Development and implementation of visual scaffolds to support students with autism spectrum disorder in inclusive classrooms

By
Mary Gabrielle Wilcock
Teaching Cert., Dip. Teach., B.A., B. Sp. Ed., M. Sp. Ed.

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Flinders University,
Department of Disability and Community Inclusion,
School of Health Sciences,
Faculty of Medicine, Nursing and Health Sciences
Adelaide, Australia

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Abstract

Commonwealth Government legislation requires that Australian inclusive Primary School education provides for meaningful participation for all students with or without a disability. At the New South Wales State Government level, the NSW Foundation Statements (NSW Board of Studies) contain a list of required student learning outcomes. Many of these rely upon student comprehension of orally presented, curriculum based learning.

For many students with Autism Spectrum Disorder, however, comprehension of orally presented learning is made very difficult by information processing impairments (Jordan & Jones, 1997; Prior, 2003). For many of these students, curriculum access requires additional support and resources.

This research study focuses upon the development and implementation of a visual scaffold to support comprehension of vocabulary for students with Autism Spectrum Disorder. Development of the scaffold was based upon an understanding of both the deficits and strengths that characterise autism.

The aims of the research were, firstly, to examine the comprehension of classroom oral instructional language by children with autism spectrum disorder and secondly, to develop the visual scaffold to support those students in inclusive classrooms. The system of analysis that allowed for measurement of both teacher and participant levels of language abstraction was based on the work of Blank, Rose and Berlin (1978; 2003).

The eight participants in the study were enrolled in one of three inclusive Primary Schools in Sydney. Each participant was provided with six visual scaffolds chosen from each of the four main curriculum areas of English, Human Society and Its Environment (HSIE), Mathematics and Science.

The research used a within subject, single-case, multiple baseline across content design. The results demonstrated that the improvement in student vocabulary knowledge was directly related to use of the visual scaffold as the research intervention.

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.

Signature:

Date:

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Finally, the inspiration and motivation for this research came from the hard work and insightful reflections of the students with ASD. Each student described their struggle to learn in an inclusive primary school system which often has difficulty accommodating both the deficits and strengths of ASD.

1 Introduction

The learning progress of primary school students with autism spectrum disorder (ASD) in inclusive classrooms can be severely challenged, particularly in relation to their processing of orally delivered curriculum information. Most students with ASD have difficulty assimilating information delivered orally. This is problematic for primary school students with ASD because an oral teaching format has traditionally been the main modality for delivery of curriculum material (Janzen, 1996). In early primary school, students with ASD present frequently with a developmental delay in both receptive and expressive language (Tager-Flusberg, 2003), which inhibits the reception and understanding of classroom material and their participation in classroom learning activities.

With this in mind, the aims of the research were twofold: firstly, to develop and implement an educational aid to assist mainstreamed Primary School students with ASD in accessing the curriculum; secondly, to measure, over the period of the study, any change in the educational performance of participant students in relation to norm referenced assessment. Specifically the study examined the receptive and expressive language capabilities of the research participants.

The eight participants were students who, concurrently with the study, were enrolled in three inclusive metropolitan primary schools in Sydney. Each had a diagnosis of ASD. They were not chosen on the basis of having either specific learning difficulties or specific academic abilities. The process by which participants were selected was therefore considered to be without significant bias.

Central to the study was the educational aid, called a visual scaffold. It has been referred to more simply as a scaffold. However the importance of the word visual should not be forgotten as students with ASD are mostly visual learners (Grandin, 1996; Jordan, 2005; Quill, 1997). The scaffold has also been referred to generically as the research intervention. Each of the research participants was provided with their own scaffold, which they retained, with the intention that it be used by them in the classroom during lessons. In addition, each scaffold was designed to match the age and educational level of the particular participant.

In practice, a scaffold consisted of a document of one or two pages containing pictures of the curriculum material as well as key vocabulary and concepts. This was because

language and labelling of objects and concepts are critical to an individual's understanding of a topic. An individual scaffold was prepared for each curriculum topic for each participant – a total of forty eight scaffolds. For generality, classroom topics used in the study were chosen from each of the four main curriculum areas of English, Human Society and Its Environment (HSIE), Mathematics and Science.

The research was built around four levels of language abstraction as defined by Blank, Rose and Berlin (1978, 2003). These four levels are identified as *matching, selective analysis, reordering* and *reasoning*. The study measured the level of the classroom teacher's instructional language and compared that with the receptive language level of each participant. This was to identify any mismatch between the level of the teacher's instructional language and the ability of the participant to understand language at that level.

The effectiveness of the scaffold, as an intervention, was evaluated by vocabulary testing of research participants during the classroom delivery period for each curriculum topic. The internal validity of the research was supported by varying the point at which the intervention was introduced across the six topics for each participant.

The research method used was a within subject across multiple baseline study using a two phase AB design (Bulté & Onghena, 2009; Egel & Barthold, 2009; Zhan & Ottenbacher, 2001). Results of vocabulary testing from Phase A and Phase B were compared and analysed, using linear mathematical methods as well as statistical testing. In addition to evaluation of the participant vocabulary test results, each participant was evaluated for changes in receptive and expressive language using the Peabody Picture Vocabulary Test, Fourth Edition (Dunn & Dunn, 2007), the Expressive Vocabulary Test, Second Edition (Willliams, 2007) and the Preschool Language Assessment Instrument, Second Edition (Blank, Rose & Berlin, 2003). These are commercially available tests, which are normalised across the population and are used by Speech Pathologists, teachers and professionals working in education. Further corroborating evidence was supplied by recording the time each student was actually engaged with classroom learning and by questionnaires completed by the participant, the classroom teacher and the parent.

Within the school environment, two sources of information allow teachers to assess a student's learning needs. These are formal, standardised assessments where the student's score is compared with others of the same age and informal, anecdotal information such

as observations or comments by teachers, parents or the students themselves. Both formal and informal assessments are necessary for the design of effective teaching/learning programs for students with autism spectrum disorder (Janzen, 2003).

Each student with an ASD brings a different perspective to the classroom (Jordan, 2005). The following examples are provided to paint a picture of some of the assessment and learning challenges faced by these children. For example, when Jack presented for kindergarten enrolment, a standardised Speech and Language assessment, the Clinical Evaluation of Language Fundamentals 4th Edition, (CELF-4), established that both his receptive and expressive language were severely delayed. Anecdotally, his parents described Jack's exceptional computing abilities which enabled Jack to perform computing tasks found to be challenging by his cousin who was completing his first year of computing studies at university. In the school setting, Jack received ongoing individual and classroom based language therapy with a Speech Pathologist. He was also part of a weekly social skills program with the Special Needs teacher.

In year 3, Jack was involved in a series of lessons where the students in the class were learning the names of the states of Australia, their capital cities and iconic sites. The teacher used many visual cues. A large map of Australia showed the state and territory boundaries, the location of the capital cities and the location of iconic sites. Visual representations of some iconic sites such as Uluru were placed on the map while most visual representations were placed in the area bordering the map. After the final lesson, Jack was asked to name the states of Australia and each state's capital city. He indicated clearly that there was too much information, presented too quickly.

"I think I'll explode. There are too many words. Capital of Northern Territory – it's the orange thing. It starts with U. The capital of Queensland is The Great Barrier Reef – that is the hotel. The capital of Act (as in a play production) is Canada – that is where the Olympic winter games – but they are finished. Capital of Victoria – can you help me?"

When frustrated and uncomfortable with the classroom learning, Jack made noises, rolled on the floor or walked around the classroom. In an individual session with the Special Needs teacher, Jack asked, "Does the teacher's voice always go loud, soft, loud, soft?" As well as dealing with language issues, Jack also appears to work with sensory issues.

Julia was a kindergarten student with a diagnosis of autism. A Speech and Language assessment indicated a severe receptive and expressive language delay. The classroom

teacher gave a series of lessons on *Mrs Wishy Washy* by Joy Cowley. Mrs Wishy Washy washed each of the animals – the pig, the duck and the cow – in a tub. Julia described the story as silly. Her definition of a tub was, "You can get something inside it – your pencil case and everything." Julia was describing each student's 'tub' which in this kindergarten class was an A4 sized receptacle to hold pencils, pencil case, papers and work samples. Julia informed the Special Needs teacher, "You cannot fit a cow in my tub." Julia was totally focused on Mrs Wishy Washy's impossible action involving the tub and did not initially engage with the classroom learning about the story. Another anecdotal indicator of Julia's perception of vocabulary was when she correctly labelled the scarf as a 'scarf' only when it was around Mrs Wishy Washy's neck, and not when it was around her head. When asked why the main character was called 'Mrs Wishy Washy', Julia pointed out that it was the name on the front of the book.

Connor was a year 1 student who was assessed on the WISC IV as having an IQ in the average range. A Speech and Language assessment, the Celf 4, found that Connor's language abilities varied enormously across the subtests. Connor's major strengths were his receptive and expressive semantic knowledge. Receptively, Connor had a sound understanding of word meanings and their associated relationships, scoring at the 50th percentile. Expressively, Connor exhibited a sound ability to name people, objects and actions, scoring at the 63rd percentile. However, when this semantic information was embedded within spoken sentences or paragraphs, Connor found comprehension of the material to be enormously challenging. When assessed on his ability to recall and reproduce sentences of varying length and complexity, Connor scored at a percentile rank of 0.1. His ability to interpret information presented in spoken paragraphs was at the 2nd percentile. Each of these two scores made it extremely difficult for Connor to use language for learning in the inclusive classroom where he often asked, "How am I going to remember this?"

Despite age-appropriate vocabulary, Connor found it very difficult to maintain his attention on the classroom learning of curriculum topics. When asked about the classroom learning, Connor was unable to order and sequence the new information and frequently moved the conversation to one of his favourite topics. When there was movement or noise in the classroom, Connor put his fingers in his ears. Connor appeared to be dealing with sensory issues as well as with difficulties identifying, sequencing and recalling key

information from within the classroom topic. In addition, classroom presentation of the learning did not allow sufficient time for Connor to comprehend the information.

Danielle was a year 3 student with a diagnosis of Autism Spectrum Disorder. A standardised Speech and Language assessment, the Celf 4, assessed Danielle's receptive and expressive language as being in the average range. Danielle experienced great difficulty, however, when a classroom topic contained words with multiple meanings. The classroom Mathematics topic, Capacity and Volume, was very frustrating for Danielle who said, "There are too many words. It is very complicated." Despite having encountered this topic in year 2, Danielle defined volume as, "It goes up and down if you are listening to a radio station." Danielle was puzzled that the teacher spoke about the 'contents' of different containers. She defined contents as, "The first page of my book that has all of the pages and titles in there."

Danielle was not happy with the explanation highlighting multiple meanings. She explained that it was stressful for her because the meaning she had pictured in her brain, of the contents page of her book, might not be correct. For Danielle, to be incorrect was very stressful and often resulted in her putting her head on the desk and crying. She explained further,

"When I have pictures, I know what the words mean. I love to learn by vision. Vision is very good – you can see. My visuality is what I wanted. It's what I learn by. They say 'estimate' and they don't show you pictures – I don't exactly know what they mean."

Each of the above mainstreamed primary school students had a diagnosis of autism. Their comments about their understanding of classroom lessons demonstrated that there was often a gap between the teacher's use of particular vocabulary and the student's understanding of the meaning and contextual use of those words. The students ranged from Kindergarten to Year 4. At these year levels within the primary school, oral instruction is the main focus of classroom teaching. Comprehension of oral instructional language is therefore of central importance in the acquisition of core academic skills as well as the factual content of curriculum areas.

Children with autism, however, have difficulty processing verbal information (Dodd, 2005). Their comprehension often lags behind their expressive language development. For example, Hudry et al. (2010) found that pre-schoolers with autism showed consistently greater impairment in receptive compared with expressive language skills.

Their study was conducted using baseline assessment data collected as part of a Preschool Autism Communication Trial. The trial involved 152 children aged between twenty four and fifty nine months who met criteria for 'autism' on the Autism Diagnostic Observation Schedule - Generic (ADOS-G; Lord et al., 2000).

Luyster, Kadlec, Carter and Tager-Flusberg (2008) and Kjelgaard and Tager-Flusberg (2001) also found greater impairment in comprehension over expressive skills in toddlers and children with autism spectrum disorder. These studies have important implications for intervention programs for students with autism because these students bring a different perspective to the classroom (Jordan, 2005). Temple Grandin, an adult with autism, explained the different perspective: "I think in pictures. Words are like a second language to me…When somebody speaks to me his words are instantly translated into pictures." (Grandin, 1995, p. 19).

