices C, D, E and F, respectively. Table 4.1 summarises the participants' information.

Table 4.1

Summary of Participants' Information

Participants	**Age**	**Gender**	**Race**	**Communication System**
Levi	6y 8m	M	African	Speech
Jay	9y 10m	M	Caucasian	AAC (Photographs)
Ollie	10y 4m	M	Caucasian	Speech
Tom	11y 2m	M	Caucasian	AAC (ProloQuo2Go)
Ben	13y 2m	M	Caucasian	Speech
Trent	13y 4m	M	Caucasian	AAC (Proloquo2Go)
Jason	14y 10m	M	Caucasian	Speech
Eli	14y 3m	M	Nauruan	Speech

Note: All participant names are pseudonyms to protect their identity. 'AAC' indicates that the participant uses an augmentative and alternative communication system to communicate.

4.4 Participant Description

Participants' descriptions consist of basic demographic information, types of communication they used and general characteristics. Information was obtained from teachers and researcher observations of participants during two weeks of pre-baseline visitations. These visits were undertaken so the researcher could develop a rapport with

participants, become familiar with classroom routines and observe student skills. Formal assessments, such as psychological, speech and language, and diagnostic reports, could not be obtained by the researcher owing to confidentiality restrictions imposed by the state education authority. However, in the state in which the research was conducted, students enrolled in special schools must have a verified ID. All participants had been diagnosed with ASD and ID with no physical disability. A description of each of the participants follows.

4.4.1 Levi. At the time of the study, Levi was 6.8 years old; he is of African descent. He was very passive although eager to participate when prompted. He looked forward to participating in most school activities.

4.4.1.1 Social communication and social interaction Levi spoke English as the language of communication and was able to communicate using partial sentences to have his needs and wants met. Levi predominantly used single words or short phrases. He has good receptive language. He enjoys participating in classroom activities although he had difficulty waiting for his turn or waiting to participate in preferred activities. When he does not want to wait, he becomes visibly upset and may pout and cry. Although Levi uses speech to communicate, when upset, occasionally he is unable to communicate.

4.4.1.2 Restricted, repetitive patterns of behaviour, interest or activities. Levi does not have any significant restricted, repetitive patterns of behaviour. However, he was easily distracted by the video camera and fascinated by the real-time screen display.

4.4.2 Jay. Jay was 9.10 years at the time of the study. He is Caucasian and has good receptive but limited expressive language. He appears aloof although he is very aware of changes in the classroom. He was able to adjust items in the classroom that were out of place.

4.4.2.1 Social communication and social interaction. His communication was supplemented with a low-tech augmentative and alternative communicating system consisting of pictures and symbols, available on a board in the classroom. He comprehends the photographs but does not comprehend symbols, particularly unfamiliar and abstract symbols such as those for emotions. He also displays high levels of idiosyncratic vocalisations.

4.4.2.2 Restricted, repetitive patterns of behaviour, interest or activities. Jay engages in fleeting movements across the classroom and has difficulty remaining in the same place for reasonable amounts of time. He engages in vocal repetitions that appear as self-stimulatory behaviours. However, when engaged in a preferred task, for example sorting and classifying photographs, he can remain engaged for extended periods. He will engage in the same preferred tasks repetitively by undoing and redoing the sorting activity. Interrupting him may lead to displays of extreme screaming and crying behaviour since he is persistent and perseverative with these tasks.

4.4.3 Ollie. Ollie was 10.4 years at the time of the study. He is Caucasian and enjoys communicating verbally, occasionally using very mature adult-like language. He engages with his peers and teachers well, although he prefers adults and teachers because they are responsive to him.

4.4.3.1 Social communication and social interaction. Ollie is a pleasant and polite individual and is generally happy. However, when a task is difficult, he is unable to communicate his need for assistance or activity termination and may remain quiet or cry. The researcher frequently checked Ollie’s desire to participate to ensure it was voluntary. This meant that on some occasions, the session was terminated.

4.4.3.2 Restricted, repetitive patterns of behaviour, interest or activities. Ollie does not have any repetitive behaviours but may engage in verbose discussions on his topics of interest, for example, a game he played on the weekend. He becomes excitable during conversations and is unable to terminate appropriately. He exhibits idiosyncratic behaviours such as jumping and hand flapping that stops within seconds. This signals that he is not ready to engage in the activity.

4.4.4 Tom**.** Tom was 11.2 years at the time of the study. He is Caucasian and was learning to communicate with a speech-generating device, an iPad with Proloquo2go, which he attempts to use in some environments.

4.4.4.1 Social communication and social interaction. Tom engages in frequent vocalisations and communicates by leading adults by the hand to meet his needs and wants. While he is reported to use Proloquo2go to communicate, it was observed that he will do so only with his teacher but not with the researcher until he is prompted to do so. His receptive language is good, and he will attempt to use his augmentative and alternative communication (AAC) system when prompted but may do so inconsistently across the day. His communication device was not always available for access.

4.4.4.2 Restricted, repetitive patterns of behaviour, interest or activities. Tom is easily distracted by things in his environment and will wander around his classroom or outdoors attending to these distractions. He has an intense interest in gadgets, such as his iPad, and was fascinated by the video camera used in some of the sessions, frequently grabbing it and playing with it. He was able to operate the video camera without being taught (i.e., he could delete files and adjust settings) and would view the environment through its viewing frame.

4.4.5 Ben. Ben was 13.2 years at the time of the study. He is Caucasian; he communicates verbally and enjoys having conversations with like peers, such as Ollie.

4.4.5.1 Social communication and social interaction. Ben appears as a somewhat formal communicator, being very polite and making sure that he apologises when he perceives that he has made mistakes. He will remind himself that it is important to be polite; however, the manner in which he says it suggests it is delayed echolalia that serves a self-reminder. He expresses his needs well and generally will talk with adults more than his peers because of his mature language and mannerisms. During the intervention sessions, if Ben did not know how to tie his shoelaces at specific steps he would request to return to class and if encouraged to persist he would withdraw, remain silent and not continue with the activity. This would subsequently result in immediate termination of the session to prevent him from becoming upset.

4.4.5.2 Restricted, repetitive patterns of behaviour, interest or activities. Ben did not display any overt repetitive behaviours. However, his conversations were limited to his topics of interest. When prompted to talk about a new topic, he would do so briefly and eventually return to his topics of interest. He exhibited brief hand flapping when anxious.

4.4.6 Trent. Trent was 13.4 years at the time of the study. He is of Caucasian descent; he communicates verbally with single words, but selectively. He used an iPad with ProloQuo2Go as an AAC system to supplement his language although he required prompts for consistent use.

4.4.6.1 Social communication and social interaction. Trent rarely communicated using speech or his AAC system. When he does engage in verbal communication, it comprises mainly of immediate and delayed echolalia, for example, he will echo behaviour-specific praise that the researcher used during the study, such as ‘good job brushing’. He

would frequently move to the teacher aides present during the session and hold their forearm. This was interpreted as a desire to terminate the session.

4.4.6.2 Restricted, repetitive patterns of behaviour, interest or activities. Repetitive behaviours observed in Trent included a fascination with his reflection. He would place his face close to the mirror and engage in making facial expressions as if engaging in visual self-stimulatory behaviours. When prompted to stop he would persist, which sometimes led to termination of the session.

4.4.7 Jason. Jason was 14.10 years at the time of the study. He is Caucasian and communicates using speech. He likes to be independent and help at the school.

4.4.7.1 Social communication and social interaction. Jason is shy and takes time to interact with unfamiliar people. For example, he whispered and paced around the periphery of the classroom, avoided eye contact and engaged in self-talk. On occasions, this lasted up to 20 minutes until he was ready to engage in tasks.

4.4.7.2 Restricted, repetitive patterns of behaviour, interest or activities. Jason did not engage in any repetitive behaviours, but he did have a fascination with topics of interest, such as basketball games, which he usually played during his break. His intense interest meant he would discuss the same topic or incident repeatedly. Attempts to change the topic were generally unsuccessful, only terminating when the bell ended the session.

4.4.8 Eli. Eli was 14.3 years at the time of the study. He is of Nauruan descent and communicates using speech typically limited to single words, but very selectively.

4.4.8.1 Social communication and social interaction. Eli's communication was usually one or two words even though he could use short utterances to communicate. He occasionally has echolalia of letters of the alphabet he was learning during his literacy programme. He communicates by looking at the person and titling his head to one side and

repeating their name, for example, he would repeatedly say ‘Raj’, stating the researcher’s name, but was unable to articulate anything more. When asked how he was or what he was doing to redirect him, he would say ‘Raj’ repeatedly. Finally, when he was ready to work he would say ‘shaving’ and walk out of the classroom.

4.4.8.2 Restricted, repetitive patterns of behaviour, interest or activities. Eli had interest in limited topics that he had difficulty articulating. For example, after applying shaving foam to his face, he would perseverate on being a zombie with foam on his hands, moving towards the researcher while engaging in zombie-like behaviours echoing ‘I zombie’. Redirecting him was difficult and occasionally when he was redirected, he would continue with the behaviours towards his own reflection in the mirror. On occasions, he would say ‘Eli go back’ which meant he wanted to terminate the session and return to the classroom.

4.5 Teachers and Teacher Aide Participants

After each school principal provided consent for this study to be conducted at their site, and prior to students being recruited, teachers and teacher aides were invited to learn about the study and to provide their individual consent to participate. Teacher and teacher aide involvement in the study required supporting the researcher to recruit student participants, as described previously, to enable baseline observations, facilitate researcher implementation of VS and VS+SI, and to view videos of the participants prior to and after receiving the intervention. They were informed that they would be required to complete a five-point Likert scale survey and answer some open-ended questions. Participating staff were informed that they may choose not to answer the open-ended questions, if they so

decided. A total of 24 teachers and teacher aides consented to participate in this study. Teacher and teacher aide consent forms are attached as Appendix F.

Teachers working in the research school settings held qualifications in general education, special education or early childhood education and are required to be registered with the Teachers Registration Board of the state. However, qualifications in special education are not compulsory for working in a special school. Teachers are also required to complete Mandatory Notification Training referred to as Reporting Abuse and Neglect: Education and Care course.

Teacher aides working in the research school settings hold a certificate-level qualification in education support, a required training to work in school settings. The training allows the teacher aides to work under the broad supervision of teachers. Similar to teachers, teacher aides are also required to complete Mandatory Notification Training. On completion of both training sessions, teacher aides are granted a support officer number by the Department of Education that allows employment in school settings.

4.6 Settings

The settings for the study were an independent (i.e., private) special education school and a government (i.e., public) special education centre that enrolled students with multiple disabilities, including ASD and ID. These settings were selected because they enrolled the specific population targeted in this study, namely, students with ASD and ID. A criterion for enrolment into both the schools is a psychological assessment, following which a recommendation to a school for students with a disability is made by a Psychologist. The two settings are described below using pseudonyms:

4.6.1 Stuart Park Specialist School. Stuart Park School is an independent, nondenominational school that enrols students with intellectual and multiple disabilities between the ages of five to 21. At the time of the study, it had a full-time enrolment of 68 students; 43 boys and 25 girls, spread across four programme levels: junior, middle, senior school and a transition-to-work group. Of the school student enrolment, 1% was composed of students with an indigenous background while 2% of the school students were speakers of languages other than English.

The school had 15 teaching staff and 29 nonteaching staff consisting of school leaders (i.e., principals and heads of department), teachers, teacher aides and allied health professionals. Allied health professionals, including a speech pathologist, an occupational therapist and a physiotherapist, supported the provision of an interdisciplinary approach to intervention and educational programming.

Each classroom consists of six to eight students, led by one teacher and supported by one or two teacher aides. Each student had an individual education plan (IEP) developed in close collaboration with the student's family members or guardians. IEPs were in areas of life skills curriculum, combining academic instruction in numeracy and literacy, daily living, personal and social skills and work-ready skills.

Stuart Park School has a positive atmosphere with its emphasis on student-centred approaches and adopts a curriculum with multiple opportunities for community-based learning through activities such as horse riding, swimming, kinder gym, library trips and participation in community events.

4.6.2 Stella Park Special School. Stella Park Special School is a public-school enrolling student from ages five to 18. The school student population is very diverse comprising of students with indigenous background, non-English speaking background and

single-parent families. At the time of the study, the school had a full-time enrolment of 70 students; 52 boys and 18 girls, in three levels, junior, middle and senior school. The senior level students were also part of a transition-to-work group. Eleven per cent of the school student enrolment consisted of students with an indigenous background.

The school had 13 teaching staff and 21 non-teaching staff. Of the 21 non-teaching staff, 14 were full-time equivalent staff and seven were part-time staff. These were school leaders, teachers, teacher aides as well as allied health professionals. The school is not supported by an in-house speech pathologist, occupational therapist or physiotherapist. Students who required these services had private services that their parents engaged. However, these private services could be delivered during school hours. Some students had regular access to allied health support as part of their learning.

Stella Park emphasises numeracy, literacy, communication and AAC systems within a supportive school culture and an emphasis on developing these skills for optimal future outcomes. As the literacy, communication and AAC systems programmes are a major emphasis of the school, teachers in the school are supported by an expert consultant speech and language pathologist who is also a literacy teacher.

4.7 Daily Living Skills Selected

Daily living skills were selected for instruction in this study. Evidence suggests that students with ASD and ID often need support to develop sufficient independent daily living skills for adult life. This gap often exists even for individuals with autism who have average cognitive abilities (Duncan & Bishop, 2015; Gray et al. 2014). Skills selected for this study were based on a parent survey (Appendix G). The survey listed common daily living skills in personal hygiene (e.g., washing hands, washing face, brushing teeth and shaving) and in

domestic tasks (e.g., making a sandwich, using a toaster, setting table and washing utensils). In addition, parents could indicate other skills of their choice for instruction based on a preference for their child or owing to listed skills already mastered. The skills selected were matched between the unit pair to ensure that both participants in the unit were targeting similar skills, for example, teeth brushing. This allows for the comparison of skills between participants who are taught under the two different conditions (VS or VS+SI). From the list of daily living skills, teeth brushing, shaving and tying shoelaces were selected based on parent and caregiver responses. Thus, two units of participants (four) received interventions for teeth brushing, one unit (two) for shaving and the last unit (two) for tying shoelaces.

4.8 Materials

Materials used in the study were items required for the skills being taught. For teeth brushing, individually labelled toothbrushes, toothpaste and a cup were used. For shaving, shaving foam and individual disposable shavers with cartridges were used. For tying shoelaces, the student's own shoes were used. Visual supports for each of these skills were provided for each student as described in the next section.

4.8.1 Visual support materials. Visual supports for each step in each of the three daily living skills mentioned were created. These visuals were designed based on visual comprehension data collected for each student. Procedures to assess visual comprehension are described later in this chapter. Visual supports for teeth brushing consisted of coloured photographs and symbols, measuring 10 cm by 7.5 cm. Visual supports for shaving were coloured photographs measuring 10 cm by 7.5 cm. Visual supports for tying shoelaces were

symbols mounted on a diary measuring 21 cm by 14.8 cm. Each visual support was laminated for durability and easy mounting.

4.8.2 Teeth brushing visuals. Teeth brushing visuals were arranged sequentially from the first step involved in brushing one's teeth to the final step. One unit of participants learning how to brush their teeth had visual supports in the form of photographs, while the second unit used symbols. These visuals were mounted and secured with reusable adhesive, on the mirror in the bathroom where instruction took place. The visual supports were arranged from left to right, at the appropriate eye level for the student according to height, following the recommendations for use of visual supports in structured teaching (Mesibov et al., 2006; Mesibov et al., 2012). Figures 4.1 and 4.2 illustrate an example of a partial sequence of visual supports for teeth brushing. Appendix H (photographs) and Appendix I (symbols) show the full visual supports for teeth brushing.

Figure 4.1. Sample Visual supports for teeth brushing (photograph)

Note: Images in the visuals are not of actual participants and have been used with permission.

Figure 4.2. Sample Visual supports for teeth brushing (symbol)

4.8.3 Shaving visuals. Participants learning how to shave had visual supports that were photographs, again based on the visual comprehension assessment results. These photographs were mounted and secured with reusable adhesive, on the mirror in the bathroom where instruction took place. In addition, these visual supports were arranged from top to bottom, following the recommendations for use of visual supports in structured teaching (Mesibov et al., 2006; Mesibov et al., 2012). Participants learning shaving were taller and arranging the visual supports from top to bottom ensured these were visibly more accessible. Figure 4.3 illustrates an example of a partial sequence for shaving visual supports. Appendix J shows the full visual supports for shaving.

Figure 4.3. Sample Visual supports for shaving (photograph)

Note: Images in the visuals are not of actual participants and have been used with permission.

4.8.4 Tying shoelaces visuals. Participants who were learning to tie their shoelaces used visual supports that were symbols of the sequential steps. Each step was mounted on a notebook with a ring binder for the participant to follow. A binder format was chosen so that each step could be seen clearly by the participants since some steps were complex. Each mounted symbol was flipped as each step was completed. Figure 4.4 illustrates an example of a partial sequence for tying shoelaces. Appendix K shows the full visual supports for tying shoelaces.

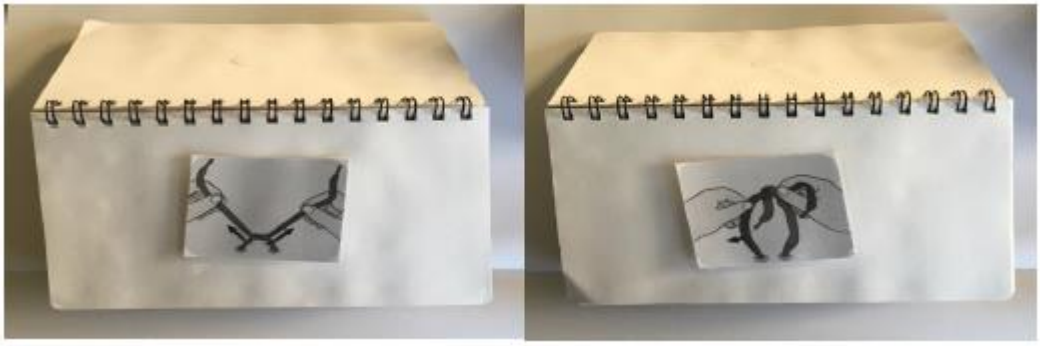


Figure 4.4. Sample Visual supports for tying shoelaces (symbol)

In the intervention phase of this study, as described later, participants in the VS condition were instructed to view the sequential visual steps to enact the targeted daily living skill, whereas participants in the VS+SI condition were instructed to follow the visual support and were provided with prompts to enact the targeted daily living skill.

4.9 Pre-Baseline Procedures

This study consisted of a pre-study phase before the MBCI was initiated. Prior to the pre-study phase, the researcher spent two weeks in the classroom so that the participants would become familiar with the researcher before the study commenced. These sessions lasted between one to two hours in each classroom depending on school schedule. In this phase, a visual comprehension assessment was conducted to determine whether the

participant recognised a referent in the form of a photograph, line drawn symbol or text. Once the visual comprehension level of the participants was determined, the study commenced.