For primary school students with autism, inclusion in mainstream education is not about location but about how the child is supported in gaining access to that education (Jordan, 2003). This study aimed to develop a visual scaffold to support these students across all curriculum areas. Strategies that utilised areas of strength for students with autism were adapted within this study to provide a visual scaffold aimed at supporting comprehension of a teacher's oral instructional language.

This introductory chapter has provided a small number of brief case studies to highlight important barriers in education for children with autism. Chapter 2 explains the rationale for the study, while Chapter 3 reviews what the literature says about autism. In Chapter 4 there is a focus on how the research findings relate to education and Chapter 5 discusses how the educational ramifications of the research literature apply to the comprehension of oral instructional language for children with autism. In Chapter 6, the visual scaffold is outlined as the research intervention and then in chapter 7, the research methodology is explained. The results of the topic vocabulary testing are presented in Chapter 8 with case studies of each of the research participants contained in Chapter 9. The emphasis within Chapter 9 is on the particular scaffolds, methodology and results as they apply to each participant. Chapter 10 restates the aims of the research, explores the implications of the results, provides recommendations, discusses the limitations of the research and suggests areas for future research

2 Rationale and Significance of the Study

2.1 Statement of the Problem

The Commonwealth Government in its *Disability Discrimination Act* (1992, Section 22) and the *Education Standards* (Commonwealth of Australia, 2005, p.17) sets out the obligation of Australian education bodies to "more rigorously address the development of inclusive curriculum frameworks that can be accessed by all students" (Shaddock, 2007, p.36, cited in *Australian Government Project to Improve the Learning Outcomes of Students with Disabilities in the Early, Middle and Post-Compulsory Years of Schooling*). Commonwealth Government legislation therefore requires that Australian inclusive Primary School education provides for meaningful participation for all students with or without a disability.

At the NSW State Government and classroom level, the *NSW Foundation Statements* (NSW Board of Studies, 2005) refer across all participant areas to requirements that students,

1. "communicate with a wide range of people on familiar and introduced topics
2. listen attentively to instructions in order to
3. gather specific information and ideas
4. ask questions to explore problems then
5. share ideas with their teacher and peers making connections with existing knowledge and understanding." (*NSW Foundation Statements*, pp. 6 and 10).

Each of these requirements relies upon student comprehension of orally presented, curriculum based learning. Within 'inclusive' Primary School classrooms, spoken language is the main medium of academic communication whereby the majority of curricular information is passed between teacher and child.

However, for many students with autism spectrum disorder, comprehension of this orally presented learning is made very difficult by information processing impairments (Jordan & Jones, 1999; Prior, 2003). Within this study, the researcher found that students often made comments such as, "There are too many words" or "I don't know what it means". Both the introductory chapter to this study and the case studies contain numerous statements by students which indicate difficulties with

comprehension of oral instruction. Students who experience difficulty comprehending what the teacher is presenting, often exhibit very low levels of engagement with classroom learning.

The difficulty experienced by students with autism spectrum disorder in coping with the demands of a verbally based instructional process is a significant problem for educators because any student who is not able to comprehend the meaning of vocabulary being used in classroom learning will not have access to the curriculum. Jordan (2003) argued that such access requires additional support and resources and different teaching strategies to those suitable for typical students.

This study will focus upon the development and implementation of a visual scaffold to support comprehension of vocabulary for students with autism spectrum disorder. This study will require an understanding of the "unique cognitive, social, sensory and behaviour deficits that characterise autism" (Roberts & Prior, 2006, p.86). Of equal importance in the design of the visual scaffold is an understanding of the cognitive strengths within autism. The particular nature of these deficits and strengths will determine the design of the visual scaffold for each student.

2.2 Purpose and significance of the study

The purpose of the present study was twofold. Firstly, it examined the comprehension of classroom oral instructional language by children with autism spectrum disorder (ASD) and secondly it developed a visual scaffold to support students with ASD in inclusive classrooms. Such a study required a system of analysis that allowed the researcher to measure both the complexity of the teachers' utterances and the level of language complexity which the student was able to comprehend.

Blank, Rose and Berlin (1978, p.12) set out an 'explicit framework' against which to analyse the formulations used by the teacher. The framework has four levels of language abstraction and is based on the dimension which Blank et al. (1978; 2003) refer to as 'perceptual language distance'. Their model of classroom language is based on research carried out in pre-school settings. This researcher, however, considered this model appropriate for primary school students with ASD because of their delayed language development. Delayed development of language is one of Gillberg and Gillberg's diagnostic criteria for Asperger syndrome (Gillberg, 1991; Gillberg &

Gillberg, 1989). A number of research studies (Kjelgaard & Tager-Flusberg, 2001; Luyster et al. 2008) have gone beyond Gillberg and Gillberg's discussion of language development as a whole and examined the relationship between the two domains, receptive and expressive language. These studies found greater impairment in comprehension (receptive skills) over expressive skills in young children with autism spectrum disorder.

Analysis of each teacher's utterances was achieved by audio recording whole lessons given by the teacher across the four main curriculum areas of English, Mathematics, Human Society and Its Environment (HSIE) and Science. Each of the teacher's utterances was assessed against Blank et al.'s four level frame work. The student's level of language abstraction was assessed using the Preschool Language Assessment Instrument Second Edition (PLAI-2) which was developed by Blank et al. to assess a student's level of language comprehension against four levels of language abstraction. Based on the literature review, analyses and comparisons of this type have not previously been undertaken within autism research. Given the receptive language difficulties experienced by students with autism, this model of language abstraction was considered appropriate for primary aged students with ASD.

According to the research carried out by Blank et al., in order for the student with ASD to have full access to the curriculum, in relation to the writer's study, the student's level of comprehension must match the teacher's level of language abstraction. The student who is not able to comprehend the teacher's use of vocabulary will not have adequate access to the curriculum.

In this study, the eight participants ranged from Kindergarten (Early Stage One) through Years One and Two (Stage One) and Years Three and Four (Stage Two). Of the eight participants in the study, two students had a diagnosis of Asperger syndrome, two had a diagnosis of autism, two had a diagnosis of Autism Spectrum Disorder and two had a diagnosis of high functioning autism. Prior to developing the student visual support scaffold, it was necessary to define the terms associated with autism (Chapter 3) and to list the deficits and strengths associated with Autism Spectrum Disorder (Chapter 4). A detailed discussion of autism deficits and strengths provides the background for the particular design details of the visual scaffold.

The Pre-school Language Assessment Instrument, 2nd Edition (PLAI-2) was designed for pre-school students. Students in this study were aged between six and nine years. PLAI-2 scores, though necessary within the study, were therefore not standardised scores. Use of the Peabody Picture Vocabulary Test, 4th Edition (PPVT-4) and the Expressive Vocabulary Test, 2nd Edition (EVT-2) provided pre and post standardised measures of each participant's receptive and expressive vocabulary.

This study is important for a number of reasons.

1) There are increasing numbers of students with a diagnosis of Autism Spectrum Disorder who are being educated in inclusive primary school classrooms (Simpson, de Boer-Ott & Smith-Myles, 2003). However, Jordan (2003, p.216) argued that "inclusion is not about location but about how the child is educated". That is, the child needs to be included in the learning not just the physical classroom. Support for comprehension of oral instructional language is required by many students with ASD because primary school classrooms require an auditory processing ability. Support for comprehension of oral instructional language in inclusive primary school classrooms is under-explored in the autism literature.

2) This researcher found no evidence within the literature of any structure or scaffold which could be applied across all curriculum areas to support the comprehension of oral instructional language for students with Autism Spectrum Disorder. In order to establish that this research was novel, the researcher used standard search strategies to search two on-line databases – Advanced Google Search and Eric. The search syntax was: (Autism OR ASD) AND "inclusive classroom" AND "scaffold to support comprehension" of "teacher language". The researcher examined all the research papers between the years 1990 and 2015, that were in English and had the above words either in the title or in the key words. No matches were found for this search.

3) From experience over twenty years, this researcher has found that the issue of difficulty with comprehension of oral instructional language commonly arises in teacher, parent and professional discussions regarding students with Autism Spectrum Disorder. It is, therefore, important for educators

and researchers to have an understanding of the cognitive load encountered by these students when they are required to process oral instructional language.

4) Comprehension of oral instructional language is often difficult for students with autism (Dodd, 2005; Kunce & Mesibov, 1998). The difficulty for these students may be addressed either by changing the teacher's behaviour involving language or by changing the student's experience of that language. Numerous research studies have focused upon changing the teacher's practice such as the provision of structure, routine, visual timetable supports and the explicit teaching of social skills (Groden & LeVasseur, 1995; Kunce, 2003). However, this current study focussed on the student's experience of classroom language. No research was found in the field of autism literature where a model of instructional language, such as Blank et al. (1978; 2003), was combined with knowledge about Autism Spectrum Disorder in order to design a support scaffold for students in inclusive primary school settings. This current study therefore addresses a gap in the research literature.

5) This study set out to raise student level of oral language comprehension rather than have the teacher sensitised to the use of less complex vocabulary and sentence structure. There are two reasons for this: Firstly, simplification of vocabulary and sentence structures would be likely to result in a simplification of the content and hence a lessening of curriculum inclusion for these students (Westwood, 2003). Secondly, primary school education often involves many teachers. As well as the classroom teacher there is often specialist instruction in such areas as music, sport, drama or art. In addition, each primary school classroom teacher in New South Wales is entitled to release from face-to-face teaching. This means that the classroom teacher is replaced by an additional teacher for two hours each week. Administratively, uniform adjustment on the part of many teachers is a less feasible solution to the problem than teaching children to access the language commonly used by teachers.

6) The study, although only involving students with Autism Spectrum Disorder, may have relevance for other students with disabilities,

particularly for those with a language processing disability or for students who have difficulty filing and retrieving learned material.

2.3 Research hypothesis and research questions

It was hypothesised that use of visual scaffolds will achieve improved learning outcomes for Primary School students with ASD, specifically in:

a) their understanding of the meaning of key vocabulary and

b) their level of engaged learning time in the classroom.

There are five research questions:

1. Is there a disparity between the teacher's level of language abstraction and the student's ability to comprehend language, based on Blank et al.'s (1978; 2003) four levels of language abstraction?
2. Does use of the visual scaffold result in the student having greater understanding of classroom topic vocabulary?
3. Does the use of visual scaffolds increase a student's receptive and expressive vocabulary scores as measured by two standardised tests, the Peabody Picture Vocabulary Test, 4th Edition (PPVT4) (Dunn and Dunn, 2007) and the Expressive Vocabulary Test, 2nd Edition (EVT2) (Williams, 2007)?
4. Does the use of visual scaffolds improve the student's level of response across Blank et al.'s (1978; 2003) four levels of language abstraction?
5. Does use of visual scaffolds increase a student's level of engagement with classroom learning?

2.4 Theoretical and Methodological Rationale

From a theoretical perspective the terms of reference within this study were:

- The nature of autism, in particular the strengths and deficits associated with the disorder
- A model of classroom language (Blank et al., 1978; 2003)
- Cognition
- Metacognition
- Generalisation of learning skills.

If researchers are to have an in-depth understanding of the nature of verbal exchanges involved in classroom learning they must arrive at a framework which is able to define each exchange in terms of its parts and its level of complexity. This study therefore required a framework which accommodated a range of language activities within a "finite and meaningful set of categories" (Blank et al., 1978, p.8). Establishment of such a framework was possible because a teacher's choice of language structures depends upon the aims of the instructional process and not upon the specific content. Blank et al.'s four levels of abstraction seek to classify the wide range of language formulations.

Bloom and Lahey (1978) proposed three essential aspects of communication: content, form and use. Bloom and Lahey's (1978) 'form' involved such things as grammar, word order and verb tenses. 'Use' focused on the different ways in which language is used, such as greeting, describing or arguing. Bloom and Lahey's 'content' has a similar emphasis to that of Blank et al.'s model. In Bloom and Lahey's model (1978), 'content' focused on word meanings, the way meanings linked together and the sequencing of ideas so that we are able to use words to create what we want to say. Blank et al. (1978) also focussed on word meaning and the language of conversation. Their model, however, was an in-depth study of the increasing complexity of conversational language as a function of perceptual language distance.

Many researchers have focussed upon the cognitive functioning of the human intellect. In his *Structure of the Intellect Model*, Guilford (1967) set out his theory of general cognitive functioning which was made up of three dimensions – content, products and operations. Content referred to the nature of the materials upon which

the intellect would operate and included five kinds of content: visual, auditory, symbolic, semantic and behavioural. Guilford's product dimension related to the kind of information processed from the content types: units, classes, relations, systems, transformations and implications. Guilford's operations dimension described what the brain does with different types of information: cognition, memory, divergent production, convergent production and evaluation.

Blank et al. (1978; 2003) focused upon the language of conversation and outlined four levels of perceptual language distance. These are listed in hierarchical order of difficulty and hence indicate increasing levels of cognitive load placed upon the student.

Although Guilford's is a more general model, the model proposed by Blank et al. (1978; 2003) is compatible with Guilford's larger framework.

Blank et al.'s first level of language abstraction, 'matching perception' is similar to Guilford's first level of his operation dimension which is 'cognition'. 'Matching perception' requires that a student select an object or action based on his/her knowledge of vocabulary. Guilford's 'cognition' of semantic units for example requires that a student recognises words from within his/her vocabulary. In addition, Blank et al.'s fourth level of abstraction, 'reasoning' is similar to Guilford's fifth level of operation, 'evaluation'. Within Blank et al.'s 'reasoning', students are required to predict outcomes and justify responses. Guilford's 'evaluation' requires that a student make judgements about different kinds of information.

Within both models, the level of processing difficulty increases as the dimension progresses from one through to four or five different categories. Both 'reasoning' (Blank et al., 1978) and 'evaluation' (Guilford, 1967) represent a considerable cognitive load upon the student who must look at the material provided and judge it according to certain criteria. Within both models, the increasing level of processing difficulty represents a hierarchy of increasing cognitive load.

Blank et al. (1978; 2003) proposed that this increasing cognitive load could be explained by the 'degree of separation' that existed between the perceptual material available to the child and the language formulations used by the teacher. Blank et al.'s initial work was carried out within the pre-school setting, however, as previously

mentioned, this has direct relevance to the language levels of many early to middle stage, primary school children with ASD.

In the field of autism, many writers point out that students with Autism Spectrum Disorder are coming from a very different perspective to that of their peers (Grandin, 1995; Jordan & Jones, 1999; Prior, 2003). They may be able to learn the same skills as their peers but this learning calls for a different presentation and at times a different learning environment. These students have specific receptive language needs which are often masked in the inclusive classroom by their strengths in oral language. Without a blueprint structure which is applicable to any instructional topic, it is hypothesised by the current researcher that each oral presentation, from the student perspective, will have too many words and insufficient meaning.

It is anticipated that structured visual scaffolds will provide the student with cognitive strategies which, when labelled, will enable the student to know those strategies metacognitively such that the scaffold blueprint can be applied across a range of classroom topics.

2.5 The researcher and the study

The researcher has worked as a Special Needs teacher in inclusive primary school settings in Sydney for a period of twenty years and has written and implemented intensive reading, comprehension, language and social skill programs for students with ASD. Working in classroom settings has highlighted communication difficulties which may limit or prevent students with ASD from learning. Difficulty with word meanings and concept identification seemed to be key indicators of a student's likelihood to under-perform within the verbally based instructional process. The intellectual abilities of the participants ranged from below average to high average, yet each under-performed in a classroom learning environment which required processing of verbal information. The main purpose of the study was, therefore, to develop a visual scaffold to support classroom learning for students with ASD to enable them to achieve their maximum learning potential.

3 Defining Autism Spectrum Disorders

The preceding chapter described,

a. Australian Commonwealth Government legislation requiring that all students have access to inclusive curriculum.

b. The *NSW Foundation Statements*, which record at state and classroom level, a significant emphasis upon oral instructional language as the means of delivery of this inclusive curriculum.

c. How information processing impairments are a central part of Autism Spectrum Disorder.

These points raised a significant question about access to the education curriculum for students with Autism Spectrum Disorder.

At the time of conducting this study, there were, within autism literature, several diagnostic categories regarded by researchers as being part of autism – Kanner's Autistic Disorder, Autism, Asperger Disorder or Syndrome and High Functioning Autism. Within the current study, participants had autism diagnoses under four different categories. It was, therefore, necessary to consider whether, for the purposes of the current study, these autism diagnostic categories were sufficiently homogeneous to be considered under the one category, Autism Spectrum Disorder, in terms of student presentation and programming.

This chapter will therefore examine,

a. Kanner's Autistic Disorder as an historical introduction to autism research.

b. Asperger Disorder or Syndrome and high functioning autism.

c. Current use of the term Autism Spectrum Disorder and other key terms used within the study.

d. The prevalence of Autism Spectrum Disorders.

Since completion of this study, the DSM-IV-TR has been updated with the introduction of the DSM-5 in May, 2013. In the DSM-5, the four separate diagnostic labels have been replaced by the one term, *autism spectrum disorder* and three core domains have been reduced to two with the combination of the communication and social domains under the

heading of social communication. The emergence of the social communication domain in the DSM-5, in fact, reflects the emphasis throughout the study.

For the current study, however, the DSM-IV-TR diagnostic criteria were utilised because it was current throughout the time of the study. This study will report according to what was current at the time of the study's commencement and uses the single term, autism spectrum disorder. The DSM-5 will be discussed in more detail in Section 3.6.

3.1 Defining Autism Spectrum Disorders

In 1943, Leo Kanner published his paper, Autistic Disturbances of Affective Contact, which described the social and communication differences characteristic of autism. Kanner introduced the label 'early infantile autism'. He concluded that these children had "a number of essential common characteristics" which formed a previously unreported, unique 'syndrome' (Kanner, 1943, p.33). Although it is possible to find earlier descriptions of the syndrome it had not previously been recognised as a clinical entity (Frith, 1991). From the beginning, Kanner recognised social difficulties as a central feature of autism (Quill, 1995). Based on his observations of eleven children (eight boys and three girls), Kanner considered their common fundamental disorder to be an "inability to relate themselves in the ordinary way to people and situations", thus giving rise to an "extreme autistic aloneness" (Kanner, 1943, p.33). The children expressed this 'aloneness' by disregarding, ignoring or shutting out anything that came from outside their own world (Kanner, 1943, p.18). Kanner also reported that, as infants, almost all of the children failed "to assume at any time an anticipatory posture preparatory to being picked up" (Kanner, 1943, p.34).

In addition to describing the severe social problems, Kanner (1943, 1973) gave detailed descriptions of the unusual language and communication features exhibited by the children. "She does not seem able to conceive the real meaning of these words. Her grammar is inflexible …. Her speech is rarely communicative" (Kanner, 1943, p.32). Of the eleven children Kanner had observed, and then written about in his 1943 paper, three remained mute and eight acquired the "ability to speak" (Kanner, p.34). Of the eight children who acquired some language ability, none of them used language to convey meaningful two – way communication. Rather, their "excellent rote memory" (Kanner, p.34) facilitated mostly "parrot-like repetitions" (Kanner, p.35) of previously heard word combinations or sentences.

Kanner made several significant observations about their use of language. “Naming of objects presented no difficulty” (Kanner, p.34), however, the meaning of a word often became inflexible and could only be used in its original application. While there was “no difficulty with plurals and tenses” (Kanner, p.35), the children had great difficulty with personal pronouns. Kanner considered that “the absence of spontaneous sentence formation and the echolalic type of language production explained why these children repeated personal pronouns exactly as heard” (Kanner, p.35). Kanner gave the example of the mother who told her child, “Now I will give you your milk.” The child then continued to express his desire for milk in exactly the same words and with the same intonation. Kanner recorded that “the pronominal fixation” (Kanner, p.36) remained until about the child’s sixth year when the child gradually mastered the use of the first person when referring to himself and the second person when referring to the other person. Kanner (1943) also suggested that when the children echoed what they had heard it did not mean that they were attending to language because it often took several reiterations of an utterance before the child gave even an echoed response.

Kanner also made several observations about how children viewed their environment. He argued that each of the children exhibited a need to be left undisturbed, regarding any changes to their environment as unwanted intrusions (Kanner, p.36). Kanner also made regular references to the children’s “anxiously obsessive desire for the maintenance of sameness” (Kanner, 1943, p.36). This was evident in their resistance to change and their preference for repetitive activities.

With regard to the children’s physical abilities, Kanner (1943) wrote that “several of the children were somewhat clumsy in gait and gross motor performances, but all were very skilful in terms of finer muscle coordination” (Kanner, 1943, p.40).

With regard to the children’s acquisition of the skill of reading, Kanner considered that although the skill was acquired quickly, the children read monotonously and a story or a moving picture was experienced in “unrelated portions rather than in its coherent totality” (Kanner, 1943, p.42).

With regard to the children’s intellectual ability, Kanner (1943) described them as being “endowed with good cognitive potentialities” despite having previously been “looked upon as feeble minded” (Kanner, p.39). In a follow up report Kanner (1973)

outlined the subsequent histories of nine of the eleven children in his original paper. He noted that only two of the nine children had progressed to employment.

Despite the fact that in the first four or five years of life, the children's behavioural patterns had been remarkably similar, Kanner found major differences in the shaping of each child's life history and eventual outcome (Kanner, 1973). He recognised that the history of several of the children may have been different if they had been in a different setting and with different support. In addition, Kanner wondered whether early infantile autism might appear "in different degrees of severity" (Kanner, 1973, p.145).

During the 1970's, agreement emerged on the validity of 'infantile' or 'childhood autism' as a diagnostic category. Rutter (1978) asked the question, "To what set of phenomena shall we apply the term autism?" Rutter regarded Kanner's (1943; 1973) work as the setting out of an hypothesis suggesting that "the particular grouping of behaviours Kanner chose to call autism had a validity" … because … "children with these behaviours differed from children with other psychiatric disorders" and therefore the behavioural description in fact formed "a disease entity" (Rutter, 1978, pp.3-4).

Rutter set out to test Kanner's original behavioural observations against subsequent research. By considering Kanner's original descriptions together with the subsequent work of a number of other researchers (Bartak & Rutter, 1974; Bartak, Rutter & Cox, 1975; Rutter, 1968; Schopler, 1966; Wing, 1969) Rutter set out a definition of autism which proved to be significant for ongoing autism research. Of particular significance was Rutter's recognition of the effect of intellectual ability upon the severity of the presentation of autism and the fact that "autism and mental retardation frequently co-exist" (Rutter, 1978, p.6).

It was therefore important when diagnosing autism to make it clear that the child's impaired social and language development were inconsistent with his or her intellectual ability.

Rutter (1978) summarised the definition of childhood autism in terms of four essential criteria:

1) Onset before the age of thirty months
2) Impaired social development which is inconsistent with the child's intellectual level

3) Delayed and deviant language development which is inconsistent with the child's intellectual level

4) Stereotyped play patterns, abnormal preoccupations or resistance to change (Rutter, 1978, p.19).

There are two international systems of classification for mental and behavioural disorders – the World Health Organisation's *International Classification of Diseases* (ICD) and the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (DSM). Wing (1997) details how the definition of autism within these classification systems has been revised, reflecting changing ideas about autism. The eighth edition of the ICD (World Health Organisation [WHO] 1967) mentioned infantile autism but only as an atypical form of schizophrenia.

Official definitions of 'childhood autism' were adopted in the World Health Organisation's International Classification of Diseases, Ninth Edition (ICD-9) published in 1978 and in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III) published in 1980. By the late 1990's there was "a high degree of consensus on the diagnostic criteria for autism and consistency in the evidence on the validation of autism as a diagnostic category" (Rutter, 1996, p.257). The current diagnostic criteria in the DSM-IV-TR (American Psychiatric Association [APA], 2000) and ICD-10 (World Health Organisation, [WHO], 1993 continue to be based on the fundamental areas of deficit identified by Kanner in 1943. In both systems the triad of social, communicative and behavioural problems constitutes the basis of an autism diagnosis. The specific diagnostic term used in the DSM-IV-TR is 'Autistic disorder' and in the ICD-10 the diagnostic term used is 'childhood autism'. The diagnostic criteria in DSM-IV-TR are

1) 'qualitative impairment in social interaction',

2) 'qualitative impairment in communication' and

3) 'restricted, repetitive and stereotyped patterns of behaviour, interests and activities … with onset prior to age three years' (p.75).

Also, onset must occur during infancy or childhood (up to 36 months of age).

The DSM-5 (American Psychiatric Association, 2013) was published in May, 2013 and replaced the DSM-IV-TR. The separate diagnostic labels such as 'autistic

disorder' or 'Asperger's syndrome', were replaced by the one term autism spectrum disorder, with distinctions to be made according to the severity level of the condition.

The diagnostic criteria in the ICD-10 are:

1) 'Abnormal or impaired development in
   (a) receptive or expressive language as used in social communication or
   (b) the development of selective social attachments or of reciprocal social interaction or
   (c) functional or symbolic play
2) Qualitative abnormalities in reciprocal social interaction
3) Qualitative abnormalities in communication
4) Restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities.' (ICD-10, 1993, pp.147-149).

In addition, abnormal or impaired development is evident before the age of 3 years.