4.9.1 Visual comprehension assessment. The NPDC (2014) recommends that assessment to assess the symbol type (object, photo, picture/line drawing, text, speech, sign) level at which students understand a visual support be determined. Object is the most concrete whereas text and speech are the most abstract. In this study, visual comprehension assessments were conducted for all participants to determine their level of iconicity comprehension of the visual support. Iconicity is the degree to which the symbol represents its referent. This assessment was conducted to ensure that participants understood the graphic representations depicted in the visual supports (Koul et al., 2001; Schlosser et al., 2012). Photographs, line drawn pictures or words for each participant were selected based on their greatest level of understanding as determined by percent accuracy obtained from the assessment. Participants in a unit were matched for similar symbolic understanding of visual supports.

The visual comprehension assessments were conducted using the 'match to sample' session procedure (Mirenda & Locke, 1989). Using this approach, participants were each presented with an item to explore for 10 to 30 seconds. At the end of the lapsed time, the researcher requested that the item be returned. The participant was then simultaneously presented with the photograph, line drawing and word representing the item explored and instructed to hand the researcher the representation for the item. This was done over 10 trials for each participant. If the participant selected the photograph, it implied the participant understood that the photograph represented the item. Then, the photograph was removed and a picture line drawing with a distractor photograph (i.e., a different

photograph) was presented. The participant was instructed to hand the researcher the representation for the item just explored (i.e., through the process of elimination, the level of representation was ascertained). To be confident that the participant was selecting the form most understood, the picture line drawing was in black and white as opposed to colour to prevent the possibility that a coloured picture may appear too similar to a photograph. Figure 4.5 is an example of the range of visuals used to assess symbol comprehension and subsequently provide an appropriate visual support. The item on the left was the item explored and, on the right, examples of the two visuals for assessment. The visual comprehension assessment form is attached as Appendix L. Table 4.2 depicts the visual support used for each participant in the study.

Figure 4.5. Example of a visual comprehension assessment item and visuals consisting a photograph and a line drawing, from left to right.

Table 4.2

Summary of Participants' Visual Supports Form

Participants	**Visual Form**
Levi	Photograph
Jay	Photograph
Ollie	Picture line drawing
Tom	Picture line drawing
Ben	Picture line drawing
Trent	Picture line drawing
Jason	Photograph
Eli	Photograph

4.9.2 Randomisation. A total of 22 sessions were planned for each participant, which consisted of varying numbers of baseline and intervention sessions with a minimum of five baseline probes followed by the intervention that ranged from 11 to 15 sessions, dependent on the intervention start point randomly assigned to the unit (as shown in Table 4.3 below). This was followed by two maintenance sessions. The same number of total sessions for all participants allowed randomisation tests to be conducted.

Thus, the first unit (Unit A), which had an intervention start point of 6, received 15 intervention sessions and two maintenance sessions, the second unit (Unit B), which had an intervention start point of 7, received 14 interventions and two maintenance sessions, the third unit (Unit C) that had an intervention start point of 8 received 13 intervention sessions and two maintenance sessions while the fourth unit (Unit D) that had an intervention start point of 9 received 12 interventions and two maintenance sessions. In total, each unit received 22 sessions (see Table 4.3). In a traditional MBD, the criterion of stability in baseline is utilised to determine the introduction of the intervention. However, in the

MBCI, for purposes of randomisation, a pre-set number of sessions were identified and staggers between the units were generated randomly. Of significance here is that whenever the point of intervention is introduced, effects can be quickly demonstrated to establish experimental control (Cooper et al., 2007; Kazdin, 2011).

Three randomisation variations were adopted in this study: intervention start point randomisation, intervention randomisation and case randomisation. Randomisation is the process of allocating different interventions or conditions to the participants of a study (Dugard, File, & Todman, 2012; Ferron & Levin, 2014). Although randomisation is not widespread in single-case experimental designs, it is increasingly adopted because it strengthens the internal validity of such designs owing to its greater methodological dependability and the advantage of allowing researchers to use statistical tests for randomisation studies (Levin et al., 2014), a recent trend in single-case research.

4.9.3 Intervention start point randomisation. A total of 22 observation sessions were conducted during the study, which include baseline, intervention and maintenance phases. For the four units, out of the 22 observation sessions for the study, intervention start points that were generated were sessions 6, 7, 8 and 9. The final two observation sessions were set for maintenance across all units. Intervention start point randomisation is the assignment of specific time points at which participants begin intervention (Ferron & Levin, 2014). To obtain a randomised intervention start point, the first potential start point, number of potential starts points and total number of intervention points were entered into the randomizer tab in the ExPRT, version 2.1, which was the current version at the time, generating, intervention start points 6, 7, 8 and 9. Table 4.3 illustrates the intervention start points for the four units with intervention start points 6, 7, 8 and 9 prescribed.

Table 4.3

Intervention Start Points for Four Units of Participants

Unit A: Ben and Ollie—Intervention Start Point 6

B					I														M	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Unit B: Trent and Tom—Intervention Start Point 7

B					I														M	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Unit C: Eli and Jason—Intervention Start Point 8

B							I												M	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Unit D: Levi and Jay - Intervention Start Point 9

B								I											M	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Note: Shaded number boxes indicate intervention start points per unit

4.9.4 Intervention randomisation. Intervention randomisation is the allocation of participants to the different interventions being employed in a study. For this study, one participant in each unit received VS+SI while the other participant in the unit received VS. This was determined with a coin toss, marked on each side with VS or VS+SI.

4.9.5 Case randomisation. Case randomisation is the allocation of participants to the temporally staggered start points of the MBD (Ferron & Levin, 2014). After four intervention start points were established, that is, points 6, 7, 8 and 9, each unit was randomly assigned to one of the starting points by drawing at random a unit name out of a

bag. In addition, each unit participant was paired based on symbolic communication assessment and baseline assessment. Participants assessed with similar skill levels for the selected daily living skill were paired.

4.10 Study Procedures

The dependent variable in this study was the percentage of steps on the task analysis completed independently, (i.e., the acquisition level of the skill taught) for each daily living skill. Acquisition is defined as the accuracy of a response (Alberto & Troutman, 2013; Collins, 2012; Cooper et al., 2007). The skills taught were teeth brushing, shaving and tying shoelaces. The procedures included three phases, baseline, intervention and maintenance phases, with two conditions (i.e., VS or VS+SI) as part of the intervention and maintenance phase.

4.10.1 Baseline. In the baseline condition, the researcher instructed the participants to engage in the daily living skill identified without VS or VS+SI support. The researcher used a task analysis to assess the steps that could be completed independently by the participant to calculate accuracy. Once the required number of baseline sessions was completed, the researcher introduced the VS or VS+SI at the predetermined, randomised intervention start point. The steps for baseline were as follows:

1. The participant was instructed to engage in the skill, e.g., ‘brush your teeth’.
2. The researcher waited for the predetermined latency of five to 30 seconds.
3. If the participant did not engage in a step or eventually disengaged and did not re-engage in the task, the instruction was delivered again, up to two times. When the participant engaged in the skill, an encouragement to continue engaging in the skill was delivered, for example, ‘good try…you are doing well’.

4. If the participant was noncooperative or engaged in prolonged self-stimulatory behaviours, the session was discontinued.
5. If attempts were made to engage in the skill successfully, praise and encouragement were provided for engaging, although not for completing specific steps of the task analysis, such as ‘good try…you are doing well’.

The baseline phase lasted for five to eight sessions for each participant depending on the intervention start point generated. This allowed for the comparison of the behaviour before and after intervention (Kazdin, 2011; Kennedy, 2005).

4.10.2 Intervention. Each participant received either VS or VS+SI at a predetermined intervention start point. The fundamental purpose of introducing either the VS or the VS+SI to participants was to determine if the implemented independent variable affected a change in the dependent variable (Horner & Odom, 2014).

After engaging with the participants with a brief greeting and a question to check that the participant was ready to proceed, the researcher instructed participants to engage in the skill identified for instruction. Steps in the intervention phase were:

1. The participants were instructed to engage in the skill, for example, ‘brush your teeth’. Depending on the skill, participants were allowed 30 seconds to one minute to engage in the step.
2. The researcher waited for the predetermined latency of five to 30 seconds.
3. If the participant did not engage in a step:
    i. For the VS condition, redirection to the visual supports were provided by the researcher instructing the participant to follow the visual support.

ii. For the VS+SI condition, redirection to the visual support was provided and a controlling prompt was delivered that was specific to the type of systematic instruction selected, for example, graduated guidance.

4. When the participant engaged in the skill, verbal encouragement to continue engaging in the skill was delivered.
5. If the participant was noncooperative or engaged in prolonged self-stimulatory behaviours, the session was discontinued. For example, if the participant engaged in prolonged vocalisations, moved around excessively, did not attend to the task and could not be redirected, the session was terminated.
6. When completed, reinforcement with praise and encouragement was provided, for example, ‘excellent try at shaving’ or ‘good job looking at the pictures while shaving’.

In this study, two types of systematic instruction were used: Graduated Guidance and the system of least prompts. This was determined based on participants’ learning characteristics. A brief explanation and example of each follows.

4.10.2.1 Graduated guidance. As described in Chapter 3, graduated guidance relies on a single physical prompt that can be used within a session. The reduction of each level of prompt is determined by the responses of the participant, prior to reducing support from one level of assistance to the next. This flexibility and use of a single physical prompt make graduated guidance a simple method to adopt. Figure 4.6 is an example of a graduated guidance procedure.

Graduated Guidance with Visual Supports

1. Trent, can you please 'brush your teeth'.
2. Wait for the predetermined latency of five to 30 seconds.
3. If Trent:

Requires assistance	Enacts the step
i. direct him to the visual support while prompting him at the wrist to enact the step	i. provide praise, for example, 'good brushing'.
ii. if engaged, step back and observe	
iii. provide praise, for example, 'good brushing'	
iv. when disengaged again, prompt at wrist to engage in the step again	
v. repeat, at each disengagement.	

4. If Trent is noncooperative or engaged in prolonged self-stimulatory behaviours, for example, he becomes increasingly anxious and moves around intervention environment, discontinue the session.
5. When completed, provide reinforcement with praise and encouragement, for example, 'excellent try at brushing' and 'iPad time now'.

Figure 4.6. Example of a graduated guidance procedure used with visual supports

4.10.2.2 System of least prompts. The system of least prompts uses a minimum of three levels of assistive prompts for the intervention and these can be used in the same session. The system is provided from the least assistive to the most assistive prompts to the student. The teacher gives the student instructions to begin the task and as necessary, sequentially prompting, verbally, through modelling and partially physically guiding the student towards enacting the correct behaviour. Figure 4.7 is an example of the system of least prompts procedure provided with visual supports

System of Least Prompts with Visual Supports

1. Eli 'can you please start to shave now'.
2. Wait for the predetermined latency of five to 30 seconds.
3. If Eli:

Requires assistance	Enacts the step
i. from his side, direct him to the visual support while pointing to it, and give him a verbal prompt 'follow this picture'	i. provide praise, for example, 'good job shaving'.
ii. if engaged, step back and observe	
iii. provide praise, for example, 'good following the picture for shaving'	
iv. when disengaged again, from his side, while pointing to the picture give a model prompt to bring shaver to face	
v. if engaged, step back and observe	
vi. provide praise, for example, 'good following the picture for shaving'	
vii. when disengaged again, from his side, while pointing to the picture, give a partial physical prompt at wrist to shave	
viii. provide praise, for example, 'good following the picture for shaving'.	

4. If Eli is non-cooperative or engaged in prolonged self-stimulatory behaviours, for example, he becomes increasingly anxious and moves around intervention environment, discontinue the session.
5. When completed, provide reinforcement with praise and encouragement, for example, 'excellent try at shaving' and 'iPad time now'.

Figure 4.7. Example of a system of least prompts procedure used with visual supports

4.10.3 Maintenance. One of the most important effects of intervention research is promoting response maintenance outside the context of the intervention (Alberto & Troutman, 2013; Cooper et al., 2007; Kazdin, 2011; Kennedy, 2005). Maintenance probes were conducted over two weeks following the intervention sessions. During maintenance

sessions, no VS or VS+SI was introduced (i.e., return to baseline phase). Procedures were the same as for baseline sessions.

4.10.3.1 Data collection during intervention phase. Following the visual comprehension assessment, data collection was scheduled two to three times a week, depending on the school schedule of activities, and it involved documenting the percentage of steps completed for each targeted daily living skill. Data collection was conducted in the school setting where the instruction occurred, namely the bathroom for the skills of teeth brushing and shaving and an area inside or outside the classroom for the skill of tying shoelaces. The area was visible to other staff and the student and researcher were accompanied by a school staff member as per mandatory child protection procedures. Skill acquisition was measured using the percentage of steps completed independently in a single opportunity task analysis (Cooper et al., 2007).

4.10.3.2 Computation of skill acquisition. Baseline performance was derived as the percentage of steps of the task analysis completed independently or unassisted. Skill level for the baseline was derived by the number of pluses (+) recorded divided by the total number of steps and then multiplied by 100.

$$\frac{\text{Number of steps recorded as plus (+)}}{\text{Total number of steps}} \times 100$$

Skill acquisition for intervention was derived by the number of steps of the task analysis completed independently (I) divided by the total number of steps and then multiplied by 100.

$$\frac{\text{Number of steps recorded as Independent (I)}}{\text{Total number of steps}} \times 100$$

This allowed for comparison of skill progression between baseline and intervention phases. Unassisted correct responses during the baseline and maintenance phase were equivalent to independent responses during the intervention phase.

4.10.3.3 Baseline*.* During the baseline phase, the researcher engaged the participants with a greeting and checked that they were ready for the instruction. When the participant was ready, an instruction was delivered to the participant to begin the skill. Since it was the baseline phase, accuracy was calculated based on percentage of unassisted correct responses, recorded as a plus sign (+). An example of the task analysis used in this study is attached as Appendix M.

4.10.3.4 Intervention. Depending on the systematic instruction used, data for each step of the task analysis was recorded as follows: (a) for graduated guidance; I, independent (i.e., the participant engaged in the step independently); F (i.e., when a physical prompt was provided at the wrist), and, (b) for system of least prompts; I, independent (i.e., the participant engaged in the step independently); V, verbal (i.e., when the participant was verbally prompted, 'follow this picture'); M, model (i.e., when the researcher modelled the behaviour to the participant to bring shaver to face); and, P, partial physical (i.e., when a partial physical prompt was provided at the wrist). Accuracy was calculated based only on percentage of independent responses recorded as (I).

4.10.3.5 Maintenance. In the maintenance phase, participants engaged in the skill without VS or VS+SI. As was in the baseline phase, data for each step on the task analysis was recorded as a plus sign (+) for unassisted correct performance and minus sign (−) for incorrect performance or non-performance.

4.11 Social Validation The social validation used in this study was subjective evaluation, that is, others judgement of the participant's changes in targeted outcomes (Kratochwill et al., 2014). Social validation is the extent to which behaviours identified for change are considered appropriate and whether the change in the behaviours is significant as rated by consumers (Cooper et al., 2007), which in this study were the teacher and teacher aides. Social validation data were computed using percentage of responses from a Likert scale ticked by the teachers and teacher aides. Responses were arranged in the sequence of 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree and 5 = strongly disagree.

Social validation data were obtained from the teachers and teacher aides who supported participants daily. Teachers and teacher aides watched videos for one participant during baseline performance and one towards the end of the intervention phase, to verify that the skill was demonstrated. The videos lasted between 30 seconds to four minutes depending on the skill and whether it was discontinued. Teachers and teacher aides were informed which video was baseline performance and which video was intervention performance so that they could compare the skill of the participant with the independent variable in operation. The teacher and teacher aides then subsequently completed a survey. The survey is attached as Appendix N.

4.12 Inter-Observer Agreement

Inter-observer agreement (IOA) in this thesis is the degree to which independent observers recorded the same observed skill in the participant. To ensure accurate measurement during IOA, Cooper et al. (2007) recommend ensuring observers have good understanding of the operational definition of the target behaviour in observable terms. The

authors suggested using the same measurement systems and recording independently, both of which were adopted in this study to calculate percentage of agreement. A doctoral student, trained in the IOA procedure, acted as an independent observer to evaluate 20% of the total number of videos, (i.e., 32 videos). The percentage of agreement between the researcher's and the doctoral student's data sheets across study phases was calculated.

IOA for skill acquisition was obtained during the study using the exact agreement method (Courtade, Browder, Spooner, & DiBiase, 2010). Each step of the task analysis was compared for exact agreement and IOA was computed using the following formula:

$$\frac{\text{\# of agreements}}{\text{\# of agreements + \# of disagreements}} \text{ x100}$$

4.13 Procedural Fidelity

Procedural fidelity is the extent to which the independent variable is implemented as planned (Cooper et al., 2007). Procedural fidelity was checked by the same doctoral student who viewed videos of the sessions, totalling 20% of intervention sessions for each participant. The procedural fidelity form for baseline, VS and VS+SI is attached as Appendix O.

4.14 Data Analysis

Data analysis consisted of visual analysis, calculation of effect size and randomisation tests of statistical significance. In combination, these methods contribute to the confidence in interpreting the results of the study.

4.14.1 Visual analysis. Visual data analysis was used as one method of analysis in this study. Single-case experiments most often use visual data analysis; it is considered powerful in revealing functional relations (Horner & Odom, 2014; Kennedy, 2005). Kennedy (2005) further supports visual analysis of data by asserting that beyond translating

data into a graph, visual analysis allows investigators to ‘arrive at a better understanding of the nature of their findings’ (pp. 206–207). However, in this study because of the design adopted, visual analysis was used post-hoc to analyse data rather than to inform design (i.e., intervention start-point).

4.14.2 Effect size. Effect size allows the measurement of the magnitude of the intervention effect (i.e., how much change occurred). The specific effect size measurement used in this study was the nonoverlap of all pairs (NAP), which was calculated in ExPRT, version 3.1 for data analysis (Levin et al., 2018). NAP compares the percentage of data that improves between Phase A and Phase B. NAP measures three different types of outcomes, namely, improvement over time (pos), deterioration (neg) and no change (tie), and this interpretability makes NAP a ‘superior non-overlap index’ (Parker, Vannest, & Davis, 2014, p. 142).NAP is calculated as (Pos + .5 x Tie)/#Pairs (Parker, Vannest, & Davies). Effect size for NAP is classified as: (a) 0–0.31: small effect, (b) 0.32–0.84: medium effect and (c) 0.85–1.00: large effect (Parker & Vannest, 2009).

4.14.3 Statistical tests. ExPRT, Version 3.1, current at the time of data analysis (Levin et al., 2018) was used to analyse data. In using the MBCI design, three types of randomisation were adopted as described earlier in this chapter. Randomisation strengthens the internal validity of single-case experimental designs and ‘represents a higher level of methodological soundness’ (Kratochwill & Levin, 2014, p. 54). It allows the researcher to draw causal inferences in outcomes of studies and also control for Type 1 error probabilities when assessing interventions. In addition, randomisation allows the application of statistical tests to improve the validity of the study. The use of randomisation in this single-case design allowed for testing effect sizes and significance.

In summary, a MBCI design was employed in this thesis to address the research questions regarding the effectiveness of VS in isolation or VS+SI on supporting the acquisition of a daily living skill, in students with ASD and ID. The ExPRT software facilitated the MBCI design and data analysis beyond traditional visual inspection improving the rigour of the study. These results will be presented in Chapter 5 of this thesis.