Diagnostic criteria for autistic disorder in both the ICD-10 and the DSM-IV-TR are thus almost identical.

3.2 Description of Asperger's Disorder

In 1944 Hans Asperger based his doctoral thesis on a condition that he called 'autistic psychopathy' or 'autistic personality disorder'. Frith's (1991) book *Autism and Asperger Syndrome* contains a translation of Asperger's original work and his original case studies. Asperger's study described four boys who like Kanner's participants, preferred to play alone (Wing, 1981). Asperger also noted pedantic speech, difficulty with pronouns, difficulty with non-verbal communication, impaired social interaction, repetitive activities, excellent rote memory, resistance to change and clumsy, gross motor movement (Wing, 1981). In addition, Asperger observed that these children had odd responses to certain sensory stimuli. He also noted that these children had intelligence in the borderline, normal or superior range but had difficulty learning conventional school work. When Lorna Wing (1981) published her account of thirty four cases she referred to the syndrome she had studied as Asperger's syndrome. Wing believed Asperger's syndrome to be a preferred neutral term rather than Hans Asperger's label 'autistic psychopathy' where there was a likelihood that psychopathy

be equated with sociopathic behaviour (Wing, 1981). Asperger's name thus became attached to the syndrome.

The term 'Asperger's Syndrome' first appeared in 1990 in a draft of the tenth edition of the *International Classification of Diseases*. This edition was published in 1993 (ICD-10, World Health Organisation, 1993). The term 'Asperger's Disorder' first appeared in the *Diagnostic and Statistical Manual of Mental Disorders* in 1994 in the fourth edition (DSM-IV; American Psychiatric Association, 1994). In the DSM-IV-TR (American Psychiatric Association, 2000) the diagnostic criteria for Asperger's Disorder are listed as:

a) Qualitative impairment in social interaction and

b) Restricted, repetitive and stereotyped patterns of behaviour, interests and activities.

c) Criteria (A) and (B) are also included in the criteria for Autistic Disorder. However, the criteria for Asperger's Disorder includes,

d) No clinically significant general delay in language and in addition

e) No clinically significant delay in cognitive development or in the development of age appropriate self-help skills, adaptive behaviour (other than social interaction) and curiosity about the environment in childhood.

Unlike Autistic Disorder, Asperger's Disorder does not include the criterion 'qualitative impairment in communication'. The diagnostic criteria for Asperger's Disorder in the ICD-10 are:

1) No clinically significant general delay in spoken or receptive language or cognitive development

2) Qualitative abnormalities in reciprocal social interaction

3) Unusually intense, circumscribed interest or restricted, repetitive, and stereotyped patterns of behaviour, interests and activities.

The diagnostic criteria for Asperger's Disorder in the ICD-10 are thus very similar to those set out in the DSM-IV-TR.

3.3 Difference between Asperger syndrome and Kanner's autism

The main difference between the children Asperger (1944, 1991) described and those Kanner (1943, 1973) described was that Asperger's children were not as impaired as those described by Kanner.

Asperger himself believed that 'autistic psychopathy' (Asperger, 1944) was different from the syndrome described by Kanner (Gillberg, 2002). Kanner's cases were usually of low intelligence whereas Asperger's patients generally had normal to very high intelligence (Gillberg, 2002).

Although there are many areas of overlap, Sacks (1995) pointed out what he believed to be the most important difference:

> … people with Asperger syndrome can tell us of their experiences, feelings and states whereas those with classical autism cannot. …with Asperger syndrome there is self-consciousness and … some power to introspect and report.

Sacks (1995) thus highlighted the capacity of children with Asperger syndrome to use language to think and to communicate. Sacks also considered this ability to be the defining difference between autism and Asperger syndrome (Sacks, 1995, pp.235-236).

3.4 Diagnosis of Asperger Syndrome

In the DSM-IV-TR and the ICD-10, Asperger syndrome appears as a separate classification from autism although still under the heading 'pervasive developmental disorder'. For the participants in this study, neither the labelling of their particular diagnosis nor their intervention program will be changed by the introduction of the DSM-5. Klin, Volkmar and Sparrow (2000) argued against the existence of Asperger syndrome as a separate classification from autism. In the ICD-10 Asperger syndrome is listed as differing from autism in terms of a "lack of any clinically significant general delay in language or cognitive development" (Volkmar & Klin, 2000, p.42). Klin et al. (2000) pointed out that neither the DSM-IV-TR or ICD-10 mention the severe deficits in the social use of language by individuals with Asperger disorder. Addressing the question of the separation of Asperger syndrome from autism,

Volkmar and Cohen (1988) found that the differences between some cases of Asperger syndrome and high functioning autism were not very obvious.

Findings suggested that there are potentially important genetic links between Asperger syndrome and autism that bring them together as part of a spectrum or group of social disabilities (Volkmar, Klin & Pauls, 1998; Wing 1991). Uta Frith proposed that the individual with Asperger disorder suffers from a "particular form of autism" (Frith, 1991). For the purpose of this research, autism and Asperger syndrome were considered to be part of the same autism spectrum or continuum and this is consistent with the categorisation approach being used in the recently introduced DSM-5. Within the inclusive primary school setting, the common difficulties in the cognitive, social and behavioural areas far outweigh any differences that might be perceived between individuals who have a diagnosis of autism, high functioning autism or Asperger syndrome.

At this point in time, much of the research supports the classification of 'Autism Spectrum Disorders' as including different manifestations of the syndrome which have different diagnostic criteria but which share the common developmental difficulties within the triad of impairments (Bishop, 2000; Gillberg, 1991; Wing, 1991).

3.5 Distinction between Asperger syndrome and High Functioning Autism

There has been considerable debate about the validity of the distinction between Asperger syndrome (AS) and High Functioning Autism (HFA). The DSM-IV-TR and the ICD-10 both base such a distinction on measures of cognitive and language development. Asperger syndrome is characterised by an "absence of clinically significant cognitive and language delay" (American Psychiatric Association 2000). Although there are currently no explicit diagnostic guidelines for High Functioning Autism, in the research literature High Functioning Autism is often defined as an absence of cognitive delay (Bennett, Szatmari, Bryson, Volden, Zwaigenbaum, Vaccarella, Duku & Boyle, 2008). Any distinction between Asperger syndrome and High Functioning Autism is therefore reduced to the absence of language delay in Asperger syndrome. This has often been problematic for both diagnosticians and

researchers. When assessing older children any measurement of 'delay' requires retrospective reporting which may be unreliable.

In addition, Jordan and Jones (1999, p.10) point out that although "language is often defined as a system of communication", some students with autism spectrum disorder show how language may develop "divorced from its role in communication". This highlights the value in combining the terms 'social' and 'communication' in the DSM-5.

A number of researchers noted that early group differences in core language symptoms decreased with age such that the group with an early label of High Functioning Autism eventually performed similarly to those children with Asperger syndrome (Howlin, 2003; Szatmari, Bryson, Streiner, Wilson, Archer & Ryerse, 2000, cited in Bennett *et al.*, 2008). Bennett *et al.* (2008) hypothesised that the best way to think of Asperger syndrome and High Functioning Autism was as parallel and potentially overlapping developmental pathways.

3.6 Current use of the term Autism Spectrum Disorder and other terms used in this research study

Prior to conducting the study, the researcher defined a number of key terms. The term Autism Spectrum Disorder is at the centre of the study.

The DSM-5 (American Psychiatric Association, 2013) which was published in May, 2013 has replaced the DSM- IV-TR. While Bennett et al. (2008) hypothesised about Asperger syndrome and High Functioning Autism as parallel and perhaps overlapping presentations, the American Psychiatric Association Board has gone one step further. In the DSM-5, the separate diagnostic labels of autistic disorder (autism), Asperger's syndrome, childhood disintegrative disorder and pervasive developmental disorder not otherwise specified (PDD-NOS) were replaced with the one term, autism spectrum disorder. Under the DSM-5, distinctions will be made according to the severity level of the condition. The severity levels are based on the amount of support needed due to challenges with social communication, restricted interests and repetitive behaviours. Under the DSM-5, a person might be diagnosed with autism spectrum disorder, level 1, level 2 or level 3. Level 1 represents those people with very substantial support needs, Level 2 represents those with substantial support needs and Level 3 represents people needing some support.

In the present study, participants were diagnosed under the DSM-IV-TR and have one of four diagnoses: Asperger's syndrome, autism, Autism Spectrum Disorder or High Functioning Autism. Consistent with the DSM 5, these children will be described as having an Autism Spectrum Disorder which will be referred to using the acronym ASD. Other terms which are important have been included in Table 3.6.1.

Table 3.6.1 Terms and definitions which are important in the study's design, procedure and interpretation of results

Term	Definition
Auditory processing	The ability to comprehend and interpret information that is received aurally.
Cognitive instruction	Teaching a student the specific information, steps and skills needed to complete a specific task
Metacognitive instruction	Focus is upon the language and techniques which allow the student to think about how to learn.
Participants	The eight students participating in the study.
Primary School	The first seven years of schooling in New South Wales. This is equivalent to Elementary School in the United States.
Scaffold	A structured topic outline featuring ten key words with visual cues and the teacher's contextual use of the vocabulary in sentences.
Semantics	Relating to language meaning and often indicated by the structure (syntax) of the sentence.
Topic	A discrete unit of study within one of the four syllabus areas of English, Mathematics, Human Society and Its Environment (HSIE) and Science as specified by the NSW Board of Studies Primary School syllabus.
Visual processing	The ability to comprehend and interpret information that is received visually.
Visual supports	Real objects, pictures, photos or diagrams used to help a child with autism to understand what is being said to them.

3.7 Prevalence of Autism Spectrum Disorders

3.7.1 International Prevalence Studies

The first study of the prevalence of autism was conducted by Lotter in 1966. Studying the population of children aged eight to ten years in the area of Middlesex, England, Lotter found a group of children who fitted Kanner's criteria: they were "socially aloof and had elaborate rituals and routines" (Frith, 2003, p.59). He found a prevalence rate of 4.5 per 10,000 with a ratio of 2.6 boys to 1 girl (Frith, 2003; Lotter, 1966). Fombonne (2003) studied the design and sample details of thirty two surveys published between 1966 and 2001. He derived a conservative global estimate for all Pervasive Developmental Disorders of 27.5 per 10,000. The sum of estimates he derived as 10 per 10,000 for Autistic Disorder, 15 per 10,000 for Pervasive Developmental Disorder – Not Otherwise Specified and 2.5 per 10,000 for Asperger's Disorder (Fombonne, 2003, p.373). Other researchers have found much higher prevalence rates for Asperger's Disorder. Gillberg (2002) estimated that between 30 and 40 children per 10,000 develop "the full clinical picture of Asperger's Disorder before 10 years of age" (Gillberg, 2002, p.22).

Studies have estimated that for Autistic Disorder, males outnumber females by 3:1 (Hill & Frith, 2003). For Asperger's syndrome, however, there is wide variation in reported male to female ratio estimates. Hill and Frith (2003) reported estimates as ranging from 4:1 to 10:1. Attwood (2007) noted that girls with Asperger's syndrome may be more difficult to recognise and diagnose due to "coping and camouflaging mechanisms" (Attwood, 2007, p.46). Attwood's (2007) analysis of over 1000 diagnostic assessments over a period of twelve years gave a ratio of males to females of 4:1.

3.7.2 An Australian Prevalence Study

Concern about perceptions of an increase in the prevalence of autism spectrum disorders in Australia, coupled with a lack of evidence regarding exact numbers of people affected by autism, led to the Australian Advisory Board on Autism Spectrum Disorders commissioning a report on prevalence. The report (MacDermott, Williams, Ridley, Glasson and Wray, 2006) based its core findings on data from the Commonwealth Government's own Centrelink data because of

considerable variation in prevalence figures from other sources. The estimated prevalence of ASD's across Australia for 6 – 12 year old children in 2005 was found to be 62.5 per 10,000; 47.2 per 10,000 for Autistic Disorder and 15.3 per 10,000 for Asperger's Disorder (MacDermott et al., 2006, p.31). This means that in the age range 6 to 12 years, there is on average one child in every 160 with an ASD (MacDermott et al., 2006). This finding has significant implications for educational policy and practice.

3.7.3 Reasons for reported increase in prevalence

There is much debate among researchers about the reason for the increase in estimated prevalence figures for Autism Spectrum Disorders. Fombonne (2003) pointed out the need to assess changes in diagnostic criteria over the particular time period as well as the need to be aware of varying case detection methods. Frith (2003) pointed out the important effect upon prevalence estimates of the size, composition and age range of the targeted population. Frith (2003, p.59) concluded that "increasing prevalence figures … do not reflect a real increase in cases" because diagnostic criteria have widened and greater awareness of autism has resulted in more cases being diagnosed.