Chapter 5: Results

This chapter presents the results of the study evaluating the effects of VS and VS+SI on the acquisition of daily living skills for eight students with ASD and concomitant ID, using a single-case MBCI design. ExPRT, Version 3.1 (Levin et al., 2014) was used to analyse the results of the study. This software generated randomisation tests of statistical significance, Parker and Vannest's (2008) NAP effect sizes, and unit and individual performance figures for visual analysis. The results discussed include (a) visual analysis of the combined VS+SI and VS conditions, (b) percentage of independent steps in the daily living skills for individual participants in the VS+SI condition, (c) percentage of independent steps in the daily living skills for individual participants in the VS only condition, (d) results of social validity responses, (e) IOA and (f) procedural fidelity.

Three levels of randomisation were employed in this study; namely, intervention start point, intervention and case randomisation. Table 5.1 provides a summary of randomisation types utilised in this study for individual participants which underpins results emerging from this study

Table 5.1

Summary of Intervention Start Point, Intervention and Case Randomization

Unit	Participant	Type of Randomisation		
		Start Point	**Intervention**	**Stagger**
1	Ben	6	VS+SI	1
	Ollie	6	SI	1
2	Trent	7	VS+SI	2
	Tom	7	SI	2
3	Eli	8	VS+SI	3
	Jason	8	SI	3
4	Levi	9	VS+SI	4
	Jay	9	SI	4

5.1 Visual Analysis of VS+SI and VS on Percentage of independent steps of Daily Living Skills (by Unit)

As demonstrated in Figure 5.1, evaluation of the baseline and intervention phases revealed that data were variable for the VS+SI condition and the VS only condition between baseline and intervention phases. In the VS+SI condition, examination of trend (Lane & Gast, 2014) demonstrated that in the baseline condition there was minimal progress for Ben, Trent and Eli with increases in one data point each. For Levi, there was a deterioration in trend in three data points. Examination of stability (Lane & Gast, 2014) revealed that there was an overall narrow band of scores and because of the minimal 'bounce' (Gast, 2005, p. 1596) in the data for all four participants in baseline, the baseline was overall stable (Gast, 2005). When the independent variable (VS+SI) was introduced, a change in percentage of independent steps completed in the daily living skills was observed. All four participants demonstrated an overall accelerating trend. Percentage of independent steps in the daily living skills across phases changed from single point

acceleration (Ben, Trent, and Eli) and three single point deceleration (Levi) in baseline to improvement of percentage of independent steps in the daily living skills during intervention. Trend lines for Ben and Trent accelerated gradually while trend lines for Eli and Levi accelerated rapidly. Between trend and level, trend is considered more important in single-case intervention to researchers who 'look for an immediate and abrupt change' (Lane & Gast, 2014, p. 448). The change in trend lines between the baseline and intervention phases in the VS+SI condition demonstrated that there was a functional relationship between the manipulation of the independent variable (VS+SI) that led to a change in the dependent variable (Kaiser, 2014; Kratochwill, Levin, Horner, & Swoboda, 2014; Sheridan, 2014), the percentage of independent steps in the daily living skills for the participants.

During the VS in isolation condition, examination of trend (Lane & Gast, 2014) demonstrated that in the baseline condition there was a zero-celerating trend for Tom, Jason and Jay and a decelerating trend in two data points for Ollie. Examination of stability (Lane & Gast, 2014) revealed that because of the minimal bounce in the data for all four participants in baseline, there was an overall narrow band of scores and the baseline was thus overall stable (Gast, 2005). When the independent variable (VS) was introduced, a rapid change was observed only in Jason's performance. Overall, trend data for Ollie, Tom and Jay revealed decelerating, minimal accelerating and zero-celerating trends respectively. Ollie's data points demonstrated four decelerating data points. Tom had acceleration in two data points but within a very narrow band and Jay had a zero-celerating data trend throughout. With the exception of Jason whose performance improved rapidly, the other three participants demonstrated no improvements in percentage of independent steps in the daily living skills. The change in trend lines between the baseline and intervention phases

for Jason demonstrated that there was a functional relationship between the manipulation of the independent variable that led to a change in the dependent variable (Kaiser, 2014; Kratochwill et al., 2014; Sheridan, 2014), percentage of independent steps completed in the daily living skills. However, for Ollie, Tom and Jay, there was no functional relation between the introduction of the independent variable and the dependent variable.

In the VS+SI condition, all four participants improved their percentage of independent steps in the daily living skills, and in the VS condition, only Jason showed improvement in this regard while Ollie, Tom and Jay did not show any improvement (Figure 5.1). Overall, visual analysis of data revealed that VS+SI had a positive effect on the daily living skills for all participants in this condition of this study and their performance improved. However, VS had a positive effect on only one participant's percentage of independent steps of the task analysis for his daily living skill and three participants did not improve their percentage of independent steps of the task analysis for their daily living skills. Thus, it can be concluded that in this study, VS+SI was overall effective for students with ASD and ID since the data demonstrated a 'therapeutic' trend (Lane & Gast, 2014, p. 450) and VS in isolation was overall ineffective for three students with ASD and ID since the data demonstrated a 'contra-therapeutic' trend (Lane & Gast, 2014, p. 450).

Data from ExPRT, version 3.1 generated average effect sizes and *p*-values for the MBCI design used in this study as illustrated in Figure 5.1 below. To generate effects sizes for individual participant intervention (VS+SI or VS in isolation) and the significance values for each intervention type, VS+SI and VS in isolation, data were analysed for each intervention type using ExPRT, version 3.1. In the next section, individual participant, as opposed to unit, percentages of independent steps for their daily living skills are discussed

using visual analysis data between baseline and intervention conditions. Effect sizes for individual participants and significance values for each intervention are also discussed.

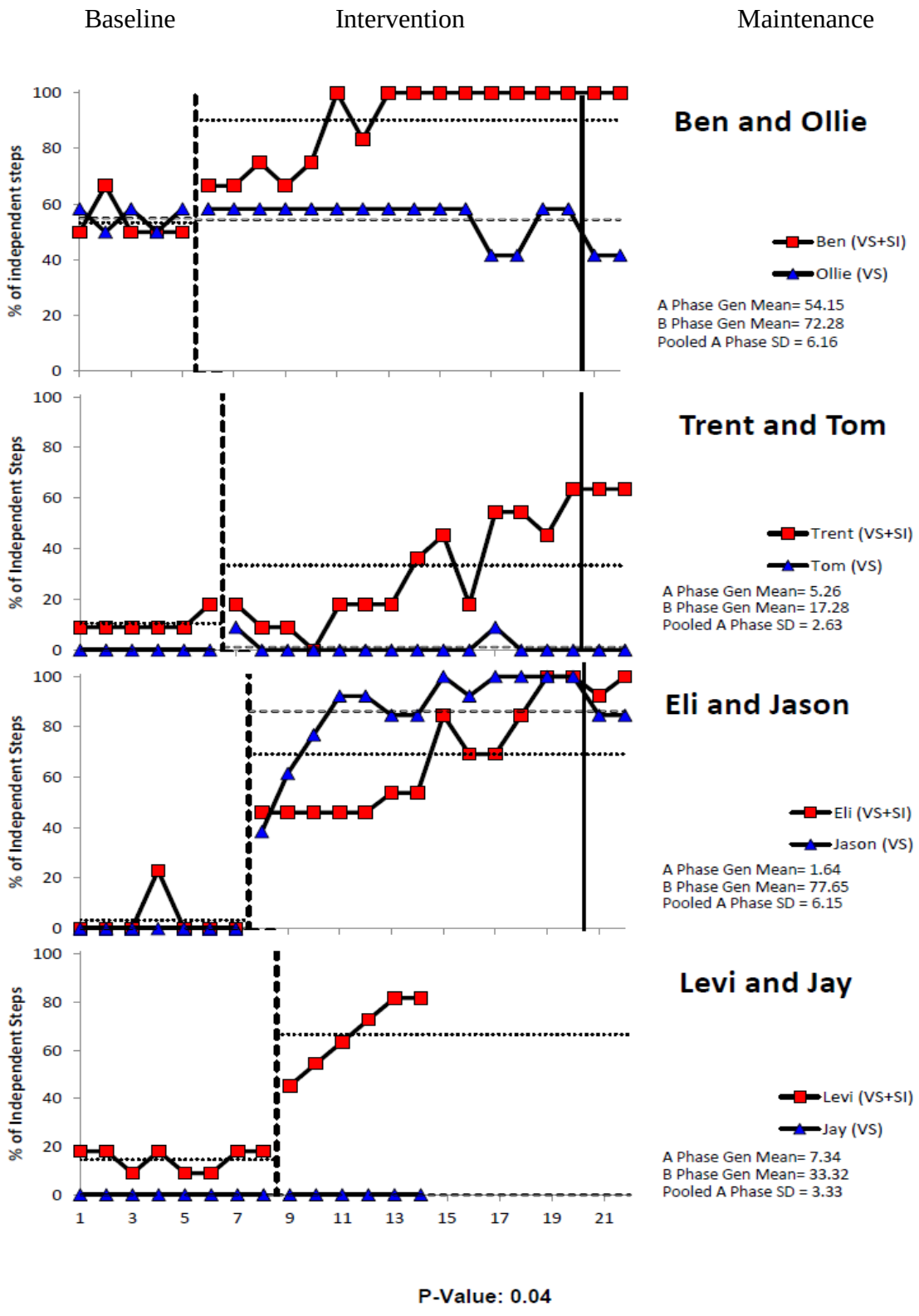


Figure 5.1. Percentage of independent steps of daily living skills completed for eight participants in VS+SI and VS conditions

5.2 Effect of VS+SI on Percentage of Independent Steps in the Daily Living Skills (Individual)

5.2.1 Ben (Unit 1, Participant A). Ben's parent identified tying shoelaces as a priority skill. Intervention start point for Ben was session 6. Intervention randomisation was VS+SI and Ben was randomly assigned to the first stagger.

5.2.1.1 Visual analysis and effect size. During baseline, visual inspection for Ben revealed that in the baseline condition, percentage of independent steps in the daily living skills of tying shoelaces generated a stable baseline with one outlier data point (see figure 5.2). However, comparing baseline and intervention conditions, visual inspection for Ben's percentage of independent steps in the daily living skills revealed a gradual accelerating trend between the baseline and intervention conditions. Mean score for Ben during the baseline phase was 53.32% (range: 50–66.6; SD: 7.42) while mean score for the intervention phase was 90.18% (range: 50–100; SD: 14.22), showing an increase mean of 36.86% during the intervention condition. Inspection of effect size revealed NAP = 0.96 (see table 5.2). This means that VS+SI had a large effect on Ben's daily living skill (tying shoelaces).

5.2.2 Trent (Unit 2, Participant A). Trent's parents identified the priority skill of teeth brushing. Intervention start point for Trent was session 7. The intervention randomisation was VS+SI and Trent was randomly assigned to the second stagger.

5.2.2.1 Visual analysis and effect size. During baseline, visual inspection for Trent's percentage of independent steps in the daily living skills of teeth brushing generally showed a stable baseline with an acceleration at session 6 (see figure 5.2). During the intervention condition, his percentage of independent steps in the daily living skills was

variable through sessions 7 to 13, after which performance steadily accelerated to a stable trend. Mean score for Trent during the baseline phase was 10.52 (range: 9–18; SD: 3.72) while mean score for the intervention phase was 33.44 (range: 18–63; SD: 22.22), showing 22.92% increase in mean score. Inspection of effect size revealed NAP = 0.64. This means that VS+SI had a medium effect on his daily living skill of teeth brushing (see table 5.2)

5.2.3 Eli (Unit 3, Participant A). Eli's parents identified the skill of shaving as a priority skill for him. The randomised intervention start point was session 8. Intervention randomisation was VS+SI and he was randomly assigned to the third stagger.

5.2.3.1 Visual analysis and effect size. During baseline, visual inspection for Eli's percentage of independent steps in the daily living skills of shaving showed an overall stable trend with one outlier data point in session 4 (see figure 5.2). During intervention, the visual inspection for percentage of independent steps in the daily living skills for Eli showed an acceleration with intervention points 8 to 12 remaining stable and an upward acceleration trend from session 13 to 20. The mean score for Eli during the baseline phase was 3.29 (range: 0–23; SD: 8.69) while the mean score for the intervention phase was 69.17 (range: 46–100; SD: 22.39), showing a 65.88% increase of the mean. Inspection of effect size revealed NAP = 1.00 (see table 5.2). This means that VS+SI had a large effect on his daily living skill of shaving.

5.2.4 Levi (Unit 4, Participant A). Levi's parent identified the skill of teeth brushing as a priority skill for him. His intervention start point randomisation was session 9 with intervention randomisation being VS+SI for case randomisation, the stagger position assigned to him was the fourth stagger.

5.2.4.1 Visual analysis and effect size. During baseline, the visual inspection for

Levi's percentage of independent steps in the daily living skills shows a variable baseline with three decreases in sessions 3, 5 and 6 (see figure 5.2). Mean score for his percentage of independent steps in the daily living skills during the baseline phase was 14.69 (range: 9–18; SD: 4.71). During intervention, percentage of independent steps in the daily living skills, there was a steep accelerating trend and mean score for the intervention phase was 66.63 (range: 45–82; SD: 14.86), showing a 51.94% increase of the mean. Inspection of effect size revealed NAP = 1.00 (see table 5.2). This means that VS+SI had a large effect on his daily living skill of teeth brushing.

5.3 Overall Intervention Effect Size and Significance for VS+SI

The effect size for the VS+SI condition was calculated using NAP (Parker & Vannest, 2009) with ExPRT, version 3.1 (2018). NAP effect size is classified as: (a) 0–0.31: small effect, (b) 0.32–0.84: medium effect and (c) 0.85–1.00: large effect (Parker & Vannest, 2009). Individual effect sizes varied between 0.64 to 1.00 using NAP (Table 5.2). These results suggest that overall, VS+SI had a medium to large effect on the improvement of daily living skills for the four participants who received this intervention.

The significance value obtained for VS+SI was $p = 0.04$, which indicates that the results obtained were statistically significant and the likelihood that improved daily living skills occurred by chance is low and changes were likely due to the intervention.

Table 5.2

Summary of Effect Sizes Using NAP for VS+SI Condition

		Magnitude of Effect [M]		
Participant	**Condition**	**NAP**	**Effect Size**	**Overall *p*-value**
Ben	VS+SI	.96	Large	
Trent	VS+SI	.64	Medium	
Eli	VS+SI	1	Large	
Levi	VS+SI	1	Large	
Overall	VS+SI			0.04*

Note: * $p < 0.05$

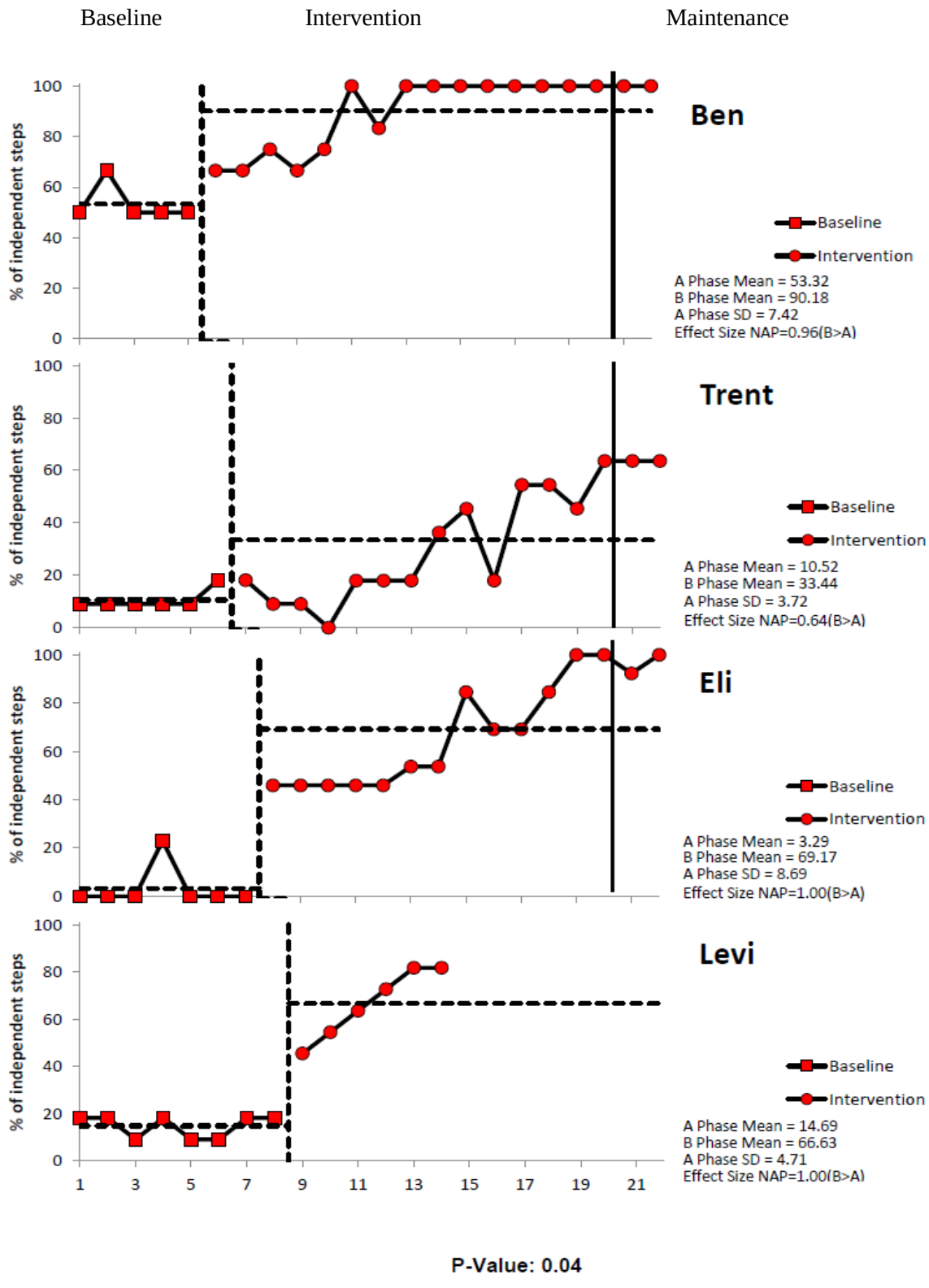


Figure 5.2. Percentage of independent steps of daily living skills completed for four participants VS+SI condition.

5.4 Effect of VS on Percentage of Independent Steps in the Daily Living Skills (Individual)

5.4.1 Ollie (Unit 1, Participant B). Ollie's parent identified tying shoelaces as a priority skill for him. Intervention start point randomisation generated for Ollie was session 6 while intervention randomisation was VS and he was randomly assigned to the first stagger.

5.4.1.1 Visual analysis and effect size. During baseline, the visual inspection for Ollie's percentage of independent steps in the daily living skills shows a stable baseline of 50 to 60% (see figure 5.3). During the intervention phase, percentage of independent steps in the daily living skills was largely maintained, demonstrating no accelerating trend, with two decelerating points for sessions 17 and 18. The mean score for Ollie during the baseline phase was 54.98 (range: 50–58; SD: 4.55) while the mean score for the intervention phase was 54.34 (range: 42–58; SD: 7.30), showing a 0.61% decrease of the mean between baseline and intervention. Inspection of effect size revealed NAP = 0.07 (see table 5.3). This means that VS had small effect on his daily living skill of tying shoelaces.

5.4.2 Tom (Unit 2, Participant B). Tom's parents identified the skill of brushing teeth for him as a priority. Intervention start point was session 7. Intervention randomisation was VS and he was randomly assigned to the second stagger.

5.4.2.1 Visual analysis and effect size. Tom's data demonstrated zero-celeration trend for percentage of independent steps in the daily living skills during both baseline and intervention (see figure 5.3), zero-celeration during the baseline percentage of independent steps in the daily living skills and two small acceleration (i.e., 10%) for intervention sessions 7 and 17 in the percentage of independent steps completed in the daily living

skills. The mean score for Tom during the baseline phase was 0 (range: NA; SD: 0.00) while the mean score for the intervention phase was 1.13 (range 0–10; SD: 3.07), showing a 1.13% increase of the mean score between baseline and intervention. Inspection of effect size revealed NAP = 0.13 (see table 5.3). This means that VS had small effect on his daily living skill of teeth brushing.

5.4.3 Jason (Unit 3, Participant B). Jason's parents identified the skill of shaving as a priority skill for him. Intervention start point randomisation was session 8. Intervention randomisation was VS and for case randomisation, he was randomly assigned to the third stagger.

5.4.3.1 Visual analysis and effect size. During baseline, the visual inspection for Jason's percentage of independent steps in the daily living skills showed a zero level of acceleration in the baseline phase. There was a rapid accelerating trend in the percentage of independent steps in the daily living skills from intervention sessions 8 to 20 (see figure 5.3). The mean score for Jason during the baseline phase was 0.00 (range: N/A; SD: 0.00) while mean score for the intervention phase was 86.14 (range: 38–100; SD: 17.02), showing an 86.14% increase of the mean between baseline and intervention. Inspection of effect size revealed NAP = 1.00 (see table 5.3). This means that VS had large effect on his daily living skill.

5.4.4 Jay (Unit 4, Participant B). Jay's parent identified the skill of teeth brushing as a priority skill for him. Intervention start point randomisation generated for Jay was session 9. Intervention randomisation was VS and case randomisation was the fourth stagger.

5.4.4.1 Visual analysis and effect size. During baseline, the visual inspection for

Jay's percentage of independent steps in the daily living skills shows zero levels of acceleration in the baseline phase (see figure 5.3). The mean score for Jay during the baseline phase was 0.00 (range: 0–0; SD: 0.00) while mean score for the intervention phase was zero (range: 0–0; SD: 0). Visual inspection for Jay demonstrated no change between baseline and intervention percentage of independent steps in the daily living skills. As such, no effect sizes were yielded (see table 5.3). This means that VS had no effect size on his daily living skill. Figure 5.3 shows the percentage of independent steps of the task analysis of daily living skills completed for all four participants in the VS condition.

Data for Jason's performance were separated to determine whether changes between baseline and intervention were significant without Jason's data. This was done because visual analysis demonstrated that Jason's performance was substantially different from the other three participants in the VS condition. Jason's data are presented with the other three participants in Figure 5.3 which was significant ($p = 0.04$). However, a significant overall *p-value* for the VS in isolation condition was likely due to Jason's data. When Jason's data (see Figure 5.4) was removed and significance value recalculated, it revealed a non-significant *p-value* ($p = 0.08$) in the percentage of independent steps completed for three participants in the VS condition.

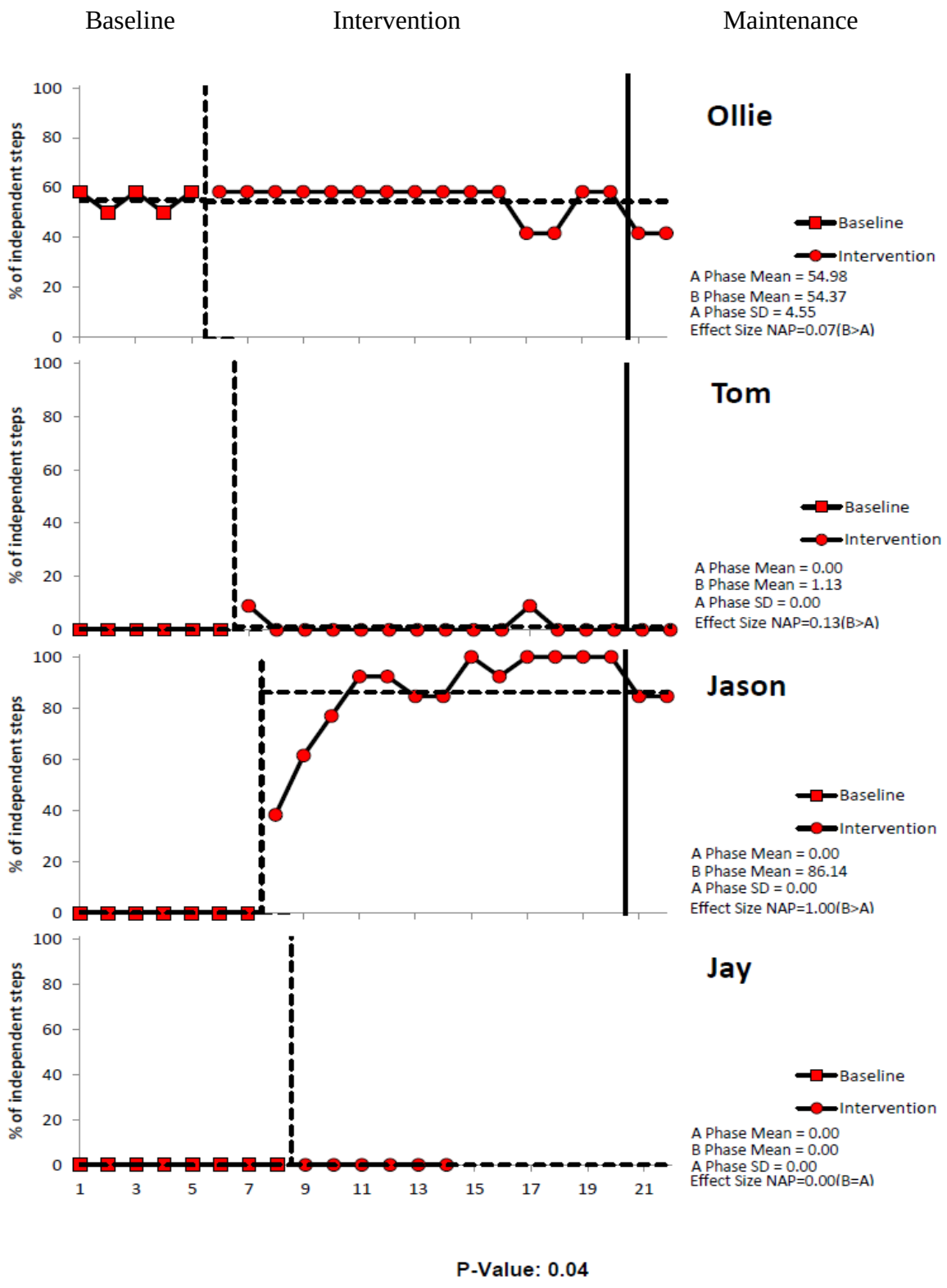


Figure 5.3. Percentage of independent steps of daily living skills completed for four participants in VS condition

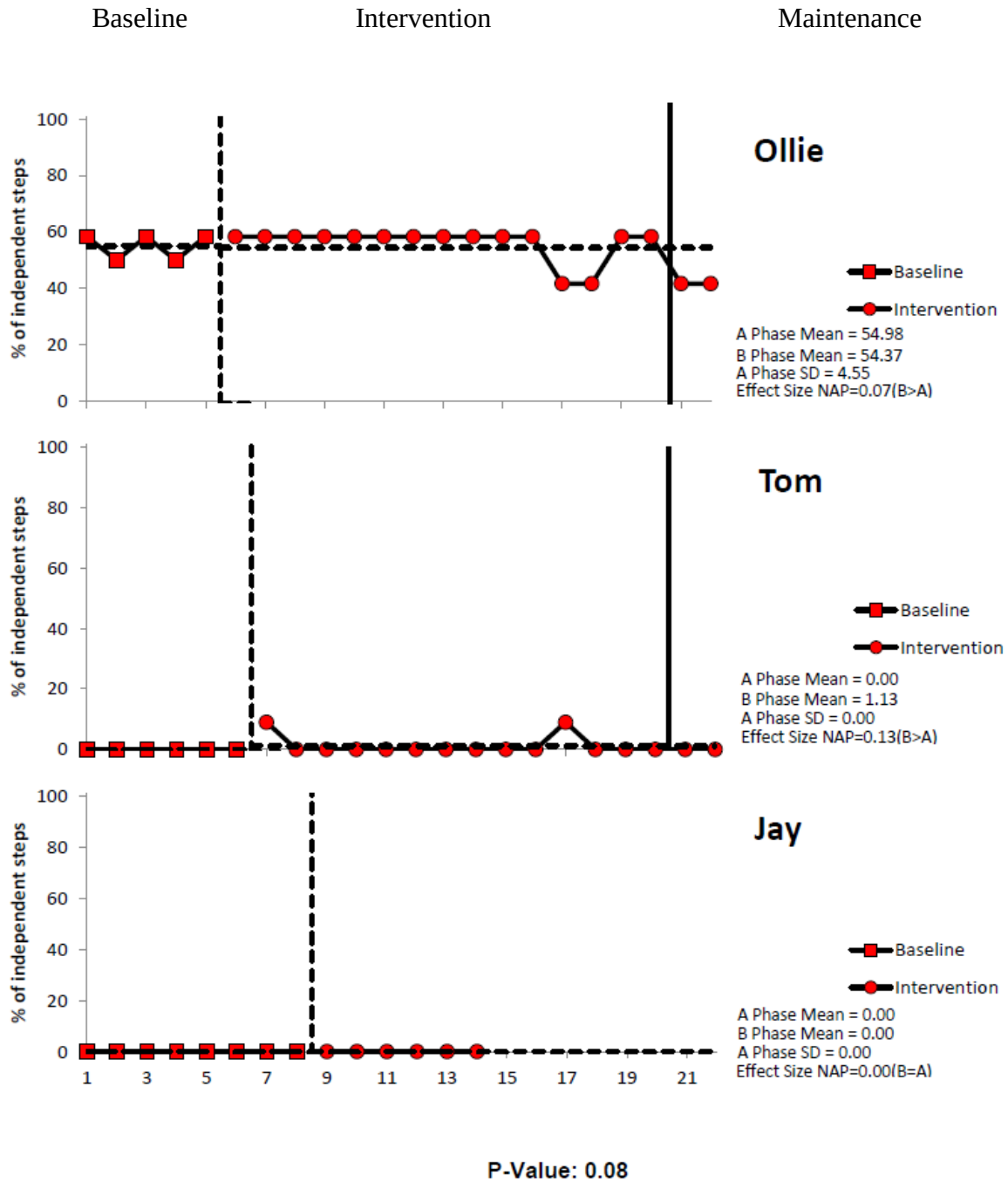


Figure 5.4. Percentage of independent steps of daily living skills completed for three participants in VS condition

5.5 Overall Intervention Effect and Significance for VS

The effect size for the VS condition was calculated using NAP (Parker & Vannest, 2009) with ExPRT, version 3.1 (2018). Individual effect sizes varied between 0.07 to 1.00 using NAP (Table 5.3). These results suggest that overall, VS had a large effect on the improvement in daily living skills for one participant (Jason) while for two other participants there was a small effect on independent daily living skills. Effect size was not generated for one participant due to no change in baseline and intervention. Overall changes between baseline and the VS condition were not significant (p = 0.08) when conducting randomisation tests that excluded Jason's data. This indicates that that the VS in isolation condition was not effective in generating significant changes in the participant's ability to learn a daily living skill. While the changes between baseline and intervention phases were significant (p = 0.04) for the VS in isolation condition when Jason's data were included, visual analysis showed that his data were likely to be inflating the outcomes of the VS condition.

Table 5.3

Summary of Effect Sizes using NAP for VS Condition

			Magnitude of Effect [M]		
Participant	**Condition**	**NAP**	**Magnitude of Effect**	***p*-value (Jason's data removed)**	***p*-value (all four participants)**
Ollie	VS	0.07	Small	0.08**	0.04*
Tom	VS	.13	Small		
Jason	VS	1	Large		
Jay	VS	-	-		
Overall	VS				0.04*

Note: * $p<0.05$ and ** $p>0.05$

5.5.1 Maintenance. Maintenance probes were conducted for six participants only since Levi and Jay were unable to continue in the study. Two maintenance probes were conducted in different settings two weeks after the intervention phase had ceased. During the maintenance phase, the independent variables VS+SI and VS were withdrawn (return to baseline). The results below summarise maintenance data.

5.5.2.1 Ben and Ollie (Unit 1). Figure 5.2 (VS+SI) demonstrated that Ben maintained the percentage of independent steps completed in his daily living skill of tying his shoelaces at 100% after intervention had ended while figure 5.3 (VS) demonstrated that Ollie had a decrease in the percentage of independent steps completed in his daily living skill during the maintenance phase at 41.6% accuracy, compared with the final intervention session (58.3%).

5.5.2.2 Trent and Tom (Unit 2). Figure 5.2 (VS+SI) showed Trent maintained a similar percentage of independent steps in the daily living skill of teeth brushing (63.6%) two weeks after intervention has ceased. Figure 5.3 (VS) showed that Tom maintained a similar percentage of independent steps in the daily living skill (0%) from intervention to maintenance phases

5.5.2.3 Eli and Jason (Unit 3). Eli and Jason (figure 5.2 and 5.3 respectively) both maintained their percentage of independent steps in the daily living skills of shaving during maintenance; however, Eli (VS+SI) demonstrated a slight decrease in the first maintenance session (92.3% of independent but maintained 100% in the second maintenance session. Jason (VS) maintained most of his skill at 86.14 for both maintenance sessions.

5.5.3 Overall summary of outcomes for VS+SI and VS. The overall results for unit and individual participants in the VS+SI condition demonstrated that when visual supports were paired with systematic instruction, positive results were obtained. All

participants in this condition increased independence in their targeted daily living skill and overall data presented an increasing trend in performance with effect sizes ranging from medium to large (NAP=0.64 – 1.00) with a significant *p*-value (*p = 0.04*).

Conversely, in the VS condition, the trends for three participants were negative and effect sizes were variable, ranging from negative for one participant (NAP= -.13), small for two participants (NAP=.13) and large (NAP-1.00) for one participant. Only one out of the four participants in the VS condition made progress and demonstrated a large effect.

This means that using VS+SI increased independent performance in daily living skills significantly, compared with VS alone which, with the exception of one participant, did not increase independent performance of daily living skills.

5.6 Social Validity Survey Data

A total of 24 educators consented to a post-study survey to evaluate their perceived effectiveness of VS or VS+SI on the acquisition of targeted daily living skills. The survey consisted of questions with a Likert scale response, as discussed in Chapter 3. Results from the social validation survey data are as follows.

5.6.1 Results. Results for VS+SI show that 90.47% of educators strongly agreed or agreed that this teaching method was effective for teaching daily living skills whereas 45.82% of teachers strongly agreed or agreed that VS was effective in supporting the participants to acquire daily living skills. Further, 44.65% of educators thought VS+SI was more effective in comparison to VS. In the VS condition, 16.66% of the respondents were neutral about its effectiveness. In terms of ineffectiveness of VS, 37.49% of the respondents felt that VS was ineffective while 9.52% felt that VS+SI was ineffective. Table 5.6 and

Figure 5.5 show the results of the social validation survey. In addition, Figure 5.6 shows the responses for individual questions.

Table 5.4

Results of the Educator Social Validation Survey

Question	**Strongly Agree/Agree (%)**	**Neutral (%)**	**Strongly Disagree/Disagree (%)**
VS Effective	45.82	16.66	37.49
VS+SI Effective	90.47	0	9.52