4 Deficits in functioning associated with Autism Spectrum Disorders and the implications for education

If researchers are to understand the particular classroom difficulties experienced by students with ASD, it is necessary for them to understand the primary deficits in functioning associated with this disorder.

4.1 Cognition in Autism

Cognition is "the process of knowing and includes thinking, learning, memory and imagination" (Attwood, 1998, p.112). It is very important that educators know how a student with ASD thinks and learns. Without this knowledge, students with an ASD may be included in a 'one size fits all' model of education. The nature of the cognitive status of the person with an ASD has therefore been an ongoing focus of research.

For many years, three different psychological theories were proposed to explain particular cognitive difficulties experienced by people with ASD. These three theories were,

a) a 'theory of mind' deficit,

b) the 'weak central coherence' theory and

c) the theory that people with ASD have an executive functioning deficit.

More recently, however, there have been an increasing number of challenges to the assumption of any single causative factor of ASD. Theories have been suggested which make adjustments to the 'theory of mind' deficit (Bartak, Bottroff and Zeitz, 2006); the weak central coherence theory (Mottron et al., 2006) and the theory of executive functioning deficit (Hill & Frith, 2003). As fundamental explanations of autism-related behaviours, 'theory of mind' deficit, 'weak central coherence' theory and 'executive functioning' deficit have been found to be incomplete.

Although the Theory of Mind theories almost certainly identify what is likely to be a necessary and common feature of autism, they do not offer a complete explanation of social and communication impairments. The more recent primary intersubjectivity theories seem likely to fill this gap (Boucher, 2009). These theories focus upon knowledge gained from face-to-face interaction between the child with ASD and another person.

Current brain-behaviour theories emphasise ways in which brain development in autism deviates from the norm as a result of some initial pathology (Courchesne, 2004; Belmonte et al., 2004b). Brain-behaviour theories attempt to put together a more comprehensive explanation of autism in terms of brain-behaviour correlates (Boucher, 2009).

4.2 Theory of Mind Deficit

Premack and Woodruff (1978) defined theory of mind as the ability to attribute mental states to oneself and to others. They suggested that the ability to infer what another person believes enables one to predict what they will do in a given situation.

However, Bartak, Bottroff and Zeitz (2006) suggested that theory of mind is likely to involve more than "knowing that other people have feelings, thoughts and motives". Bartak et al. (2006, p.252) listed an additional five defining aspects of theory of mind. These are,

- "Receptive skills to decode facial expressions, body language, social contexts and tone of voice.
- Knowing what others feel, think and desire.
- Knowing what one feels, thinks or wants.
- Receptive skills to decode one's own facial expression, body language or tone of voice.
- Knowing the effect of one's own behaviour on others."

From an educational perspective, this more detailed definition of theory of mind sets out the knowledge and skills which make up this area of autism deficit. This has important practical implications because it provides the basis for an individual student's check list of knowledge and skills which may allow the development of theory of mind skills.

Baron-Cohen, Leslie and Frith (1985) devised and conducted the Sally-Anne experiment to test the prediction that children with autism would not understand that another person can have a belief that is different from their own.

Of the children diagnosed as 'autistic' according to Rutter's (1978) criteria, Baron-Cohen et al. (1985) found that 80% failed the Sally-Anne task. The task involved two dolls, Sally and Anne. Sally placed a marble in her basket and then left the scene. Anne removed the marble and hid it in her box. When Sally returned, the experimenter asked the 'belief

question': Where did Sally look for her marble? Those who failed the task did not take into account Sally's false belief about the location of the marble. This was despite their having a much higher mental age than the other children in the study.

Further evidence for a theory of mind deficit within autism emerged when Baron-Cohen et al. (1985, p.41) found that children with autism were able to sequence story scenes dealing with objects more successfully than stories where it was necessary to comprehend the beliefs of other people.

Frith and Happé (1999) hypothesised that people with autism often found it difficult to examine or observe their own mental processes or to recognise and understand the beliefs, thoughts and feelings of another person. Frith (1989) referred to this aspect of autism as an inability to 'mind read'. Frith used the term 'mentalising' rather than 'theory of mind'. Frith defined mentalising as "what we do when we attribute mental states to others to predict their behaviour" (Frith, 2003, p.80).

Happé (Frith, 2003) reviewed a large set of data and found that the majority of normally developing children were able to pass typical false belief tasks by the age of five. In contrast, Frith (2003) found that the majority of children with ASD, irrespective of their level of intelligence, did not pass false belief tasks until reaching a mental age of approximately ten years. Frith considered that this represented a five year developmental delay (Frith, 2003, p.94).

Happé (Frith, 2003) wrote a series of short stories that could only be understood if intentions and beliefs were attributed to the characters. These stories were used in one of the earliest neuroimaging studies in which mentalising tasks were explored. The participants in the study were adults diagnosed with autism and assessed with high ability. Results showed an abnormal pattern of brain activation (Frith, 2003). Other brain imaging studies have supported the view that brain activity during theory of mind tasks is weaker in individuals with an ASD than in controls (Frith, 2001; Nieminen - von Wendt et al., 2003).

Frith and Happé (1994) proposed that the Theory of Mind construct was very successful at making predictions about the triad of impairments in socialisation, imagination and communication shown by people with autism. In their view, however, it did not account for certain experimental findings of both strength and weakness on non-social tasks nor for instances where people with autism consistently passed false belief tasks. Frith and

Happé (1994) discussed instances where a person with autism was able to 'intellectualise' what a person may have been thinking or feeling but could not apply the knowledge effectively. Frith and Happé discussed weak central coherence as an explanation and put forth some preliminary evidence for this theory (Frith & Happé, 1994).

4.3 Weak Central Coherence

Central coherence refers to an information-processing style where the individual is able to integrate various pieces of information to form a coherent whole. Information is processed in its context. The emphasis therefore is upon "pulling information together for higher-level meaning" (Hill & Frith, 2003, p.284).

An individual who has weak central coherence, however, will have a different system of information processing, focusing on details rather than the coherent whole. Frith and Happé's (1994) research suggested that children and adults with Asperger syndrome exhibited weak central coherence and therefore had difficulty integrating pieces of information and did not understand the overall context in which an event happened.

The tendency of children with an ASD to notice detail has been shown to be an advantage in visual-spatial tasks such as the block design subtest of the Wechsler intelligence tests (Frith, 2003; Hill & Frith, 2004). Frith (2003) cited an experiment by Shah and Frith (1993) in which children with 'autism' experienced a similar advantage in locating embedded figures, scoring above their mental age.

However, weak central coherence has been shown to be a disadvantage when a task requires that a stimulus be interpreted differently according to the context. Hill and Frith (2004) cited research by Frith and Snowling (1983), Happé (1997) and Jolliffe and Baron-Cohen (1999) which found that individuals with autism did not take account of sentence context when asked to read homographs aloud. Homographs are words that have identical spelling but different pronunciation depending on the context of their usage, for example, *sow* as in 'to sow seed' or *sow* referring to a 'female pig'. The individual with autism was less likely than controls to pronounce the homograph correctly depending on sentence context.

Hill and Frith considered that this tendency would work "at the expense of contextual meaning and in favour of piecemeal processing" (Hill & Frith, 2003, p.284).

The underlying neurological processes involved in central coherence tasks are not fully understood. However, Hill and Frith (2003) referred to a brain imaging study by Ring et al. (1999) in which adults with and without autism underwent Magnetic Resonance Imaging scans while completing the embedded figures test. The individuals with autism showed greater activation of the visual cortex while the controls demonstrated greater activation in the pre-frontal cortex. Hill and Frith (2003) considered these findings to be consistent with the idea of the individual with ASD having intact sensory processing but where the early information processing stage which extracts the global features of a stimulus item is not functioning appropriately (Hill & Frith, 2003, p.285).

Mottron et al. (2006) proposed an 'Enhanced Perceptual Functioning' model to explain the main differences between autistic and non-autistic perceptual processing. Mottron et al. (2006, p.1), set out eight principles of autistic perception which included

> locally oriented visual and auditory perception, enhanced low-level discrimination, enhanced perception of first order static stimuli and autonomy of low-level information processing toward higher-order operations.

Mottron et al. (2006, p.39) concluded that "perception plays a different and superior role in autistic cognition".

Happé and Frith (2006) reviewed more than fifty empirical studies of coherence. This review suggested significant findings of detail-focused processing in ASD but only mixed findings regarding weak global processing. Happé and Frith (2006, p.21) considered it was clear from the review that "people with ASD can process globally for meaning when explicitly required to do so" and therefore suggested that the discussion of weak coherence had moved towards "an emphasis on superiority in local processing rather than deficit in global processing".

In their update of the Weak Central Coherence theory, Happé and Frith (2006) discussed possible causes which included problems of attention switching (Mann and Walker, 2003) as well as theories concerning brain development, organisation and function. Sensory integration was viewed as the interface between psychological and neurological processes (Iarocci and MacDonad, 2006).

Vermeulen (2011) attributed the perceived emphasis on 'local processing' in ASD to a lack of contextual sensitivity. He re-conceptualised 'weak coherence' as 'context blindness' which was defined as a reduced spontaneous use of context when attributing

meaning to a stimulus. Vermuelen argued that 'context blindness' is able to explain why individuals with ASD have difficulty with communication, social interaction, flexible thinking and behaviour.

Studies focusing on sensory integration and neurological processes have also expanded our understanding of comprehension weakness within ASD. Functional magnetic resonance imaging studies have found differences in the distribution of brain activation during sentence comprehension in high-functioning autism. When compared with control participants, there was a large difference between the autism and control groups in the distribution of brain activation in the key language areas – Wernicke's and Broca;s areas (Just, Cherkassy, Keller and Minshew, 2004). Impaired connectivity is seen by some researchers as the brain basis of the impairment of complex information processing which they believe to be the cause of autism at the psychological level (Kinshino et al., 2005; Carpenter et al., 2001; Rippon et al., 2007).

4.4 Executive Functioning Deficits

Executive function is a term used to describe a collection of cognitive processes including self-awareness, self-monitoring, ability to delay or inhibit responses, resistance to distraction, persistence toward a future goal and anticipation of long term consequences of behaviour (Ozonoff, Pennington & Rogers, 1991).

Studies involving the theory of executive dysfunction in autism have made research links to individuals with injuries to the frontal lobe area (Pearce, McDonald & Coltheart, 1998). Cognitive processes involved in executive functioning activities, such as abstract language processing, are typically impaired in patients with acquired frontal lobe damage. Difficulties experienced by children with autism such as resistance to change in routines, stereotypical behaviours, narrow interests, rigidity and repetitive behaviours are considered to be indicative of a deficit in executive functioning (Hill & Frith, 2003).

Skills of executive functioning are important in everyday life and critical to educational success in an inclusive primary school classroom. Landa and Goldberg (2005) considered that within autism research, executive dysfunction has been most evident in planning and set shifting (flexibility), two skills which are of central importance in the primary school classroom where the student is required to manipulate relevant information.

A number of research studies point to poor cognitive flexibility as a key aspect of executive dysfunction in autism (Goldstein, Johnson & Minshew, 2001; Ozonoff,

Pennington & Rogers, 1991; Prior & Hoffman, 1990). Cognitive flexibility is a central feature of Blank et al.'s third level of language abstraction, 'Reordering of Perception' which requires the student to select perceptually subtle aspects of an entity or action based on linguistic constraints.

Hill and Frith (2003) considered the theory of executive functioning in autism to have three weaknesses. Firstly, there was a lack of agreement as to which aspects of executive function are typical of autism. Secondly, executive dysfunction is found in clinical conditions other than autism, for example Attention Deficit Hyperactivity Disorder (ADHD). This would reduce the possibility of using executive dysfunction as a diagnostic indicator for autism. Thirdly, although difficulties with executive function appear to be common in individuals with ASD, they may not be evident in all individuals with ASD who have normal IQ levels (Russell & Hill, 2001).

4.5 Sensory Processing Difficulties

Prior to DSM-5, sensory sensitivity was a feature not referred to within the diagnostic criteria for autism. For students with ASD, however, their sensory experiences are often different from those of other people (Grandin, 1996). For many children with autism there is "a defect in the systems which process incoming sensory information" (Grandin, 1996, p.9). This means that the child may over-react to some stimuli and under-react to others. Grandin (1996, p.67) has described how as a young child, loud noises often felt "like a dentist's drill hitting a nerve".

Blackman (1999, p.51) described her sensitivity to overwhelming auditory stimulation:

> Because other people's sound processing was alien to me, I had no idea that sound should not be like a pressure-cooker lid … in the classroom there was visual stimulation and noise, which combined with my own breathing … I rocked, swayed and scampered … .

Donna Williams (1994) found the world incomprehensible and she struggled constantly to gain meaning from her senses. In her autobiography, *Nobody Nowhere*, Williams (1994, p.46) described her love of the saying, "Stop the world I want to get off". She explained that the stress of trying to keep up often became too much and she often tried to slow everything down. Williams (1994, p.46) also described how turning the sound up and down on the television broke up the voices and seemed "to imitate the difficulty she sometimes had hearing people consistently". When tested, Williams's hearing was better

than average. The problem was "one of a fluctuation in the awareness of sound" (Williams, 1994, p.46).

The inclusive primary school classroom requires students to process a wide range of sensory input simultaneously (Anderson & Emmons, 1996). For many students with ASD this leads to sensory overload. Williams (1994, p.181) explained that:

> When overloaded, any of several meaning systems can shut down … On a cognitive level … the comprehension of the meaning of words could drop away leaving me lost to both concept and significance.

In addition, poor sensory processing may undermine a student's ability to attend to the classroom instructional process (Wetherby & Prizant, 2000).

4.6 Stress Management

Bartak, Bottroff and Zeitz (2006) proposed a dynamic model of autism. Based on the student's level of deficit in processing information, the student is placed at one of four levels – primary, secondary, tertiary or quaternary. The student's level of stress would increase with progression through the four levels of the model. Bartak et al. (2006) viewed poor sensory integration as a common problem among children with ASD. In their four level model of autism, however, Bartak et al. (2006, pp.248-249) placed poor sensory integration at the secondary level because:

> Sensory integration seems dependent on the person's understanding of their environment. As their comprehension of language and social situations improves, their sensory integration follows suit.

Thus, a visual scaffold which supports the student's language processing within classroom curriculum topics would be expected to aid sensory integration and reduce the amount of stress experienced by the student in the learning environment.

4.7 Implications for Education

For students with ASD in inclusive primary schools, learning success requires that they are able to comprehend curriculum content, exchange information with teachers and peers and develop independence in managing their own classroom learning tasks. When these requirements are met the student with ASD is able to achieve learning success and experience a lower level of classroom anxiety. With a growing awareness of the difficulties encountered by children with ASD in inclusive classrooms, there has been a

change in emphasis from language-based instruction to more visual instructional supports.

Students with ASD bring specific needs to classroom learning. Although not always present as discrete entities, the three theories discussed earlier – theory of mind deficit, weak central coherence and executive functioning deficit – provide a useful structure within which to plan effective interventions to support these students.

Many students with ASD appear to have theory of mind deficits. It is likely, therefore, that they will need explicit instruction in the following areas –

1) Other people have thoughts, feelings and beliefs. Such instruction is needed if students are to be able to answer questions such as, "How did the boy feel when his friend became sick?
2) There will be times when I need to talk to other people about what I think, feel or believe. A question relevant to this area would be, "What do you think the father should have done when he realised his young daughter was lost?"

Students with an ASD may have difficulty understanding a teacher's intentions in relation to instructions or topic content. The student may need explicit, individual instruction if they are to understand the teacher's requirements within an assignment task. Jordan (2005, p.110) reported that students with ASD often need "explicit, external (visual) cueing for what others are able to intuit naturally".

Students with an ASD often have a detail-focused processing style, or weak central coherence, where they attend to minute detail and are unaware of the over-arching nature of the classroom topic and teacher-directed focus upon particular content (Burack, 1994).

For students with ASD, executive functioning difficulties will often mean problems with planning, organisation, flexibility and self-regulation (Hill & Frith, 2003). Twachtman-Cullen emphasised the importance of support for those students in the area of self-regulation because self-regulation is "the basis for adaptive learning and thinking" (Borkowski & Burke, 1996, p.238 cited in Twachtman-Cullen, 2006, p.306). These difficulties may create "a web of stress that is particularly problematic in complex, high-demand environments" (Twachtman-Cullen, 2006, p.305). For students with ASD, the inclusive primary school classroom is often complex and very demanding.

Students with ASD, therefore, require support in order to manage these difficulties (Quill, 1997). Classroom support of executive functioning difficulties may include – consistent classroom rules and routines, clear beginning and end points for each task, tasks broken down into clear steps and structured plans for text writing tasks. An example of a text writing task is when the student is asked to write a Narrative, an Explanation or a Procedure.

The current research aimed to develop and implement an individualised, visual scaffold which would:

1) Represent a consistent approach which could be applied to any curriculum topic,
2) Indicate the beginning and end points for each topic content and accompanying tasks,
3) Present the learning content in a series of clear steps,
4) Provide explicit structured plans for such learning tasks as text writing or mathematical procedures and
5) Provide the opportunity for learning how to learn.

Quill (1997) emphasised the value of visually cued instruction for students with ASD. Auditory instruction is transient. However, when visual supports are used, the student may refer to the visual information as often as needed. Grandin (1996, p.37) described having difficulty with "long strings of information", explaining that her thinking and learning style was a series of visual associations. Visual thinking was a great advantage in her career as a designer of equipment for livestock.

Groden and Le Vasseur (1995), Quill (1997) and Roberts (2004) have commented on or carried out research on the value of using visuals to support students with ASD. Groden and Le Vasseur (1995) developed the cognitive picture rehearsal strategy which used pictures and an accompanying script. The long term goal was the development of self - control and social skills in children with autism. Although Groden and Le Vasseur's social skill focus is different to the current research focus on comprehension of curriculum content, both studies address the learning strengths of individuals with autism by providing a visual system combined with structured routines.

Roberts (2004, p.xi) reported that there was "considerable evidence to support the use of visual strategies and visually cued instruction" for students with ASD. Roberts (2004) listed symbols, pictures, photographs and objects of reference as being useful in supporting comprehension of oral language.

Quill (1997) focused upon impairments in attention, information processing and memory as the three key aspects of cognitive dysfunction, impacting upon language and communication for young children with ASD. Although Quill's focus was not specifically on inclusive primary school classrooms, the rationale she set out for visually cued instruction is relevant for all educators working with students with ASD. For many of these students, visually cued instruction caters to their area of learning strength. Quill reported that there was evidence that "the simultaneous presentation of visual and oral language instruction facilitates joint attention … and receptive language" (Quill, 1996; Quill & Grant, 1996).

5 Comprehension of Oral Instructional Language

Oral language is the main medium through which Primary School learning is conveyed to students. In Primary School classrooms, oral instructional language is of central importance in the acquisition of core academic skills as well as the factual content of the curriculum areas.

Rutter (1983) considered autism to be a brain-based developmental disorder of information processing. As a result, the student with ASD brings a different perspective to classroom learning (Jordan, 2005).

If this learning is to be successful, the student with ASD must be able to,

1) Attend to the relevant aspects of the learning situation.
2) Identify the key vocabulary and concepts within the teacher's discourse.
3) Realise when the message they are receiving from the teacher is unclear.
4) Make connections between current learning and prior learning.
5) File the information they have learned in memory.

Each of these five steps can be difficult for the student with ASD because of deficits in the processing of oral language.

In a Primary School classroom, teacher and student must adapt to one another's knowledge and needs in order to reach mutual understanding (Dahlgren & Sandberg, 2008, p.335). In a typical Primary School lesson the teacher describes to the students "a particular referent, so-called referential communication" (Dahlgren & Sandberg, 2008, p.335). The referent may be a science topic, for example 'Mammals', a Mathematics topic such as 'Two Dimensional Shapes' or the structure for writing a 'Narrative Text'.

Based on work in Applied Linguistics, Perkins (2000) considered that shared communication such as classroom referential communication requires a "cognitive area of competency which comprises knowledge, of the domain of discussion" (Perkins, 2000, cited in Bartak et al., 2006, p.251). If the student is to communicate with the teacher he/she must comprehend what is being talked about.

5.1 A model of classroom language – Blank, Rose and Berlin (1978; 2003)

In order to improve the quality of the teaching-learning process, it is necessary to have a model that identifies "the key factors that underlie productive teacher-child interchanges" (Blank, et al., 1978, p.3). Blank, et al. were concerned with the difficulties encountered by

pre-school teachers as they planned and conducted programs to develop the thinking skills of pre-school students. Blank et al. observed the teaching programs in many different pre-school settings. Almost all of the programs agreed on the central importance of the verbal exchange that occurs between the teacher and the child. However, Blank et al. found very little agreement between existing programs as to the level of structuring, the type of resource material or the quality of teacher-child interaction that should be present in any pre-school program designed to teach thinking skills. In addition, they found that many questions posed by teachers presumed that the children had mastered certain verbal and conceptual skills.

Blank et al. (1978) argued that "the instructional process is … a special form of communication" where the core of the teaching process is in the exchange that takes place between teacher and child. This exchange requires that the child,

a) Focuses upon a concept or idea formulated by another person.

b) Responds in a way that meets any constraints posed within the question and

c) Integrates the information within prior learning so that overall knowledge is increased.

Blank et al.'s research therefore focused upon instructional language in the pre-school setting. They identified discourse skills as being at the heart of a "verbally based instructional process" (Blank et al., 1978, p.21). Due to the large number of concepts being taught the two main features of this discourse are –

1) The diversity of verbal formulations and

2) The varied levels of complexity of the formulations.

In order to have an in-depth understanding of the verbal exchange between teacher and child, Blank et al. sought a single dimension against which the teacher's language structures could be measured. They proposed the term "perceptual language distance" as a concept taking into consideration both

a) The material being discussed as represented by the term "perceptual" and

b) The particular language used by the teacher to direct the child's interpretation of the learning.

The teacher's language can be close to or removed from the material, depending on how the question or statement is constructed. As the distance between material and language widens there is an increasing cognitive load placed upon the child to abstract information from the material. Blank et al. (1978; 2003) represented this 'continuum of abstraction' on a scale containing four levels:

1) Matching perception
2) Selective analysis of perception
3) Reordering perception
4) Reasoning about perception.

There are some important links between the research by Blank et al. and the current study.

This study is focused upon student comprehension of teacher's oral instructional language. Blank et al. considered that in order to understand the teacher's instruction, it was necessary to develop a conceptual framework within which to identify and categorise the teacher's utterances. For Blank et al., this conceptual framework was the first step in the development of a model of classroom language.

The current study by this author has the same requirement for a framework which allows for analysis of each teacher utterance. The current study will therefore adopt the four levels of language abstraction developed by Blank et al. (1978; 2003) with some adjustments to category definitions aimed at clarifying some confusions between categories two and three.

Both Blank et al.'s research and the current study were based on the premise that teacher utterances will not vary according to differences in content but rather in response to the teacher's specific instructional aim. For Blank et al. (1978; 2003) the central focus was upon how perceptually constrained the child was as he/she processed the teacher's question or statement. At Level 1 the child perceives the object or its picture and gives the label for the object as a whole. Over the four levels, the processing requirement moves further and further away from the cues in the picture until by Level 4, 'Reasoning', the processing response is not evident in the picture and there may well be no picture provided.

The present researcher's work will focus upon the level of structuring and the type of resource material necessary to assist students with autism to comprehend the teacher's instructional language. The particular nature of the structuring and resource material to be used was directed by Blank et al.'s four level analysis of the teacher's instructional language.

Having developed a model of classroom language, Blank et al. then used this framework in the development of the PLAI and PLAI-2 (Pre-school Language Assessment Instrument, 2nd Edition). The PLAI-2 is an instrument which is designed to assess a child's ability to respond to different levels of language abstraction. This test allows examiners to measure and compare the child's receptive and expressive modes of response across the four levels of abstraction.

These four levels of language abstraction will be explained in terms of what the student is required to focus upon in order to correctly process and comprehend the teacher's utterances. Examples given at each level are taken from Blank et al.'s (2003) PLAI-2.

The first level of language abstraction is called Matching Perception. At this level, the child is required to match a name or label to an object or action as a whole or to perform an imitation of something the teacher says or does. Examples of teacher utterances at the matching level in both receptive and expressive modes are:

1) Show me the clock (Receptive)
2) Watch. Now do what I do. (The examiner points to his/her nose.) (Receptive)
3) Look at this (a saucepan). When I show you the next page, I want you to find one like it. (Receptive)
4) Examiner points to a cup and asks, what is this called? (Expressive)
5) What is the girl doing? (Expressive)
6) Listen. Say what I say, "The boy saw the car" (Expressive)

The second level of language abstraction is called Selective Analysis. At this level, the child must attend to a selective attribute or attributes of an object or situation. Selection of the object, entity or action is based on such things as shape, size or colour. Examples of teacher utterances at the selective analysis level in both receptive and expressive modes are:

1) Show me the tool which is sharp (Receptive)
2) Look at these pictures. Point to the one that shows a girl feeding some chickens. (Receptive)
3) Look at these two bicycles. Point to a part of this one and a part of this one that are different from each other. (Receptive)
4) What shape are the wheels on this car? (Expressive)
5) Where are they walking? (Expressive)
6) What do you do with these? (Picture of knitting needles) (Expressive)

The third level of language abstraction is Reordering Perception. At this level of language abstraction, rather than attend to perceptual aspects which are evident in a visual cue, the child is now required to internally manipulate his or her knowledge about an object or process so that his or her response is in line with the specified linguistic constraint or criteria. The answer to the question or the meaning of the utterance is not evident in the visual cue.