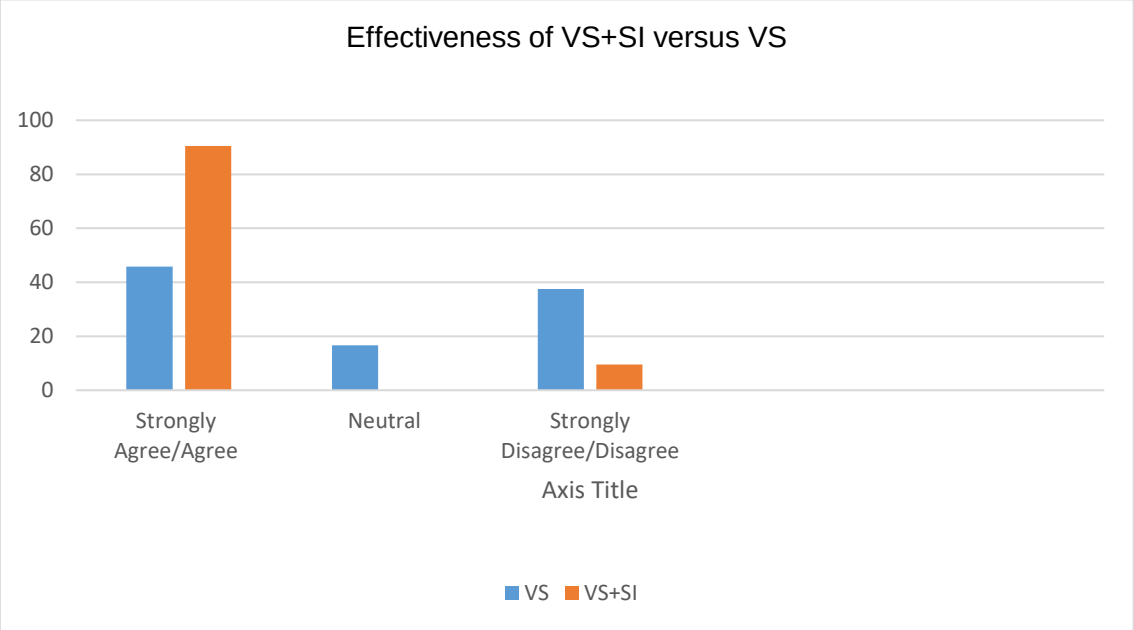


Figure 5.5. Educator perception of effect of VS+S and VS interventions

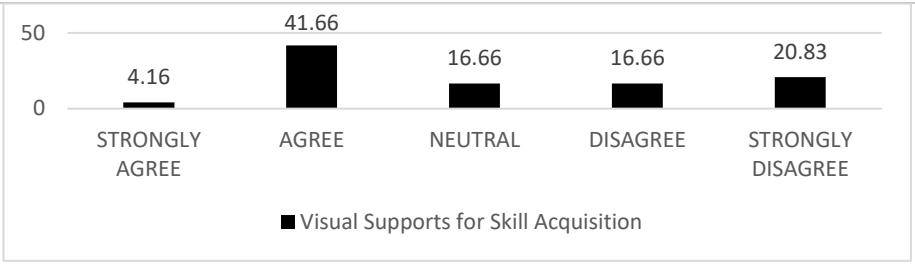
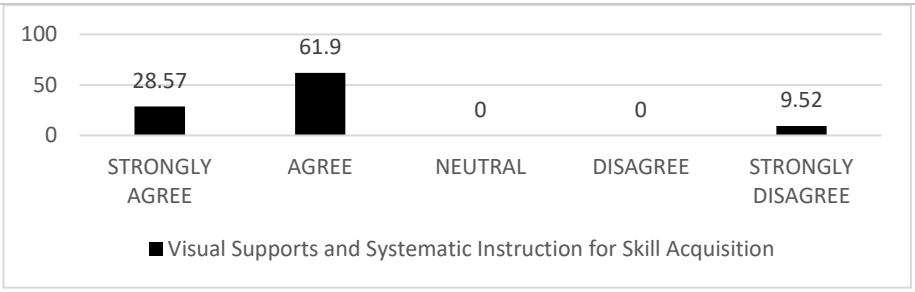
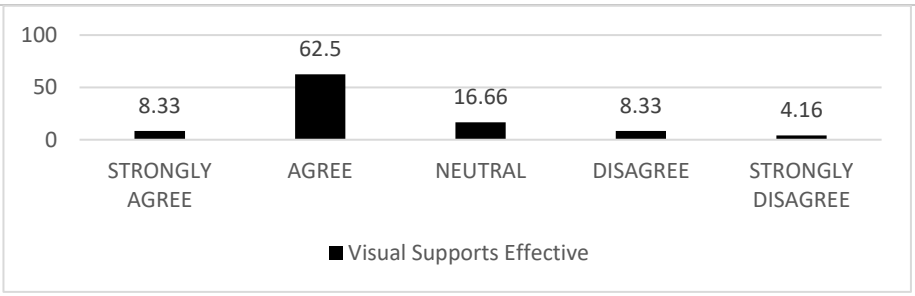
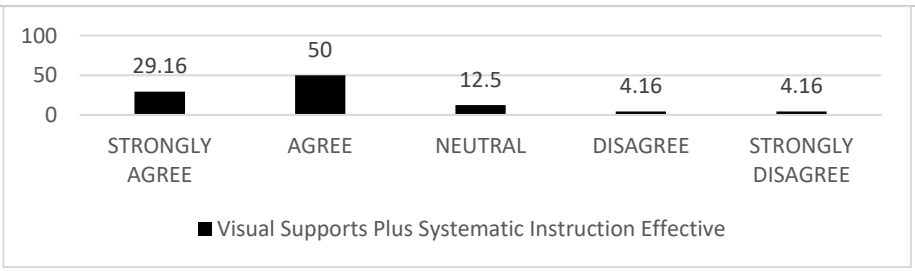
Survey	Educator Responses
When provided with the visual supports, the student acquired the skill to engage in the relevant behaviour.	
When provided with the visual supports plus systematic instruction, the student acquired the skill to engage in the relevant behaviour.	
I feel visual supports are effective in developing skills and engaging the students.	
I feel visual supports plus systematic instruction are effective in developing skills and engaging the students.	

Figure 5.6. Summary of teachers' and teacher aides' perceptions of effectiveness of VS+SI and VS

The survey also provided the teachers and teacher aides an opportunity to respond to open-ended questions. On the question of benefits of combining VS+SI, overall positive

responses included the following sample responses for VS+SI (see below). Most of these comments reflected that teachers and teacher aides felt that combining VS+SI led to the participants becoming more confident in their completion of the task. In addition, another theme that emerged from the responses was that students improved their task engagement. There was also a perception that visual supports provided the steps and thus more information in addition to the prompting system assisting the student. A sample of quotes is listed below.

- "In this case, combining VS and SI is strongly needed to boost the student confidence in completing the task."
- "Including the SI allowed the student to remain engaged and remain and follow the procedure. The visual alone did not give enough information and confused the student. Adding SI gave student sufficient prompting."
- "Combining VS and SI is great to let the student know the correct sequence and pathway to follow. VS is a good support tool to accompany SI."
- "VS—helps to provide more information about the required skill."
- "Being able to see visuals of the tasks in which is asked increases knowledge and understanding of what is asked."
- "Visual supports serve as a reminder for each step in the process. Visuals are easier for students for decode when compared with text. Breaking down a task into smaller steps is beneficial as students can focus on learning one step at a time and are less likely to become overwhelmed."

On barriers to combining VS+SI, the comments suggested that the teachers and teacher aides felt that barriers to combining VS+SI were that it was time-consuming to

prepare the visual supports. In addition, they felt that it was necessary to ensure that all involved in teaching the students also used consistent language in delivering the intervention. The following are sample of quotes.

- "Very comprehensive and time-consuming setting up. May have overwhelmed some students. Need to use consistent language to match pictures and name actions during specific activity."
- "Combining two sets of instructions could overwhelm the student."
- "I guess there are no barriers since VS and SI is needed in order to follow instruction and at the same time give the student consistent prompts to match the activities."
- "Consistency of prompts if more than one person is supporting. Transportability- how many visuals are used and how many environments they need to be used in.'
- 'Some students may not be able to follow the instructions or make the connection between the visuals and the instructions."
- "The student may become too over-reliant on a visual if it has not been faded in due time. Visuals may be different from one environment to the next. Students eventually need to rely on the natural cues in the environment and not need visuals to be independent."

Interestingly, some teachers and teacher aides felt that using VS+SI could be overwhelming to students; however, this could be owing to the misconception of the way in which visual supports should be used when students have mastered the skills.

The overall theme for this section revealed that the teacher and teacher aides felt that the students were more engaged and were more confident as opposed to being

distracted easily prior to the intervention. On comments about the student before and after intervention, the following sample responses were obtained.

- "Easily distracted, difficulty staying on task and following through."
- "Didn't do as good a job at brushing."
- "Very distracted and not attending to VS."
- "Gave up easily, even though he was doing okay at the task."
- "Seems student distracted in doing the specific activity."
- "Student is more confident in doing the task required."
- 'He was confident about the task, he knew he would succeed.'
- "Student received feedback as he went so he didn't look for it. He used the VS and the feedback if he was doing it right and to see when the task was complete. He seemed more confident in the activity."
- "More confident. He will need to continue the new skill to maintain. It is a great skill for him to have. Lifelong."
- "He was able to achieve the skill of tying his shoe lace. Still requires some assistance."
- "More understanding of correct procedure of brushing teeth since pictures were shown how to do it. Numbering the pictures in order would have helped follow which pictures was next as a bit unclear of the order."

Full survey responses are attached as Appendices N to Q.

5.7 Inter-Observer Agreement

Data to establish IOA were collected for 20% of the study sessions (i.e., four out of 22 sessions for each participant comprising two baselines and two interventions each).

Thirty-two video recorded sessions (16 baseline and 16 intervention) for VS+SI and VS only were viewed by a doctoral candidate. IOA was collected using point-to-point agreement (Courtade et al., 2010) to check that each step of the task analysis as recorded by the researcher matched that of the doctoral candidate's observation. IOA was computed as follows: Total agreements ÷ Number of steps from the task analysis × 100%.

Table 5.5 presents IOA data for all eight participants. Participants 1 and 2, 3 and 4, 5 and 6, and 7 and 8 were grouped into pairs to form four units. The IOA was 100% for all participants during both baseline and intervention phases.

Table 5.5

Inter-Observer Agreement for Performance on Steps of the Task Analysis

Participant	**Sessions**		**Agreement**
	Total	**Percentage**	**Mean (%)**
Ben	4	20	100
Ollie	4	20	100
Trent	4	20	100
Tom	4	20	100
Eli	4	20	100
Jason	4	20	100
Levi	4	20	100
Jay	4	20	100

5.8 Procedural Fidelity

The same doctoral candidate that observed the IOA videos independently viewed 20% of the video recorded sessions for each participant to verify that the procedures were accurately followed by the researcher. The procedural integrity checklist can be found in Appendix M. Procedural fidelity checks reviewed by the doctoral candidate produced an

overall mean of 90%. For five participants, procedural fidelity data were above 90%. For two participants, procedural integrity data were 84% and for one participant, it was 64%. Ollie's data were low since he allowed the videos to be started only when he said it was okay, which was sometimes midway through the session. Similarly, sometimes he would request the videos be turned off. On both instances, for ethical reasons the request was granted. The data are summarised in Table 5.6 below.

Table 5.6

Procedural Integrity as Recorded in the Checklist

Participant	**Steps Followed (%)**	**Range**	**Mean (%)**	**Overall Mean (%)**
Ben	100	100–100	100	90
Ollie	64	50–100	64	
Trent	92	83–100	92	
Tom	100	100–100	100	
Eli	100	100–100	100	
Jason	97	86–100	97	
Levi	84	83–86	84	
Jay	84	83–100	84	

Collier-Meek et al. (2013) and Keller-Margulis (2012) state that self-monitoring is a practical method of data collection for fidelity in school settings. Ledford and Wolery (2013) report that the use of checklists as a measurement type for fidelity in single-case research has increased significantly over the past 10 years. In this study, owing to a lack of personnel and the difficulties with video recording for procedural integrity, the researcher also used a self-monitoring checklist to ensure that each step of the intervention procedure was followed. This was the same checklist used by the doctoral student to measure procedural integrity. Using a step-by-step implementation checklist (Collier-Meek et al.,

2013) that outlined all the core steps of the intervention, the researcher achieved 100% fidelity during self-monitoring.

This chapter summarised the results of the study, visual supports with and without systematic instruction, on the acquisition of daily living skills for students with ASD and ID. Overall, VS+SI (NAP=0.64-1.00) was more effective than VS (NAP=0.07-1.00) in the acquisition of daily living skills for students with ASD and ID. All participants increased independent daily living skills in the VS+SI condition; however only one participant increased these skills in the VS condition. Randomisation tests demonstrated that changes in the VS+SI condition ($p = 0.04$) and VS condition ($p = 0.04$) were significant, that is due to intervention and not by chance. However, removal of the outlier data (Jason) for VS revealed that the VS condition result was nonsignificant ($p = 0.08$). The ways in which these results relate to the overarching research questions in this study are discussed in detail in Chapter 6.

Chapter 6: Discussion

The primary purpose of this study was to examine the effects of VS+SI and VS in isolation on the acquisition of daily living skills for students with ASD and ID. A total of eight participants were involved in the study, four receiving the VS+SI intervention and four receiving the VS intervention. The study was conducted in two Australian special schools that served students with ASD and ID. To date, the researcher has found no studies that have investigated VS+SI and VS, side-by-side, on the acquisition of daily living skills for students with ASD and ID.

This study was designed based on a novel single-case experimental research design, MBCI, by Levin et al. (2014). In this design, the independent variables, intervention start points and intervention staggers are randomly assigned to the participants. The random intervention start points selected were 6, 7, 8 and 9, for each pair, generated by the randomizer function of ExPRT, version 3.1 (Levin et al., 2014). Data were analysed to obtain effect size and significance value, using ExPRT version 3.1. This chapter provides a discussion of the results of the study as they relate to the four research questions in this study.

6.1 Summary Results of the Study

Overall results obtained revealed that VS+SI and VS alone were effective; however, there was greater improvement in the VS+SI condition than the VS condition in the acquisition of daily living skills for students with ASD and ID. VS+SI had a medium to large effect (NAP=0.64-1.00), with one participant showing medium effect and three participants showing large effect, and significantly increased daily living skills (p = 0.04). This demonstrated that increased daily living skills did not occur by chance and was caused

by the intervention. VS in isolation had a small to large effect (NAP= 0.07-1.00), with two participants showing small effect and one participant showing large effect, and significantly increased daily living skills (p = 0.04). This likely inflated the overall significance for all four participants. Effect size was not generated for one participant due to no change in baseline and intervention. VS alone was effective for only one out of four participants. These results are important since these may suggest that for students with ASD and ID, combined FIPs, specifically visual supports and systematic instruction, are more effective than a single FIP, which in this study was visual supports. More importantly, systematic instruction is likely an important method for teaching the use of other FIPs, such as visual supports.

It can be concluded that VS are effective if systematically taught. It is unrealistic to expect students to learn using VS without instruction. The implication of this finding is that while VS are an EBP, their use must be taught intentionally, so that when systematic instruction is faded, VS continue to support the learner to maintain their acquired skills.

Students with ASD and ID often have difficulty acquiring, and are thus at risk of lacking competency in, daily living skills without specific instructional support (Kanne et al., 2011; Kraper et al., 2017; Wells, Condillac, Perry, & Factor, 2009). The results of this study are significant because they show that a combination of VS+SI can support children with autism to learn a daily living skill more effectively than VS in isolation. The results also suggest implications for educators, in that pedagogically, it may be prudent to pair VS+SI in teaching students daily living skills as well as adopt this combination as a general pedagogy for teaching other social and academic skills. This chapter now proceeds to discuss the implications of this study by addressing the research questions.

6.1.1 VS+SI is effective in teaching daily living skills to students with ASD and ID. The first research question in this thesis aimed to investigate whether VS plus SI was more effective in supporting the acquisition of daily living skills for students with ASD and ID compared with VS alone. Statistical analysis indicated that VS plus SI was indeed more effective with all four participants in this condition showing improvement in daily living skills compared with one out of four students in the VS only condition. Overall, the VS+SI condition had a large effect size and the VS in isolation had negative effect size. Multiple studies have demonstrated the effectiveness and efficiency of the most-to-least prompts, graduated guidance, system of least prompts, simultaneous prompts and time delay systematic instructional systems in academic and non-academic domains, such as receptive labelling (Boulware, 2001; Leaf, 2008) and adaptive behaviour (Aykut, 2012; Denny et al., 2000; Eren et al., 2013; Gardner, 2014; Gruber, 2008; Gruber & Poulson, 2016; Harriage et al., 2016; Jerome et al., 2007; Lindsey, 2013; Manley et al., 2008; McConville et al., 1998; Mechling et al., 2008; Rehfeldt, 2002; Schuster, 1987), on-task and on-schedule behaviour (Eliçin & Tunalı, 2016; Pelios et al., 2003), communication (Filla et al., 1999), academic skills (Brodie, 2008; Cihak et al., 2010; Cihak, 2011), vocational skills (Smith et al., 2015; Williams, 2013), community skills (Slocum, 2016) and parent training (Batu et al., 2014). Thus, the evidence that systematic instruction procedures are effective is substantial.

Multiple studies have concluded that visual supports are effective. However, although the premise for these studies state that visual supports are successful for teaching, in reality, many of these studies have included other types of instruction to facilitate their effectiveness. In other words, instructional practices other than visual supports were also adopted within the design to aid instruction using visual supports (Betz et al., 2008; Blum-

Dimaya et al., 2010; Breslin, 2009; Bryan & Gast, 2000; Carnahan et al., 2009; Carson et al., 2008; Cirelli et al., 2016; Danko, 2004; Dettmer et al., 2000; Duttlinger et al., 2013; Fittipaldi-Wert, 2007; Kenville, 2014; King, 2015; Lopez et al., 2005; Pierce et al., 2013; Spriggs, Knight, & Sherrow, 2015; Watson & Dicarlo, 2016; Zimmerman et al., 2017). Importantly, the current study is novel and contributes to the research literature in that it is one of the first studies to evaluate whether VS in isolation is sufficient to support the acquisition of daily living skills or whether VS in combination with SI is more effective and necessary. Many studies evaluating the effectiveness of VS have often included a form of SI, and thus, the benefits of VS as a singular tool are less understood. This is important given the widespread belief that children with ASD are strong visual learners, which may lend itself to educators implementing visuals in the classroom believing these students will simply understand them, rather than, as this study demonstrates, that a form of SI combined with such visuals is often necessary. This has implications for pre-service and in-service professional development as SI is a technical teaching method that requires sound knowledge, understanding and skill to implement effectively.

Adopting EBPs from established, authoritative reports, such as those by the NPDC and NAC, ensures that interventions with an evidence base are adopted and also seek to mitigate the adoption of approaches that may be pseudoscience. This is especially so for students who were the target population in this study and are typically very challenged in learning given the nature of their disability (i.e., autism and concomitant ID). This may enhance opportunities for skill acquisition in a very important domain, daily living skills. In addition, given the already extensive adoption of VS in classrooms that serve students with ASD and ID, it may be necessary for educators to embrace an additional pedagogical approach that will enhance their existing practice (Cohen & Demchak, 2018). Several other

observations, although not the direct focus of this study, were noted and are discussed below due to their potential relevance to future investigations.

6.1.1.1 Least assistive SI effective with VS. SI systems provide a varying range of assistance, from least assistive to most assistive, in helping students achieve their learning goals (Collins, 2012). Collins (2012) described prompts as providing students with opportunities to likely be successful through prompting which 'consists of assistance' (p. 210). Paradoxically, prompts have also been discussed to have a degree of 'intrusiveness' (Snell & Brown, 2011, p. 161). Considering that prompts are meant to assist students in making progress, as opposed to being intrusive, this is likely a case of an interpretive misnomer. Decisions on the prompt systems to use are based on initial baseline assessments. Typically, the preferred prompting systems are those that provide the least assistance, followed by prompting systems that provide increasingly assistive prompts as required by the individual (Snell & Brown, 2011). This is to prevent a situation in which the learner is reliant on over-prompting, which is regarded as not only unnecessary but may also create a student characterised as lacking independence (Collins, 2012; Snell & Brown, 2011).

In this study, based on baseline assessment data, it was decided that the two SI systems to be used would be the system of least prompts and graduated guidance. Both of these systems have procedural parameters that can be considered least assistive and therefore, less intrusive towards facilitating greater independence compared to other prompting systems. In using the system of least prompts, the researcher provided assistance as required from least-to-most assistance within a session. For graduated guidance, although a physical prompt was provided in a planned manner, the researcher provided this

only as necessary and faded assistance as required within the session or over a period. This is as opposed to, for example, the 'SI prompting system' of most-to-least prompts, that specifies number of days for the physical prompt to be in effect before it is reduced to the next level of assistance (Collins, 2012), which may be perceived as more intrusive.

This study revealed that when VS was used with the selected prompts, in this case two least assistive SI procedures, the prompts were adequate and effective in promoting skill acquisition by the participants. This finding is significant since one criticism of prompts is that it may lead to unnecessary reliance on adults and decrease independence, thus fostering further reliance on prompts (Mesibov et al., 2006). However, at least in the context of this study, least assistive prompts were promising in facilitating skill acquisition. In other words, provision of minimal assistance was effective. It is important to note that in this study, other types of SI, such as most-to-least prompts, were not employed. Hence, it is not known if other forms of SI plus VS would be as effective.

In addition, in the maintenance phase, students who received the VS+SI combination largely maintained their skills after termination of the intervention. This finding implies that there was greater independence in the acquisition of the daily living skill. Throughout the implementation of this study, prompts were provided only in instances in which they were necessary to prevent errors and to promote errorless learning, which is the premise behind SI, to systematically provide instruction as needed and fade prompts (Collins, 2012; Cooper et al., 2007; Snell & Brown, 2011).

Cohen and Demchak (2018) state that SI makes the adoption of VS easy and could be incorporated into daily classroom practices. This view is supported by this study in that SI is indeed assistive and applicable to all classrooms. This study in fact demonstrated that the addition of SI was necessary to achieve independence for the majority of participants in

this group (ASD and ID). If SI is implemented as intended, with fidelity, prompts should be faded, and hence, the issue of prompt dependence becomes mute. The issue then arises as to the preparation of educators to implement SI with fidelity.

6.1.1.2 SI with VS an effective accommodation. Students with ASD and ID still require instruction even if they are provided with VS. Much of the research around VS has included some type of instruction (Betz et al., 2008; Bryan & Gast, 2000; Cirelli et al., 2016; Dettmer et al., 2000; Duttlinger et al., 2013; Fittipaldi-Wert, 2007; Lopez, 2015; Knight et al., 2015; Spriggs et al., 2007). Hence, it could be argued that the evidence leading up to VS being considered an EBP has included research that evaluated VS with some other form of instruction, such as SI. Hence, VS could be considered an accommodation rather than a method of therapeutic intervention. The use of VS as an accommodation is potentially effective in reducing the cognitive load on students to understand speech and facilitate comprehension. In addition, the static nature of visuals could be effective in enhancing independence instead of replacing instruction. Further, VS could be effective in delaying reinforcement (e.g., “I am working for puzzles”). Moreover, it may be concluded that at least in the context of this study, VS in isolation may not be effective for learning chained tasks for students with ASD and concomitant ID.

Finally, it is important to understand that singularly, not all EBPs are suitable for all students (i.e., three out of four participants did not benefit from VS). Thus, the suitability of an evidence-based intervention must be evaluated in two ways prior to adoption: Does it promote learning behaviour, or does it promote meaningful learning for each learner? Learning behaviours are the prerequisite behaviours to make individuals ready to learn, such as attention, engagement and transitions, as opposed to meaningful learning, which is what individuals learn in terms of content from the curriculum (Howley, 2015).

6.1.1.3 SI with VS may help redirect interfering behaviour. Students with ASD and ID are often known to engage in interfering behaviour. Interfering behaviours are repetitive behaviours as well as disruptive behaviours that may inhibit the teaching and learning process, thus impeding development (Neitzel, 2010). Interfering behaviours may also culminate in aggressive behaviours, found to be higher in the autism population as described by Kanne and Mazurek (2011). This may be a result of stimulus over-selectivity, characteristics that many students with ASD and ID experience, in which a fixation on a very specific and yet narrow stimulus of interest prevents the student from engaging with other relevant stimuli. In this study, over-selectivity was evident in the participants.

An observation during this study was that when the participants engaged increasingly in interfering behaviour this often occurred on days when the video recording device was used in the session. SI procedures were effective in redirecting the participants to the VS and to engage in the expected behaviour on some occasions. The video recorder was the antecedent to the interfering behaviour. Altering instructional antecedents have the potential to reduce interfering behaviour (Munk & Repp, 1994). Explicit strategy instruction has been used to reduce problem behaviours in a student at risk for emotional-behaviour disorder (Hagan-Burke, Burke, & Sugai, 2007). Similarly, the explicit instruction provided to re-engage in the instructional tasks in this study was effective for redirecting interfering behaviour, suggesting that the SI and VS were effective antecedents to redirect behaviour. The verbal instruction provided was ‘Look at the photo: What are you supposed to do?’ or ‘Follow the photo’—both of which were least assistive verbal prompts. Evidently, the use of SI systems and VS was effective in redirecting the participants to the existing learning task, thus minimising, and on some days eliminating, interfering behaviour and preventing challenging behaviour. This allowed the sessions to continue,

thus enhancing behavioural approximations towards the desired learning goal of the session despite the initial distraction. That SI and VS, two levels of support, were effective in disengaging the participants from the interfering behaviour to the present learning task is important since it suggests that these may be a competing variable to interfering behaviour. While this was not part of the plan in the context of this study, it is a welcome observation and a worthwhile area to be considered for future investigation. Potentially, this is also a sign that the use of SI and VS provide a 'double-dose' of intervention strategies that promote not only meaningful learning but also learning behaviour to mitigate interfering behaviour.

The next section of this chapter discusses the second research question and implications for teacher practice with regard to VS.

6.1.2 VS alone not effective for teaching daily living skills to students with ASD and ID. A review of the data for each of the four participants in the VS condition revealed that overall, negative results were associated with the use of VS alone. When the independent variable, VS, was employed in isolation, three out of four participants, Ollie, Tom and Jay, did not make any progress in the acquisition of daily living skills, however one participant, Jason, made significant progress. This result was consistent with the investigator's prediction that despite the fact that VS is classified by the NPDC (2014), which defines VS as "any visual display that supports the learner engaging in a desired behaviour or skills independent of prompts" (NPDC, 2014, p. 22), with the emphasis being on 'independent of prompts', not all students with ASD and ID may benefit when VS is implemented without instruction.

One of the main questions that this study sought to answer was whether VS, a common feature in classrooms that serve students with ASD and ID (Francis, 2005;

Mesibov, Browder, & Kirkland, 2002), is effective on its own to support students with ASD and ID (i.e., whether the visual support would be effective in promoting learning when used without systematic instruction). Answering this question is important for several reasons.

Several studies have demonstrated the effectiveness of VS in areas such as imitation (Ganz & Flores, 2008), improving engagement levels (Betz et al., 2008; Carnahan et al., 2009; Danko, 2004; Watson & Dicarlo, 2016), on-task and on-schedule behaviours (Bryan & Gast, 2000; Cirelli et al., 2016; G. Lopez, 2015; Spriggs et al., 2007), play (Blum-Dimaya et al., 2010; Morrison et al., 2002), physical education (Breslin, 2009; Fittipaldi-Wert & Mowling, 2009), independence (Duttlinger et al., 2013), transitions (Dettmer et al., 2000; Pierce et al., 2013), vocational transition between school and community (Carson et al., 2008) and challenging behaviour (Kenville, 2014; King, 2015; Zimmerman et al., 2017). However, all these studies had one common aspect: While examining the effects of VS, the investigators also incorporated other intervention strategies, such as prompting systems and video modelling, thus aiding and facilitating the use of VS. In other words, it is difficult to determine confidently that a particular intervention was effective in the broad range of skills taught because the control measures in these studies did not isolate the independent variables for comparison, nor was it the intent of these studies. However, this research gap raises questions about the effectiveness of visual supports for all students with ASD and until more studies are undertaken, participants' progress in these studies cannot be confidently attributed to VS alone. Rather, it would be more accurate to state that effects were achieved with a packaged intervention (VS with instruction), and for the majority, VS in combination with SI. It is important to note that not all students with ASD and ID need SI, as was the case with Jason in this study; similarly, it should not be assumed that all

students with ASD will benefit from VS without explicit instruction. This may be an area of future research to determine the extent to which SI is necessary

While the researchers in the above studies did not aim to investigate the effect of VS in isolation, conclusions of its effects on skill acquisition, maintenance and generalization should be interpreted with caution or the combined effect with instruction clarified. Mesibov and Shea (2010) have called for the individual components of the structured teaching approach to be examined under research conditions, stating 'More refined research is needed because the individual contributions of these mechanisms and their sub-components have not been studied' (p. 575). To answer this call and in line with assertions by Howley (2015) and the analysis by Knight et al. (2015), this study investigated VS, one of four major components of structured teaching. Several conclusions are drawn including variables that may impact the effectiveness of VS and discussed from here on.

One major aspect of this study was that it was designed to specifically evaluate VS as a standalone instructional technique. Evidence from this study has provided insights that VS alone is not necessarily effective, despite its evidence-based status, while VS may be beneficial for a few (such as Jason), depending on their characteristics (e.g., the level of ID). It is important to consider the characteristics of students who may benefit from VS without the need for SI which could be a future area of research. In a recent study, on teaching students how to type, listen to an audio book and collect and eat lunch, Cohen and Demchak (2018) reported that VS alone did not contribute to behaviour change significantly and that 'Visual supports presented without systematic teaching of their use are not effective intervention strategies' (p. 96). However, Cohen and Demchak's (2018) study is unique because of the three phases it considered: In phase one (baseline),

systematic instruction was provided, in phase two, visual supports were provided and in phase three, systematic instruction and visual supports were provided. The authors caution that in phase two, while no notable difference in performance was noted, the exposure to visual supports could have influenced the participants' subsequent performance in phase three. Important to note too, in phase one, systematic instruction was provided. Hence, by phase three, the participants had been exposed to systematic instruction and visual supports and the cumulative effects on improved phase three performance are unknown. The present study is different, as during baseline, no intervention was provided in either conditions, and allows for a demonstration of the differing effects of the independent variables on acquisition. This study was specifically designed as a comparative investigation and it can be confidently assumed that there were no confounding variables that may have had cumulative effects on behaviour in the intervention phase. However, the present study and that of Cohen and Demchak (2018) provide contributions to the very limited literature on the effectiveness and limitations of VS implemented without instruction.

This suggests that interventions that are established as EBPs, and thus likely perceived as effective, must be considered carefully with student characteristics and the assumption that explicit instruction is part of the intervention. Decisions on intervention use or adopting a combination must be carefully considered. Educators should be critical consumers, selecting interventions that have research evidence before adoption, bearing in mind the learning challenges and characteristics of the learner. This requires specific knowledge and skills that pre-service and in-service educators may require, along with professional development of the intervention itself.

6.1.2.1 Teaching self-prompting may be useful to facilitate visual supports. Given

the large effect of the VS condition on Jason's acquisition of daily living skills, observations of learning characteristics displayed by Jason may inform on the type of student who could benefit without the need for SI. Jason realised that the pictures were 'telling a story' and subsequently his progress was quite rapid. While overt or covert self-instruction or rehearsal was not within the scope of the study, his unexpected behaviour revealed that self-prompting (talking himself through the steps, pointing to the picture and trying to imitate the actions), may be an effective facilitator of the use of VS. Jason was characteristically different from his peers, after the introduction of VS; he demonstrated engagement with the VS, and early on in the study engaged in self-talk and referred to the VS through pointing, tracking and labelling the actions. This suggests that students who have more self-regulation and engagement with instructional variables may benefit from learning self-prompting techniques with VS.

Participants in the study were from learning environments in their classrooms that employed visual schedules, to follow the daily classroom activities and school transitions. In addition, the common areas accessed, such as toilets, also consisted of many VS, such as chained sequences of hand washing. Non- responsiveness to visual supports was a frequent lament of educators and teacher aides working with the participants. Although use of the schedule was often prompted, the chained steps of skills were not. This was particularly evident for one school who engaged in professional development for structured teaching and VS. Specifically, the training had emphasised the promotion of VS over verbal prompts, possibly because of presumed visual strengths in students with ASD (Travers & Ayres, 2015) and the promotion of the use of VS over other approaches to teaching.

However, observations revealed that while the participants were able to follow daily schedules, to varying degrees of independence, this was usually predicated by repeated staff

directives for students to use their schedules (VS). In addition, while multiple environments had abundant VS of chained sequences, such as washing hands, students did not engage with or use the VS to self-prompt through the steps. In short, while VS were ubiquitous in the learning environments, they appeared to be of limited to benefit to students without instruction. As reported by Cohen and Demchak (2018), visual supports were only effective when systematic prompts were used to teach students with ASD. In addition, Mesibov, Browder and Kirkland (2002) states that use of visual supports such as schedules must be taught systematically and suggest several important steps in teaching, comprising, (a) defining the purpose of the schedule, (b) incorporating components of self-determination in the schedule, (c) creating a schedule in a format that the student understands, (d) teaching the student how to decode the schedule for comprehension, (e) determining the schedule length and method of organization and finally, (f) teaching the user to initiate the activities within the schedule. These suggestions clearly indicate the need to teach visual support use systematically.

6.1.2.2 Visual learning strength in autism. Issues discussed above including (a) the relative ineffectiveness of VS without instruction on skill acquisition, (b) matched visual comprehension level not mediating to success in the VS condition, and (c) exposure to a visually coded environment without teaching VS use, supports the question raised by several authors (Erdődi et al., 2013; Preis, 2006; Trembath et al., 2015): Is visual learning a strength in students with ASD? Supporting their conclusions, this study showed that strength in visual learning was not evident for three of the four participants who were exposed to the VS condition. The point being that individual differences in visual strengths exist and not all children with ASD may benefit from the addition of VS in isolation (Trembath et al., 2015), as was observed in this study.

Addressing the limitation identified by Preis (2006) that visual comprehension was not established for their participants, and therefore difficult to ascertain whether participants understood the meaning of the visual supports, the current study assessed visual comprehension to ensure graphic symbols were understood by participants. Despite this approach, three participants in this study did not make gains in the acquisition of a daily living skill. Erdődi et al. (2013) observe that the performance of children with ASD in learning involving visuals was relatively weak and they conclude that their 'finding potentially poses a challenge to the current conceptualisation of learning in ASD and its educational application, which assumes that ASD children typically display relative strengths in visual learning' (p. 887). The authors assert that while visual learning is probably a strength, the novelty and complexity of the visual may overwhelm the learning. This assertion might be valid but the ambiguity regarding relative visual strength in students with ASD persists.

6.1.2.3 Educators' perspective on potential benefits of VS+SI. Educators and teacher aides also provided some qualitative feedback in the survey in the form of comments, with several themes emerging. Some noteworthy comments were that VS was essential to follow the procedure in completing the task, that prompts facilitated skill acquisition, and that combining both was affirming to the participants about their progress. These suggest that the educators and teacher aides responsible for teaching the participants in this study felt that the combined VS and SI provided greater benefit to their students when learning how to acquire daily living skills. Researchers in Australia concur that Australian special educators reportedly employ strategies embedded in empirical evidence (Carter, Stephenson, & Strnadová, 2011b). In response to Dempsey's (2011) rejoinder to their study on self-reported use of EBPs among special educators in Australia, Carter,

Stephenson and Strnadová (2011a) surmised that while some differences exist between their findings and Dempsey's, it was concluded that special educators should employ strategies based on empirical evidence. Their assertion is welcome in the context of the present study that has provided empirical evidence for the combined use of VS and SI to support the learning of daily living skills for individuals with ASD and ID. This contribution to the literature may encourage educators to adopt this pedagogical practice. Given that this current study found that VS plus SI was effective in acquisition of daily living skills and some survey respondents stating that they did not know enough about systematic instructional procedures, it is essential that educators have knowledge about EBPs and professional learning as a model to enrich teacher pedagogy, which will be discussed subsequently in this chapter.

6.1.2.4 Educators' perspectives on potential barriers of combining VS+SI. On barriers to implementing the combination of VS and SI, educators commented that it could be time-consuming; that the students may find it overwhelming to have two systems; concerns about portability, number of visual supports needed; over-reliance on visuals if these are not faded; and that there were already visuals in the natural environments. However, it is important that the barriers are viewed in light of what could be achieved for students in terms of independence. These barriers can be overcome with professional learning on knowledge of EBPs and specific skill development of FIPs, in this case VS and SI. Particularly the implementation of technical methods of instruction such as SI.

6.2 Implications for the Field of Education

The discussion thus far has several implications for the field of education, specifically in three broad areas: (a) pre-service teacher education, (b) professional learning for teachers and (c) leadership and policy for professional learning.

6.2.1 EBPs in teacher preparation programmes. If university-based pre-service special and general education programmes are responsible for equipping teachers to work with a diverse range of students, introduction of pedagogy specific to the needs of students with complex needs is important. According to Scheuermann, Webber, Boutot and Goodwin (2003) teachers lack the skills to teach students with ASD. Among other reasons, this is a result of noncategorical versus categorical teacher training in special education, that is, whether the training is specifically designed to teach students with ASD, or general in nature with the expectation that teachers will be able to apply it to students with ASD. Consequently, with general approaches in preparing pre-service teachers, teachers may not have the skills to implement FIPs to support the heterogeneity of students with ASD and ID, particularly the explicit procedures required to implement FIPs with fidelity. The heterogeneous nature of ASD suggests that to be effective, teachers should have skills in multiple EBPs (Simpson et al., 2011). Compounding this issue, teachers receive limited professional development in evidence-based behavioural approaches (Begeny & Martens, 2006; Simonsen et al., 2010). Thus, it is necessary to include knowledge, understanding and skill development of EBPs in initial teacher education programmes (Lauderdale-Littin & Brennan, 2018; Scheurmann et al., 2003). In addition, these programmes often do not include the development of teaching practices to meet the needs of students with ASD (Lauderdale-Littin & Brennan, 2018). One approach to address this gap in teacher

education is to replace one or two generic courses with autism-specific courses and this may affect teacher's ability to meet the needs of students with ASD (Lauderdale-Littin & Brennan, 2018; Scheuermann et al., 2003). It may also be important to ensure that existing courses match research evidence emerging in this field. This could be a possible simple strategy to make an immediate impact on teacher pre-service training and increase the potential of beginning teachers in working with students, assuming that beyond historical and foundational knowledge of ASD and ID, EBPs are the mainstay of such a program. If a competency-based model is adopted in such a pre-service training model as suggested by Leko et al., (2015), pre-service teacher training may have a lasting impact as trainee teachers receive practical knowledge as well, in addition to theoretical knowledge.

6.2.2 Professional learning for teachers. Professional learning has three systematic outcomes: (a) changes practices of teachers, (b) positively affects their attitudes and beliefs about students and, perhaps most importantly, (c) improves student learning outcomes (Guskey, 2002). Professional learning for teachers is important if they are to remain current in their practices to support students to achieve their educational outcomes. These three outcomes are particularly important for teachers working with students who have complex needs, such as ASD and ID.

The results of this study have implications for teacher's professional development. The analysis of teacher responses to this study yielded clues about teachers' pedagogical knowledge and the importance of teacher professional learning. In particular, comments about combining SI with VS stood out such as, (a) "I don't know enough about SI", and (b) "don't know enough about this to answer…", and (c) "combining two sets of instructions could overwhelm the student". According to Lauderdale-Littin and Brennan (2018) "research suggests educators report having only moderate levels of confidence in their

ability to implement these EBPs" (p. 369). This supports the findings of the present study in which educators reported limited understanding of SI. Ultimately, a lack of understanding and inadequate professional learning both affect intervention fidelity and student outcomes. Partial or inconsistent implementation is known to reduce the effect of intervention and result in poor learning outcomes for students (Collier-Meek et al., 2013; Noell, 2014).

Without professional learning of EBPs educators are likely to select practices that appear less technical or easier to implement, such as VS, or attempt to implement strategies without sufficient knowledge and understanding, and thus may implement pseudoscientific interventions (Travers, 2017). This could be mitigated if educators receive professional development and coaching to build their capacity and confidence in applying technical practices such as SI. Further, the more complex the practice, the more educators will require ongoing development in learning effective evidence-based pedagogy. One such practice as outlined by Odom et al. (2012) describes the process for developing evidence-based individualised programmes for students with ASD and ID that features professional development through an intensive coaching process. While intensive, its critical features are the adoption of SI and goal generation, selecting FIPs and emerging 'manualised' interventions and professional development through coaching.