Examples of teacher utterances at the level of Reordering Perception in both receptive and expressive modes are:

1) Point to all the items that are not cups (Receptive)
2) Show me the thing that you can put water into, you hold and you drink from (Receptive)
3) If I wanted to cook some dinner, point to the things I do not need (pictures of a saucepan, a doll, an oven, vegetables, a toy train, a knife and fork, a beach ball) (Receptive)
4) How are they the same? (Picture of a cup and a saucepan). (Expressive)
5) Tell me what a knife is. (Expressive)
6) A girl dressed her doll, walked her dog and then went to a friend's house. What did she do first? (Expressive)

The fourth level of language abstraction is Reasoning about Perception. At this level of language abstraction, the child is required to focus on what could, would or might happen under specified conditions. It also includes 'why' questions and 'how do you know'

questions. At this level, the child is required to understand the characteristics of items and to be able to give logical responses. Examples of teacher utterances at the Reasoning about Perception level in both receptive and expressive modes are:

1) Tom's dinner keeps sliding off his plate. Which one of these devices could be used so his dinner stays on the plate? (tongs, oven mitt, plate guard) (Receptive)
2) This dog is happy and this dog is not. Point to what shows he is happy. (Upright posture, tail wagging) (Receptive)
3) Why are we mammals? (Expressive)
4) An aeroplane can move so is it living? (Expressive)

5.2 Adjustments to language abstraction definitions

The first of the research questions (section 2.3) required analysis of the teacher's instructional language against Blank et al.'s (1978, 2003) four levels of language abstraction. In analysing each teacher utterance, some ambiguity arose in the original definitions for levels 2 and 3. For example, when the kindergarten teacher gave a lesson on the story text, *Mrs Wishy Washy*, she discussed what a noun was and gave several examples. She then asked, "What else is a noun?" If the child selects a word based on function, that is, its function as the name of a person, place or thing, then the teacher utterance would be classified as Blank et al.'s second level of language abstraction, selective analysis. The role of 'function' within selective analysis, as a discourse level, is set out in the PLAI-2 examiner's manual. However, if the emphasis is on the child selecting a word based on the linguistic constraint, that it be a noun, then the teacher utterance would be classified as Blank et al.'s third level of language abstraction, reordering. The central role of the linguistic constraint in Blank et al.'s third level, reordering, is also set out in the PLAI-2 examiner's manual.

To eliminate any ambiguity between Blank et al.'s second and third levels of language abstraction, the researcher refined the definitions of 'selective analysis' and 'reordering'. For the purpose of the study, 'selective analysis' was defined as naming or selecting objects, entities and actions based on feature(s) which were evident in the visual format provided to the student. 'Reordering' was defined as naming or selecting perceptually

subtle aspects of objects, entities or actions based on linguistic constraints not evident in any visual format and which, therefore, require the student to cognitively manipulate two or more concepts at the same time, in order to make a response. The teacher's question, 'What else is a noun?' is therefore categorised as being at Blank et al.'s third level of abstraction, 'reordering of perception'. The student was required to manipulate two concepts, the word in question and the definition of 'noun', without access to relevant visuals.

Applied to the task of categorising the teacher utterances, use of the refinements to Blank et al.'s definitions, achieved an inter-rater reliability of 90%. The refinements to the definitions were consistent with the researcher's assessment of Blank et al.'s original intentions.

6 Research Intervention - The Visual Scaffold

6.1 The Need for a Visual Scaffold

Howlin considered that, "educational qualifications are one of the key factors in determining successful adult outcome." (Howlin, 1998, cited in Jordan, 2003, p.213). Although Howlin (1998) was referring specifically to students with Asperger syndrome or High Functioning Autism, Howlin's argument applies to each of the participants in this study. Each participant has a diagnosis of ASD and is in an inclusive educational setting. Under the Australian Commonwealth Government legislation, these students are entitled to as broad and meaningful a curriculum as all other students. Primary school syllabus outcomes are specific statements which set out the results of the learning as intended by the syllabus. At the primary school level, these outcomes are arranged in four stages: Early Stage1 (Kindergarten), Stage 1 (Years 1 and 2), Stage 2 (Years 3 and 4) and Stage 3 (Years 5 and 6). In this study, the primary school students are at Early Stage 1, Stage 1 or Stage 2. They range from Kindergarten to Year 4 and are aged from four to nine years. For these students much of the teacher instruction is verbal. For students with ASD, difficulties with language and communication can interfere with the student's ability to process, understand or remember verbal information (Kunce and Mesibov, 1998). As Jordan (2003, p.213) points out, "The issue then becomes one of access; what is needed in the way of support and additional resources…to enable that access?"

The acquisition of language and communication is often a major challenge for students with ASD. This is reflected in the diagnostic criteria for autism as set out by both the American Psychiatric Association (DSM-IV-TR) and the World Health Organisation (ICD-10). Both sets of diagnostic criteria include impairments of verbal and nonverbal communication as a primary diagnostic feature. Under the DSM-IV-TR language delay is listed as a criterion for diagnosis. The participants in this study have diagnoses of ASD under the DSM-IV-TR. The DSM-5 which was introduced in May, 2013 does not include language delay as a criterion for diagnosis. It does however have a similar emphasis upon verbal and non-verbal communication to that listed under the DSM-IV-TR. The DSM-5 refers to "persistent deficits in social communication…across multiple contexts". A teacher's oral instructional language is delivered socially in an individual, small group or whole class setting within a classroom, playground or community context and focuses

upon the learning of multiple concepts within many different contexts and so would seem to present challenges to students with ASD.

Children with ASD often have difficulty processing verbal information (Dodd, 2005; Prior, 2003) For these students, language is often delayed in comparison to both age norms and the student's general cognitive ability (Seltzer, Shattuck, Abbeduto & Greenberg, 2004). The main aim of this study has been to develop a visual scaffold to support comprehension of oral instructional language for students with ASD in inclusive classrooms. The planning and development of such a scaffold has required attention to both strengths and deficits within autism. These strengths and deficits were discussed in chapter four under the heading, 'Implications for Education' (4.7). The structure and content of the scaffold are a function of both strengths and deficits in ASD.

Research by Wetherby, Prizant and Schuler (2000) focused upon communication deficits in children with ASD and highlighted capacity for joint attention as an area of difficulty for these children. Joint attention occurs in an inclusive classroom when the student and the teacher or the student and his/her peers are focused on the same site of interest. Dawson, Meltzoff, Osterling, Rinaldi and Brown (1998) examined the degree to which children with ASD oriented toward both social and non-social stimuli. In an inclusive classroom, social stimuli would include the teacher calling either a child's name or the attention of the whole class, in order to gain student attention at the beginning of an instructional lesson. Nonsocial stimuli would include visual aides such as a diagram of the water cycle in a Stage 2 HSIE lesson or a three dimensional model of a prism which could be used in a Stage 2 maths lesson. The results indicated that the children with ASD failed to orient to both types of stimuli, however their failure to orient to social stimuli was more pronounced than their impaired orienting to non-social stimuli. These joint attention (engaging) and social orienting difficulties have important ramifications for students with ASD in an inclusive classroom. The student who is not oriented to either the teacher or the instructional material will not have the same access to the learning as his/her peers. In order to learn, the student must first be able "to attend selectively to relevant information" (Gabriels, 2002). The student with ASD will therefore often have great difficulty identifying key instructional information which is relevant to the particular classroom topic.

Kunce and Mesibov (1998) argued that one of the most effective strategies to support students with ASD in their learning was to write down the information. In their view,

written information had many advantages. It was more efficient than repeating the information several times, it reduced reliance on comprehension of oral language, it utilised the student's relative strength in reading (Minshew, Goldstein, Taylor & Siegel, 1994) and provided the student with a lasting, visual reminder of the learning. Some students with ASD need more practice when learning new skills (Moore, 2002). A student who has a visual scaffold supporting a classroom topic is able to revise that topic as many times as required.

The primary school curriculum contains many topics. Within this study, the oral instructional language of seven teachers was recorded in order to establish whether a disparity existed between the teacher's level of language abstraction and the student's ability to comprehend that language. Teacher's instructional language was recorded across four subject areas: English, Mathematics, Science and Human Society and Its Environment (HSIE). Within these four subject areas, recording of the teacher's language covered many different classroom topics. There were thousands of words and many details.

At the Inaugural World Autism Congress in 2002, Temple Grandin, an adult with autism, explained that, "All aspies think in details – but different sorts of details." This perspective has three important ramifications for teachers working with students with ASD. Firstly, it is central to understanding conceptual difficulties which are often experienced by students with autism. Secondly, it necessitates the teacher's understanding of the student's own 'manual' of details. Jordan (2005) referred to these details as 'within-individual' variables. From an intervention perspective, it is therefore necessary to program for an individual rather than for a diagnosis (Volkmar & Klin, 2000). Thirdly, it means the child with ASD can often see only the 'bits'. It is the connections and the applications they do not understand. They cannot 'see' the whole. This inability to see the relevance of different types of knowledge to a particular problem (Frith & Happe, 1994) has important ramifications for how teachers deliver academic curriculum to students with ASD. This inability to generalise learning from one situation to another means that the student with ASD must be taught how to use a new concept as well as where, when and why they might use it.

Prior to the research intervention, several research participants described the teacher's instructional language as having "too many words and they don't make sense". For these students with ASD, who bring a different perspective to the learning, there is often no

indication within the verbal instruction to indicate which detail is more important than another or whether there is an over-arching sequential organisation of those details.

This study has viewed ASD as a brain-based developmental disorder of information processing (Rutter, 1983). "Difficulties with language can interfere with the student's ability to attend to, process, understand or remember verbal information." (Kunce & Mesibov, 1998, p.231). The study aimed, therefore, to formulate a visual scaffold which would provide the student with a structured visual breakdown of the curriculum information being presented orally in the classroom. This breakdown would be required at the single word level, at the concept or sentence level and at the system level. For the primary school student, the scaffold, therefore, sets out the key vocabulary, key concepts and main connections within the learning. The right hand section of the page contains visual images of key vocabulary, key concepts or a more complex system which occurs when several concepts combine. The scaffold blueprint is set out below in Figure 6.1.1. It may be used as the blueprint for any scaffold at any Primary School learning stage and for any curriculum topic.