The type of professional learning that educators receive is important, fundamentally, for sustainability of their practices and impact on their learners. Coaching is an approach that can be meaningful as it is not only constructivist to promote teacher growth and change but is also premised on the agreement that it is based on the needs of the teacher and not the interpretations of the coach (Jewett & MacPhee, 2012). Coaching can consist of peer coaching, cognitive coaching, team coaching, collegial coaching and instructional coaching (Netolicky, 2015). In addition, Gallagher and Bennett (2017) propose six principle of

coaching that consists of: (a) “pre-requisite: teachers’ receptivity”; (b) “process: from building trust to collaborating and reflecting”; (c) “precipice: tension between knowledge and beliefs”; (d) “promotion: administrative support”; (e) “proof: evidence of change, impact, and capacity building”; and (f) “promise: future of the role” (p. 19). Each of these principles are significant whether educators work in special or inclusive classrooms as they evolve from Gallagher and Bennett’s (2017) willingness (pre-requisite) to learn to the change (proof) and more importantly the future development of coaches for novice teachers (promise).

Specifically, for teachers of students with ASD, Bellini, Henry and Pratt (2011) propose that it is important to measure the outcomes of professional learning for teachers through the processes of (a) resources and inputs available such as human, financial, organizational and community, (b) program activities such as processes, tools, events and actions, (c) outputs, the products of activities, (d) outcomes, specific changes in participants performance in terms of behaviour, knowledge, and functioning and (e) intended and unintended changes that occur in the system. Of these, outcomes and changes in performance are likely the most critical impactful result for improving students learning. Leblanc, Richardson and Burns (2009) reported that professional learning for teachers in an inclusive classroom resulted in teachers reporting positive feelings about teaching students with ASD, welcoming students with ASD in the classroom and technical knowledge increased. Of significance is that teachers in the Richardson and Burns (2009) study is that teachers received 200 minutes of training in technical knowledge with expert coaches. Similarly, Maddox and Marvin (2012) reported that teachers who received professional learning in an 18-month program consisting of workshops and on-site coaching improved

the participants confidence and skill levels. Mentors also completed post-coaching checklists and reflected that there was improved performance in their trainee's performance. Importantly, systematic instruction and environmental and programme structures (visual supports considered environmental antecedents) were included and reported to improve in the training, both examined in this present study.

These studies support the findings that professional learning when guided by coaching and on-site support impact teacher's performance and ultimately student outcomes. Thus, in the context of EBPs and FIPs being technical in their application, it is imperative that such as coaching model be adopted in in-service teacher training.

6.2.3 School leadership and policy. The Organization for Economic Co-Operation and Development report (2009) identified that more than half of the teachers reported needing professional learning. However, the professional learning available was not suitable for their needs and consequently this led to teachers feeling indifferent about the outcome. In addition, Appova and Arbaugh (2018) report that the emphasis in professional learning has been more on quantity than on quality, thus affecting teachers' motivations.

These findings have important implications for school leadership and policy. It is important for school leadership to understand that pedagogical restructuring (Owen, 2014) may be necessary from time to time to keep teachers up to date and current in their instructional approaches. Importantly, the training must be relevant to the needs of the teachers, so that it facilitates their growth to become effective implementers of pedagogy that is specific to their student populations. This approach may motivate teachers to remain current when the professional development is relevant to the students they teach (Appova &

Arbaugh, 2018). It is well known that effective professional development must be timely and relevant to the needs of educators and their students (Desimone, 2009).

From a policy perspective at a national level, one approach to this for students with ASD and ID, could be the development of professional learning to update practitioners' use of and selection of EBPs (NPDC, 2014). This may address educators' concerns around technical instruction methods to support students who have complex learning needs. Given the ever-increasing expectations for educators to deliver the best approaches to the most vulnerable students in the classroom, such models of EBPs that have a strong basis for success are imperative (Odom et al., 2012) and should be a high priority in professional learning for school leaders in this era of accountability.

6.3 Limitations and Delimitations of the Study

The results of this research revealed that VS and SI can significantly enhance acquisition of daily living skills for individuals with ASD and ID, compared with VS in isolation, but that individual variations in learning abilities must also be considered. In light of these positive findings, several limitations of this study need to be acknowledged and addressed in future research.

First, being single-case experimental research, the findings cannot be extended to the population of students with ASD and ID, nor is it the intention of the research design employed (Cooper et al., 2007; Kazdin, 2011; Kennedy, 2005). In addition, the design selected was intentional to attempt the comparison of two intervention approaches across the participants. Traditionally, in single-case designs comparisons are made within participants, that is, each participant receives both interventions. It is acknowledged that the MBCI design selected, when using single-case experimental designs is non-traditional and

therefore has limitations, particularly related to the randomization of intervention start-point explained further below.

Second, it would have been ideal to have educators and teacher aides employ the use of VS+SI and VS as opposed to the researcher implementing them, as was the original intention of this study. However, participant recruitment, cost and scheduling associated with employing substitute teachers made this impossible. Therefore, whether educators inexperienced in VS and SI could employ an intervention with fidelity and the level of professional development required to do so may be areas of future research to be explored.

Third, the design adopted in this study, MBCI (Ferron & Levin, 2014) employed randomization and statistical analysis, thus, to generate intervention start points, it was necessary to fix the number of sessions. Consequently, it was decided that there would be 22 sessions. In addition, school schedule also meant that only a limited number of sessions were allowed. As a result, the baseline conditions were variable between five to eight sessions, after which the independent variable had to be introduced. This is in comparison to a response guided approach traditionally used in single-case intervention research. In traditional multiple-baseline designs, level and trend of baseline for all tiers drives the introduction of the intervention in the subsequent tiers of the multiple baseline. In the baseline condition, another limitation was that the sessions were terminated when the participant did not respond, instead of having the researcher complete the task and then allowing the participant to continue with the next steps. This inadvertently may have supressed true baseline performance.

Fourth, the number of participants in the study were limited to four in each condition. In addition, individual differences in students may have impacted the outcomes

for the two independent variables (VS and VS+SI). Although this was controlled by matching students according to skill and baseline performance there may have been individual differences that influenced performance.

Fifth, given time and school limitations changing intervention conditions for the participants was not feasible, (i.e., each participant receives VS+SI followed by VS). It would have been ideal if participants received both intervention conditions, to evaluate the effects of the intervention on skill acquisition. This would have made the study a robust *comparison* of the two conditions and could be the focus of evaluation in future studies.

Sixth, state education department restrictions did not allow the researcher to access psychological reports. Thus, the level of ID was not verifiable when pairing the participants and had to be determined by their symbolic communication and baseline data results. Future research should report level of ID for greater clarity.

Finally, future review of the design chosen for this study needs to reconcile the traditional multiple-baseline approach of using level and trend of baseline for all tiers of the design to drive the introduction of the intervention to the approach adopted in this design, (i.e. randomization of the introduction of the intervention.) One approach to remedy this would be to generate the randomization for the subsequent tiers much later, after a stable baseline had been demonstrated to mitigate the suspicion that behavioural covariation could have occurred.

6.4 Future Research

Results from this study and observations made by the researcher suggest that future research should be considered in several areas regarding VS. One important area of future research would be to investigate further the effects of visual comprehension assessment and

multiple methods of visual support presentation on the skill development of students with ASD and ID in academic and daily living skills. While this study used levels of visual support that the participants comprehended, and factored presentation modes according to complexity of tasks, it is recommended that in future studies, the same participant should be exposed to varying representation and presentation modes of VS. For example, photographs versus symbols, presenting one at a time versus a sequence of chained tasks presented to determine the effects on skill acquisition. This may determine whether there are certain thresholds for processing visual information based on visual support form and method of presentation.

Second, investigators should investigate the extent to which VS are more effective for teaching students with ASD at different diagnostic levels (i.e., students diagnosed with Level 1 autism versus students diagnosed with Level 3 autism). This was beyond the scope of this study which focussed on students with ASD and ID, likely to require support at level 3.

Third, future research could consider the usefulness of teaching self-mediated strategies, such as overt self-talk, for developing skills in students with ASD and ID. This may reveal if cognitive self-mediation (self-instruction) strategies used with visual supports versus explicit instruction may impact student outcomes. It would be beneficial to understand whether the skill of self-instruction is effective and efficient in guiding visual support use.

Fourth, another important area of research is determining how often and the extent to which students with ASD and ID interact with the multitude of visuals peppered in classrooms, without instruction. Such research should also consider whether the degree of interaction, or lack of interactions with visuals around the classroom without instruction

influence how well children can use visual supports to learn a new skill and then generalise it to novel settings. This may illuminate the relationship between perceived visual learning and indicate whether students with ASD and ID do have a propensity to seek and utilise this augmented input modality available in classrooms purposefully.

Fifth, the impact of visual clutter in classrooms on student's responsiveness to visuals can be examined in terms of whether they become indifferent to VS if it is present, but not purposefully used, in their daily lives.

Finally, it is recommended that VS for an academic skill versus a life skill be compared. This comparison might determine if the nature of the content affects the effectiveness of VS.

In addition, several recommendations for future research of VS plus SI also made. First, future research could compare VS based on visual comprehension assessment, versus SI alone, an extension of this research would be to include students with varying degrees of autism and ASD and ID for comparison in similar conditions.

Second, research should determine if the level of assistance in selecting the SI matters for students with ASD and ID with different autism support levels (level 2 and 3), that is, whether a more assistive level of assistance is superior to a least assistive level of assistance with the use of SI, with a Level 1 versus Level 3 support need students with ASD and ID. Is there a correlation between providing SI or not providing SI based on support level of autism?

Third, it would be important for future research to compare the effects of VS versus VS+SI in academic and behavioural domains, that is, whether the latter is effective in competing with the onset of, and can therefore potentially mitigate, behaviour problems.

For example, as observed in this study, participants who received VS plus SI were more easily redirected to the task.

Fourth, it would be important to also investigate teacher-implemented VS or VS plus SI to determine whether educators can use the interventions with fidelity in classroom settings. In addition, what type of professional learning leads to sustained implementation of SI and/or VS and what are the effects on student learning. This may have implications for professional development for educators.

Fifth, it will be worthwhile to investigate the extension of the use of VS plus SI in home settings so that parents may be a part of the teaching process. Its effect on extent and speed of maintenance of the skill would be a useful contribution to the literature.

Sixth, it would also be important to examine the impact on the types of professional learning on VS+SI and if it would lead to sustained practice in the classroom that serve students with ASD and ID.

Finally, future research should examine the different EBPs and compare them for effectiveness for students across the spectrum. This could be achieved with more popular or common EBPs and subsequently expanded to the other EBPs.

6.5 Conclusion

This study investigated the use of two established EBPs in the field of ASD, namely, VS and SI in combination and VS as a standalone intervention. The aim of this study was to determine if VS, which is widely used in classrooms that support students with ASD and ID, is indeed an effective EBP–FIP in itself. It also aimed to determine whether SI with the VS was necessary. This was in the context of its widespread application and perceived effectiveness. Much of the research on VS has included some level of explicit

instruction, including SI, leading to its EBP status. The results of this study clearly suggest that a combination of VS+SI is more effective for the majority of children with ASD and ID within the study sample. Daily living skills were examined because students with ASD and ID often lack adaptive behaviours, which limits their opportunities for social inclusion and independence. Targeting daily living skills for students with ASD and ID using a combination of VS+SI, at least in this study, was overall a more effective instructional approach for teaching daily living skills compared to VS in isolation.

Consequently, when working with students with ASD and concomitant ID, educators must be made aware of and given the opportunity to learn and subsequently demonstrate the knowledge and skills to implement technical pedagogical practices such as SI if students are to achieve desired learning outcomes. Education authorities and leaders must understand the importance of providing educators the opportunities for sustained and effective professional learning that leads to implementation of EBPs and resultant improved student outcomes.

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Appendices

Appendix A: Flinders University Social and Behavioural Research Ethics Committee

Dear Rajkumar,

The Chair of the Social and Behavioural Research Ethics Committee (SBREC) at Flinders University considered your response to conditional approval out of session and your project has now been granted final ethics approval. This means that you now have approval to commence your research. Your ethics final approval notice can be found below.

FINAL APPROVAL NOTICE

Project No.:	**6988**
Project Title:	Visual supports from TEACCH and systematic instruction for teaching students with austism spectrum disorders
Principal Researcher:	Mr Rajkumar Brij
Email:	rajkumar.brij@flinders.edu.au
Approval Date:	20 August 2015
Ethics Approval Expiry Date:	**30 June 2019**

The above proposed project has been **approved** on the basis of the information contained in the application, its attachments and the information subsequently provided.

Appendix B: South Australia Department for Education and Child Development

Government of South Australia
Department for Education and Child Development

Strategy and Performance

Level 8
31 Flinders Street
Adelaide SA 5000
GPO Box 1152
Adelaide SA 5001
DX 541
Tel: 8226 3825
Fax: 8226 1605

DECD CS/15/00005-1.10

27 August 2015

Mr Rajkumar Singh Brij
School of Education
Flinders University
GPO Box 2100
ADELAIDE SA 5001

Dear Mr Brij,

Your research project titled "Visual supports from TEACCH® and systematic instruction for teaching students with autism spectrum disorders" has now been reviewed by a senior Department for Education and Child Development (DECD) consultant with respect to protection from harm, informed consent, confidentiality and suitability of arrangements. Accordingly, I am pleased to advise you that your project has been **approved.**

Please contact Ms Kali Stefanopoulos, Project Support Officer - Research and Evaluation on (08) 8226 3825 or email: kali.stefanopoulos@sa.gov.au for any other matters you may wish to discuss regarding the general review/approval process.

Please supply the department with an electronic copy of the final report which will be circulated to interested staff and then made available to DECD educators for future reference.

I wish you well with your research project.

[redacted]

Abi Alfred
A/MANAGER, RESEARCH AND EVALUATION

Att: Principal/Director/Site Manager letter

Appendix C: Letter of Introduction

Dear parents/caregivers

Mr Rajkumar Brij holds the position of a Research Higher Degree student in the School of Education at Flinders University.

He is undertaking a research project leading to the production of a thesis or other publications on the subject of 'Visual Supports from TEACCH® and Systematic Instruction for Teaching Students with ASD and IDs.'

I would be grateful if you would volunteer to assist him in this project by allowing your child consent to participate in this study. The researcher will collect data from direct observation of your child's engagement in a daily living skill with the use of visual supports and visual supports plus systematic instruction; three to four days a week for the duration of this study which is during Terms 3 and 4 for the year 2015.

I assure you that complete care will be taken to maintain the confidentiality of you and your child. This will be done by using a code or false name instead of your child's given name in the study.

The research student will be liable to produce her student card as proof of her identity, if needed. Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on 8201 5748 or by email (julie.mcmillan@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

Dr Julie McMillan
School of Education

Appendix D: Information Sheet

Information Sheet

Title: 'Visual Supports from TEACCH® and Systematic Instruction for Teaching Students with ASD and IDs.'

Principal Researcher:

Mr Rajkumar Brij
School of Education
Flinders University

Supervisor(s):

Dr Julie McMillan
School of Education
Flinders University
Ph: 8201 5748

Dr Karyn Carson
School of Education
Flinders University
Ph: 8201 5684

Emeritus Professor Bob Conway
School of Education
Flinders University
Ph: 8201 3219

Description of the study:

This study is part of the project entitled 'Visual Supports from TEACCH® and Systematic Instruction for Teaching Students with ASD and IDs.'

This project will investigate the effects of visual supports and visual supports combined with systematic instruction on the skill acquisition and engagement of children with autism. It will observe and analyse changes within skill acquisition and task engagement of participating students. This project is supported by Flinders University School of Education.

Purpose of the study:

This project aims to determine whether intervention using visual supports and visual supports combined with systematic instruction:

- improve skill acquisition by the student, engaged in a daily living skill, thereby improving learning outcomes and meeting the educational goals
- improve engagement in tasks by the student.

What will I be asked to do?

You will be asked to grant permission for your child to participate in the intervention that comprises visual supports or visual supports combined with systematic instruction:

- For up to 20 minutes three to four times a week, for the third and fourth term of the school year. Up to 20% of the teaching sessions will be recorded.
- This intervention will indicate if there has been any change in skill acquisition and engagement for your child in a daily living skill.

What benefit will I gain from being involved in this study?

Your child will obtain access to interventions that are evidence-based practice for students with ASD and IDs. Your child may benefit from the lasting outcomes of this intervention.

Will I be identifiable by being involved in this study?

Your child's name and address details will not be revealed to anyone outside the study. Other parents from the classroom will not be aware of your child's participation in the study or the programme. The data will be stored securely at the school during the study and later at a secure facility at the university for the required period of 5 years. Other documentary data will be stored in the same secure facility at school and the university after removing all identification from it.

Are there any risks or discomforts if I am involved?

There is no risk of physical or psychological injury to your child as a result of participation in the study. The effectiveness of the programme depends on voluntary participation of the child in the activities, thus eliminating risk of coercion. You are free to contact the Principal Researcher if you need clarification of any issues. You are also free to withdraw your child's participation at any time during this study. Withdrawal will not affect the child's curriculum delivery, programme delivery, assessment or reporting.

How will the child be prepared for the possible changes in the routines of the classroom with the researcher present?

The Principal Researcher will spend about five school days volunteering in the classroom prior to the study to give students opportunity to develop rapport. In addition, the researcher will be in the class an hour earlier on days that the study will be conducted so that the students will become used to his presence and to working with him.

How do I agree to participate?

Participation is voluntary. You may sign the consent form and return it to the school via the class teacher at the front office.

How will I receive feedback?

Outcomes from the project will be summarised and given to you by the investigator if you would like to see them.

Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

Appendix E: Consent Form (Parent)

PARENTAL CONSENT FORM FOR CHILD PARTICIPATION IN RESEARCH

CONSENT FORM FOR PARTICIPATION IN RESEARCH

(by participation in the programme)

I ….....being over the age of 18 years hereby consent to my child.....participating, as requested, in the Letter of Introduction for the research project on 'Visual Supports from TEACCH® and Systematic Instruction for Teaching Students with ASD and IDs.'

I have read the information provided.

Details of procedures and any risks have been explained to my satisfaction.

I agree to allow data collection of my child's engagement in a daily living skill.

I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.

I understand that:

My child may not directly benefit from taking part in this research.

My child is free to withdraw from the project at any time and is free to decline to answer particular questions.

While the information gained in this study will be published as explained, my child will not be identified, and individual information will remain confidential.

Whether my child participates or not, or withdraws after participating, will have no effect on his/her progress in his/her course of schooling, or results gained.

My child may ask that the recording/observation be stopped at any time, and he/she may withdraw at any time from the session or the research without disadvantage.

I agree to the data recording and questionnaire being made available to the researcher and other teaching staff for the purpose of social validation.

I have had the opportunity to discuss taking part in this research with a family member or friend.

Parent's signature……Date……...

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

Researcher’s name: Rajkumar Brij

Researcher’s signature……..Date…….

Appendix F: Consent Form (Teachers and Teacher Aides)

Consent Form (Teachers and Teacher Aides)

I ….....consent to participate in the research project on 'Visual Supports from TEACCH® and Systematic Instruction for Teaching Students with ASD and IDs.'

I have read the information provided.

Details of procedures and any risks have been explained to my satisfaction.

I agree to answer a questionnaire of participating students at my school, after written permission from participants' parents.

I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.

I understand that:

I may not directly benefit from taking part in this research.

I am free to withdraw from the project at any time and am free to decline to answer particular questions.

While the information gained in this study will be published as explained, the students or school will not be identified, and individual information will remain confidential.

I have had the opportunity to discuss taking part in this research with colleagues, family member or friend.

Teacher's signature……Date……...

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

Researcher's name: Rajkumar Brij

Researcher's signature……..Date…….

Appendix G: Daily Living Skill Lists

Daily Living Skill Lists

Dear Parent/Carer,

Please tick the skills your child is unable to do *independently (without any assistance or reminders).* You may add some skill that your child may not have in the lists below too. S*howering and toileting skills are not to be included.* Your child will be assessed for the skills the he is unable to do and one skill will be selected for instruction.

Personal	Domestic
☐ Washing hands	☐ Making a simple sandwich
☐ Washing face	☐ Using a toaster
☐ Applying moisturiser	☐ Setting table
☐ Combing hair	☐ Cleaning up after meal
☐ Brushing teeth	☐ Washing utensils
☐ Shaving	☐ Broom and dustpan use
☐	☐
☐	☐
☐	☐
☐	☐

Notes to Raj, if any:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Thank you for completing this form.

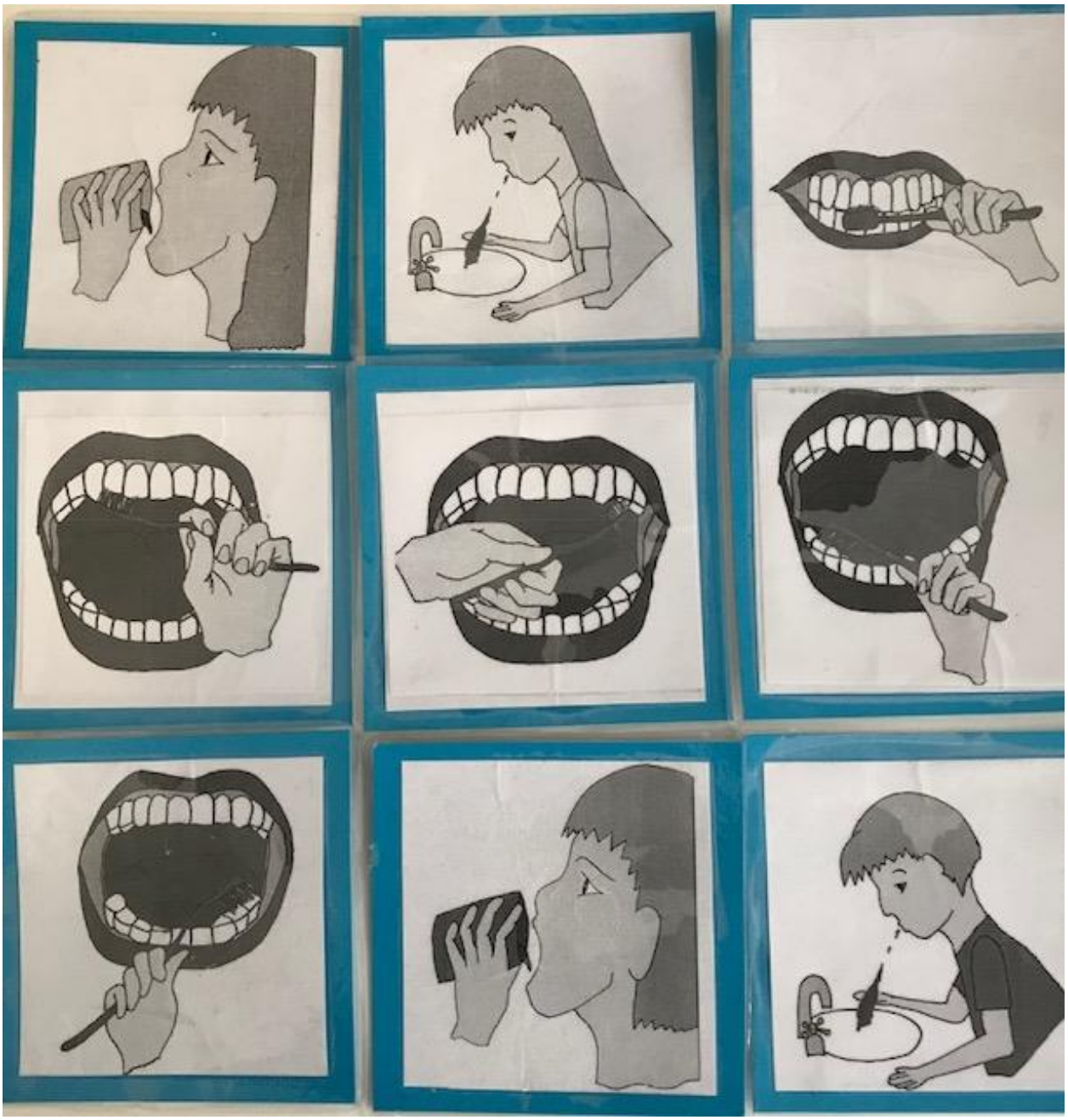
Appendix H: Visual Support for Brushing Teeth (Photographs)

Visual Support for Brushing Teeth (Photographs)

Note: Image not of participants in the study. Image used with permission.

Appendix I: Visual Support for Brushing Teeth (Symbols)

Visual Support for Brushing Teeth (Symbols)



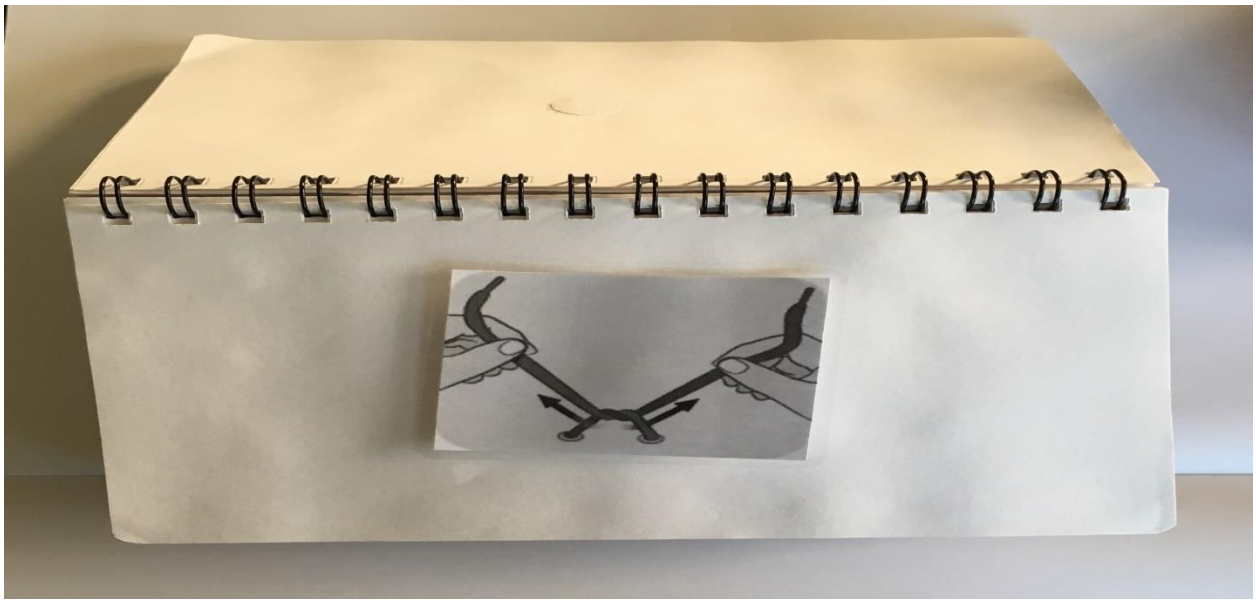
Appendix J: Visual Support for Shaving

Visual Support for Shaving

Note: Image not of participants in the study. Image used with permission.

Appendix K: Visual Support for Tying Shoelaces

Visual Support for Tying Shoelaces



Appendix L: Visual Comprehension Assessment

Visual Comprehension Assessment

Student		**Date**		**Assessor**	

No	**Object**	Cross (X) accordingly				
		Real Object	Photograph	Symbol/Drawings	Words	Combination
1	Gak					
2	Bubbles					
3	Starfish					
4	Studded ball					
5	Bear counter					
6	Toy car					
7	Toy skate					
8	Links					
9	Slinky					
10	Play-Doh					
%						

Appendix M: Task Analysis Form

Participant											**Skill**						Brushing teeth										
Principal Researcher			Raj Brij																								
Form			☐ Real Object				☐ Photographs				☐ Symbols / Drawings				☐ Words				☐ Combination								
Presentation			☐ One a time				☐ First-Then				☐ 3–4 Step				☐ Part Sequence				☐ Full Sequence								
Systematic Instruction			☐ SLP				☐ GG				☐ MTL				☐ SP				☐ TD (C/P)								
Steps		**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	2	
11	Rinse mouth																										
10	Brush lower biting surface (L)																										
9	Brush lower biting surface (R)																										
8	Brush lower (L)																										
7	Brush lower (R)																										
6	Brush upper biting surface (L)																										
5	Brush upper biting surface (R)																										
4	Brush upper (L)																										
3	Brush upper (R)																										
2	Brush front teeth (U/L)																										
1	Rinse mouth																										
	CORRECT(%)																										

Data Recording	+: Able to	−: Unable to	0: No response	F: Full Physical	P: Partial Physical	M: Model	G: Gesture	V: Verbal	I: Independent

Appendix N: Social Validity Survey

Social Validity Survey

Directions: Please observe the student and tick one of the five choices below that reflect the extent to which you agree or disagree with the statement.

Name: _____ (Optional)

Skill Acquisition

1. When provided with the visual supports, the student acquires the skill to engage in the relevant behaviour.				
□ **1** Strongly Disagree	□ **2** Disagree	□ **3** Neutral	□ **4** Agree	□ **5** Strongly Agree

2. When provided with the visual supports and systematic instruction, the student acquires the skill to engage in the relevant behaviour.				
□ **1** Strongly Disagree	□ **2** Disagree	□ **3** Neutral	□ **4** Agree	□ **5** Strongly Agree

3. I feel visual supports is effective in developing skills and engaging the students.				
□ **1** Strongly Disagree	□ **2** Disagree	□ **3** Neutral	□ **4** Agree	□ **5** Strongly Agree

4. I feel visual supports and systematic instruction is effective in developing skills and engaging the students.				
□ **1** Strongly Disagree	□ **2** Disagree	□ **3** Neutral	□ **4** Agree	□ **5** Strongly Agree

5. What do you, if any, perceive as the benefits of combining VS and SI?

6. What do you perceive as the barriers to combining VS and SI?

7. Comments about the student before the intervention:

8. Comments about the student after the intervention:

Appendix O: Procedural Fidelity Checklist

Procedural Fidelity Checklist

Baseline

Step	Procedure	☑ if observed	
		Sessions	
		1	2
1	Secure learner's attention—e.g., call learner by name		
2	Engage with attentional cue—e.g., state task is about to begin and instruct 'Brush your teeth'		
3	Observe response		
4	Deliver social consequence—encourage, praise, etc.		
5	Record data		

Visual Supports + Systematic Instruction

Step	Procedure	☑ if observed	
		Sessions	
		1	2
1	Secure learner's attention—e.g., 'Eli'		
2	Engage with attentional cue—e.g., 'Are you ready?'		
3	Deliver task instruction—e.g., 'follow the picture to show me how me how you…I will help you if you need it'		
4	Observe response		
5	If incorrect or no response, deliver controlling prompt, making reference to visual supports		
6	Deliver social consequence—encourage, praise, e.g., 'good try'		
7	Record data		

Visual Supports Condition

Step	Procedure	☑ if observed	
		Sessions	
		1	2
1	Secure learner's attention—e.g., 'Eli'		
2	Engage with attentional cue—e.g., 'Are you ready?'		
3	Deliver task instruction—e.g., follow the picture to show me how you brush your teeth		
4	Observe response		
5	Deliver social consequence—encourage, praise, e.g., 'good try'		
6	If incorrect or no response, redirect to visuals, e.g., 'look at the pictures and follow what it shows to brush your teeth'		
6	Record data		

Appendix P: Open-Ended Responses from Teachers and Teacher Aides

Q1: What do you perceive as the benefits, if any, of combining Visual Supports and Systematic Instruction?

1. The VS provide 'more' information specific to the task expectation.
2. Nil
3. Nil
4. Nil
5. I don't know enough about SI
6. Our student only had VS so can't comment on both
7. Visual support is needed in order to follow the procedure in completing the task. The systematic instruction prompt adds more proficiency to the student following the given task.
8. Nil
9. In this case, combining VS and SI is strongly needed to boost the student confidence in completing the task.
10. Nil
11. Don't know enough about this to answer, although I would have thought the systematic instruction would assist the student to further understand the visual supports—or provide another way of allowing the student to process incoming information.
12. Including the SI allowed the student to remain engaged and remain and follow the procedure. The visual alone did not give enough information and confused the student. Adding SI gave student sufficient prompting.
13. Depends on student—can provide more prompts and reminders and support for the student to acquire new skills.
14. VS–helps to provide more information about the required skill.
15. Being able to see visuals of the tasks in which is asked increases knowledge and understanding of what is asked.
16. I do–but it depends on the student, too much verbal engagement can be a negative for some students as it can overwhelm them.
17. Nil
18. The student gained the skills and confidence by looking at the VS and listening to SI.
19. Combining VS and SI is great to let the student know the correct sequence and pathway to follow. VS is a good support tool to accompany SI.
20. Nil
21. Visual supports serve as a reminder for each step in the process. Visuals are easier for students to decode when compared with text. Breaking down a task into smaller steps is beneficial as students can focus on learning one step at a time and are less likely to become overwhelmed.

22. Using both refocuses the student. It also clarifies for them what to do next. They are more likely to take risks, that is, perform task more independently. Combining the two allowed the student to focus on task and not try to pre-empt what was required of them. By using SI after VS on each step, you are rewarding/confirming their progress in a positive an encouraging manner.
23. Nil
24. Student is engaged and demonstrates understanding of new skills.

Appendix Q: Open-Ended Responses from Teachers and Teacher Aides

Q2: **What do you perceive to be the barriers to combining Visual Supports and Systematic Instruction?**

1. Very comprehensive and time-consuming setting up. May overwhelm some students. Need to use consistent language to match pictures and name actions during specific activity.
2. Nil
3. Nil
4. Getting the students attention to look; engaging the student.
5. Nil
6. Combining two sets of instructions could overwhelm the student.
7. I guess there is no barrier as VS and SI is needed in order to follow instruction and at the same time giving the student consistent prompt to match the activities.
8. Nil
9. Too many instructions.
10. Nil
11. Perhaps too much stimuli to focus on at the same time.
12. Consistency of prompts if more than one person supporting. Transportability—how many visuals are used and how many environments they need to be used in.
13. Can be too much information for the student to process. Needs consistency of person to deliver.
14. Nil
15. Not having a clear focus as the pictures are just a guide. The need for prompting is still there to assists.
16. Some students may not be able to follow the instructions or make the connection between the visuals and the instructions.
17. For tooth-brushing, translating VS of up/down left/right of mouth is quite challenging.
18. Nil
19. Nil
20. Nil
21. The student may become too over-reliant on a visual if it has not been faded in due time. Visuals may be different from one environment to the next. Students eventually need to rely on the natural cues in the environment and not need visuals to be independent. (UNSURE WHAT VISUALS CONSTITUTE_OBJ IS VIS TOO)
22. There could be at times too much verbal input, which could distract/confuse student. In T case especially he was more interested in the exploration of the

objects. (NEED REAL OBJ?)

23. Nil
24. Student may not understand VS/SI, and therefore become agitated.

Appendix R: Open-Ended Responses from Teachers and Teacher Aides

Q3: Comments about the student before the intervention:

1. Easily distracted, difficulty staying on task and following through.
2. Didn't do as good a job at brushing.
3. Nil
4. Nil
5. Very distracted and not attending to VS
6. With prompting was able to put the toothpaste on the brush but didn't brush his teeth.
7. Student lacks of self-confident in completing the activity.
8. Gave up easily, even though he was doing okay at the task.
9. Seems student distracted in doing the specific activity.
10. Nil
11. With little verbal prompting achieved first steps of brushing his teeth, that is, squeezing toothpaste on his brush but didn't follow through with brushing his teeth without prompt even with a prompt. J appeared less (or calmer—more calm) before intervention.
12. The student was looking for feedback to see if he was doing the right thing. He only completed part of the activity.
13. Lacked confidence. Needed explicit instruction to learn new skill. Desires to learn skill = motivation.
14. He assistance to complete the task. He did not have the skill set.
15. Basic knowledge of brushing teeth was known and used.
16. He didn't believe he could do the activity.
17. Only brushing from teeth.
18. The student was knowledgeable of some of the steps but looking for verification to proceed.
19. The student was not engaged in the task before. He did not understand the task.
20. J was unfamiliar with shaving equipment and was unsure how to use it. He looked confused and uncomfortable.
21. Students not understanding how the tools and materials are used. Students not knowing where to start in the process. Using toothpaste and shaving cream as a sensory experience rather than for its intended use. Students not looking in the mirror. Low arousal level.
22. They were unclear of what was expected of them, that is, what the task was. Sort reassurance from adult constantly (esp. E). J did not realise the steps involved. T was compliant but not successful.

23. Nil
24. Student looked confused and didn’t understand or know of appropriate processes and steps to take.

Appendix S: Open-Ended Responses from Teachers and Teacher Aides

Q4: Comments about the student after the intervention

1. Better comprehension of tasks, more attention to detail and focus.
2. Did good coverage of brush most teeth.
3. Nil
4. Nil
5. Same as before intervention.
6. Was happy and was in his own world playing with the cup; he couldn't seem to get past the first image of filling the cup up, without being distracted doing his own play.
7. Student is more confident in doing the task required.
8. He was confident about the task, he knew he would succeed.
9. Same as above.
10. Nil
11. J appeared to be enjoying the sensory experience of filling, emptying and refilling his cup.
12. Student received feedback as he went so he didn't look for it. He used the VS and the feedback if he was doing it right and to see when the task was complete. He seemed more confident in the activity.
13. More confident. He will need to continue the new skill to maintain. It great skill for him to have. Lifelong.
14. He was able to achieve the skill of tying his shoe lace. Still requires some assistance.
15. More understanding of correct procedure of brushing teeth as pictures were shown how to do it. Numbering the pictures in order would have helped follow which pictures was next as a bit unclear of the order.
16. Seemed more confident and proud to have completed the task.
17. Better coverage of mouth.
18. The student became more confident, in the process, he still needed verification to proceed but followed the visuals well and seemed more fluent in the process.
19. The student was a little more engaged. He still did not seem keen to participate but he was confident in the correct pathway and knew what was required.
20. J knew what to do and started independently. He constantly referred to visuals and pointed to the next one. He was very engaged and didn't get distracted by others and interactions.
21. Students understand there is a specific sequence of steps. There is less wastage of toothpaste. Students are handing tools and materials correctly. Students are looking in the mirror. Students are more aroused.
22. They were more engaged. Even a distraction didn't bother them (i.e., someone coming in) they kept checking the schedule with more independence. Their eyes

were more focused on mirror, checking their progress. Sought reassurance (SI) less. Appeared pleased with their achievement.

23. Nil
24. Student was able to demonstrate appropriate use equipment while following along and using the correct visuals.