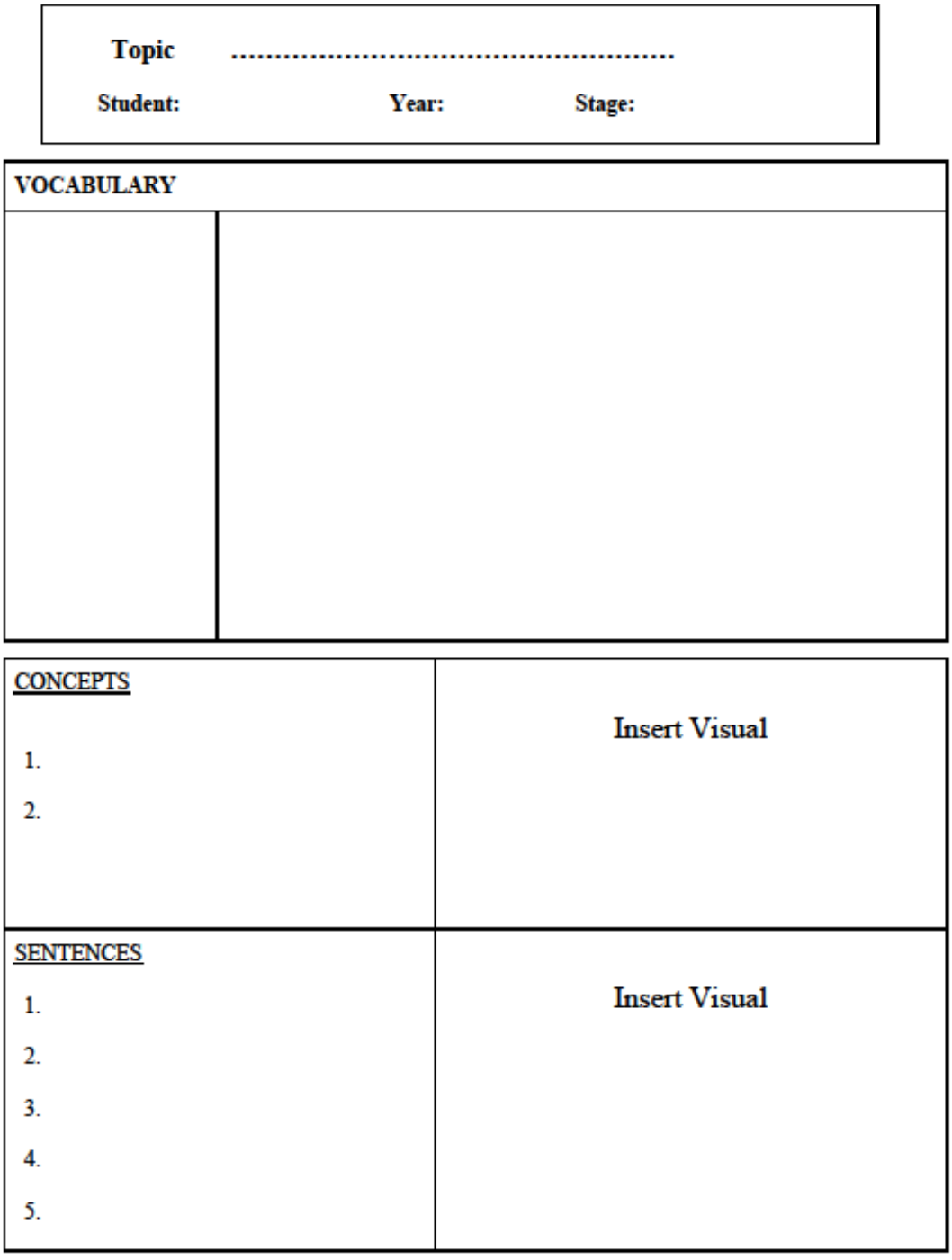


Figure 6.1.1 Blueprint for use in preparation of visual scaffolds

6.2 Student difficulties learning new vocabulary

Within the study, student knowledge of topic vocabulary was tested a number of times both before and after the scaffold was included as a support within the instructional process. At the beginning of a new topic, students with ASD often experience the following difficulties with the new vocabulary:

1) Correct articulation of the vocabulary being used. When the teacher was talking about the diagonal of a rectangle, one Year 2 student commented, "I don't know what a 'diangle' looks like." Individual instruction, using the scaffold prior to the classroom lesson, addresses this difficulty.
2) The meaning of the vocabulary being used by the teacher. The student may not have previously encountered the word.
3) The context of the vocabulary within the particular topic.
4) The sequence or order of the information.
5) The link between this topic or concept and past learning.

The scaffold was designed to support the participants in overcoming these difficulties.

6.3 Rationale for the Structure of the Visual Scaffold

Within the teacher's oral instructional language, there is a hierarchy of importance for both vocabulary and concepts and a context to which the learning belongs. The rationale behind the structuring of the scaffold is based upon six core characteristics of a teacher's oral instructional language. These are:

1) Some words are more important than others. There are key words as well as words which are of secondary importance to the main concept.
2) Many words have multiple meanings but only one meaning is relevant to the current learning.
3) Some ideas or concepts are more important than others to the current learning.
4) Within the teacher's oral instructional language, there is a sequence of ideas that builds towards the main concept(s) that the teacher is conveying to the students.

5) The learning of any concept is rarely isolated but rather it is in the context of past learning.

6) These links to past learning are important for the student's filing and later retrieval of the lesson content.

The first section of the scaffold is labelled 'vocabulary'. Under this heading, ten items of teacher nominated topic vocabulary are listed as the central and most important feature of the visual scaffold because these ten words will be at the centre of both the teacher's instructional language and the teacher's questioning about the learning. The second section of the scaffold is labelled 'concepts'. This section lists the three or four main concepts nominated by the teacher as the key concepts within the classroom topic. The third section of the scaffold is labelled 'sentences' and consists of five or six sentences nominated by the teacher as the sentences which will be used frequently throughout the instructional process.

Vocabulary is best taught in context (Moore, 2002). Students with ASD are often very good at memorizing facts but have difficulty comprehending meaning and using pieces of information which they have previously stored in memory. When vocabulary is taught in context, the student can more easily form a visual image connecting the word meaning and the related topic concepts. Repetitive use of the key vocabulary, within the teacher nominated sentences, during the classroom learning, facilitates the generalization of vocabulary learning (Warren & Kaiser, 1986). The right hand side of the scaffold contains the visual images of the key vocabulary and/or the key concepts.

Some key vocabulary and key concepts require that a student is able to move or rotate the visual image. Within the research, examples included positional language in Mathematics (Figure 9.1.1) and 2D Space in Mathematics. Some vocabulary requires that the student has a three dimensional visual image such as when learning about 3D space in Mathematics. In each of these cases, manipulatives were used. The Kindergarten participant was then able to physically place the dog under the tree or the photo of him/herself beside the table (Figure 9.1.1). The Year 1 student was able to manipulate and rotate each of the 2D shapes (Figure 9.3.5) and the Year 2 student was able to hold and manipulate each of the shapes in 3D Space (Figure 9.5.5).

6.4 Blank, Rose and Berlin's levels of language abstraction and the visual scaffold

The curriculum content of the NSW Syllabus follows a conceptual sequence from Early Stage 1 through to Stage 4. This study has focused upon Early Stage 1 (Kindergarten), Stage 1 (Years 1 and 2) and Stage 2 (Years 3 and 4).

At Kindergarten or Early Stage 1, the scaffold emphasis was on key vocabulary (single word level) and the concept or sentence level. Figure 6.4.1 below shows an example of a scaffold at Early Stage 1. Examples of Blank et al.'s four levels of language abstraction are included in the scaffold. However, the emphasis is on the first three levels. These levels were represented by teacher questions such as the following:

Level 1	Matching perception	Show me the duck.
Level 2	Selective Analysis	Where did the cow jump?
Level 3	Reordering	What did Mrs Wishy Washy do first/last/next?
Level 4	Reasoning	Why did the cow, pig and duck go back to the mud again?

Topic Story text - Mrs Wishy Washy

Student: Julia **Year: Kindergarten** **Stage: Early Stage 1**

VOCABULARY

1. mud
2. paddle
3. duck
4. cow
5. pig
6. screamed
7. tub
8. wishy-washy
9. scarf
10. apron




CONCEPTS

1. The story has four main characters – Mrs Wishy-Washy, the cow, the pig and the duck.
2. What happens in the story, takes place in a certain order: first...., next…., then…., finally….

SENTENCES

1. The cow jumped in the mud.
2. The pig rolled in the mud.
3. The duck paddled in the mud.
4. "In the tub you go," screamed Mrs Wishy-Washy.
5. The cow, the pig and the duck went back to the mud again.

scaffold - mrs wishy washy text.doc G. Wilcock, 2011

Figure 6.4.1 An Example of a Visual Scaffold Designed for Primary School Early Stage 1

Figure 6.4.2 below shows an example of a Year 1 and 2 or Stage 1 scaffold. At the Stage 1 level, scaffold emphasis was on key vocabulary (single word level) which represents Blank et al.'s first two levels of language abstraction – matching perception and selective analysis. In addition, the emphasis was upon the concept or sentence level which represents Blank et al.'s third level of language abstraction – reordering perception. Blank et al.'s levels of language abstraction were represented by teacher questions such as the following:

Level 1	Matching perception	What is this called? (Teacher points to an ant's egg).
Level 2	Selective Analysis	What is happening in this picture? (Teacher points to ants building a nest)
Level 3	Reordering	What are the three body parts of an ant called?

Blank et al.'s fourth level of language abstraction – reasoning – could have been represented by such questions as "Why is an ant an insect?" However, this scaffold focused on the first three of Blank et al.'s levels of language abstraction and did not move to the more complex fourth level.

The scaffold is visual, explicit and has a level of flexibility to allow the teacher increased emphasis upon either vocabulary or concepts. The same flexibility enables increased emphasis on any of Blank et al.'s levels of language abstraction. In this scaffold on Ants, the emphasis is on Blank et al.'s first three levels. The reason for the particular emphasis is specific to the particular student. Connor was motivated to learn about ants and the classroom teacher planned to use the work on ants to inform English lessons on construction of an Information Report on ants. Construction of the Information Report was to be based upon six headings – classification, description, habitat, movement, feeding habits and breeding habits. Each of the ten key pieces of vocabulary belonged under one of these headings. These headings have been placed above the relevant vocabulary because Connor has stated that it is easier for him to have all the important information at the start and not "a bit, then a bit, then a bit".

Topic Ants (important information) leading to an information report

Student: Connor **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary	Detailed Vocabulary	
classification insect { queen ant male ant worker ant description three body parts 1. head 2. thorax 3. abdomen six legs two antennae habitat { nest colony	movement smell trail feeding habits • insects • seeds • dead animals breeding habits • queen ant • eggs • larvae	

CONCEPTS

1. Ants are insects. This means they have,
   a. three body parts – head, thorax and abdomen.
   b. six legs.
   c. two antennae.
2. Ants live and work in nests called colonies.
3. There are three types of ant – queen, male and worker ants. Each type of ant has a special job.
4. The queen ant lays eggs which hatch into baby ants called larvae.

Worker ants with eggs

SENTENCES

1. Ants are insects. They have a body that has three parts and they have six legs.
2. Ants live and work in nests called colonies.
3. There are three types of ant in a colony.
4. Every ant in a colony has a job.
5. Most ant nests are underground.
6. Baby ants called larvae hatch from eggs.

Ants building a nest

scaffold ants.doc G. Wilcock, 2010

Figure 6.4.2 An Example of a Scaffold Designed for Primary School Stage 1

At Stage 2, which is Years 3 and 4, both vocabulary and concept requirements within the curriculum become more complex. At Stage 2 there is often emphasis upon a combination of concepts which form a system or cycle of events. An example of a scaffold at the Stage 2 level is the Water Cycle, set out below in Figure 6.4.3. Each of the ten items of vocabulary represents quite complex concepts, which then combine to form a more complex system, the water cycle. Each of Blank et al.'s levels of language abstraction are represented by teacher questions such as the following:

Level 1	Matching perception	Show me precipitation in the diagram.
Level 2	Selective Analysis	What is happening in the diagram?
Level 3	Reordering	Evaporation and precipitation are two important parts of the water cycle. Name two other parts of the cycle.
Level 4	Reasoning	Why does water vapour condense to form clouds?

Within the topic, the Water Cycle, the classroom instructional emphasis was on Blank et al.'s final two levels of language abstraction – reordering and reasoning. This was reflected in the same emphasis on the scaffold. The diagram showing the component parts of the water cycle occupies most of the top half of the scaffold. Emphasis is firmly on the combination of a number of concepts to form a system or cycle. If a student experiences difficulty with any of the contributing concepts such as evaporation then that student's scaffold would set out the necessary written explanation with a supporting visual.

For each of the research participants who ranged from Kindergarten to Year 3, the visual scaffold was structured, explicit and flexible in its ability to meet individual student needs at any one of Blank et al.'s four levels of language abstraction.

Topic **The Water Cycle**

Student: **Danielle** **Year:** **3** **Stage:** **2**

VOCABULARY

Water cycle

Atmosphere

Evaporation

Condensation

Precipitation

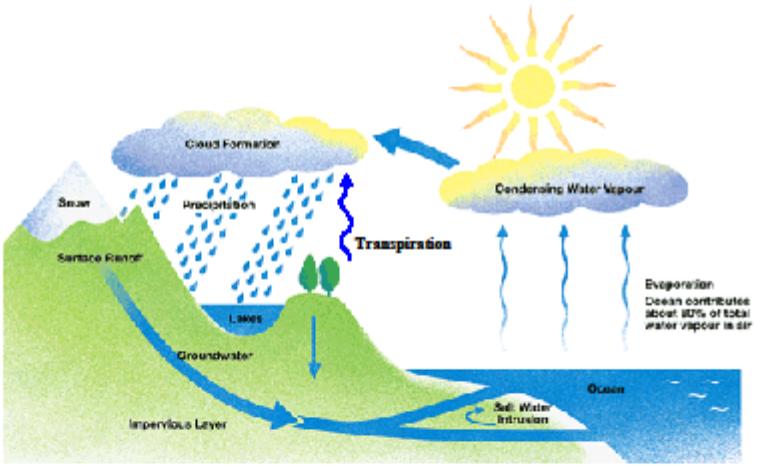
Conservation

Transpiration

Humidity

Water vapour

Solid
liquid
gas

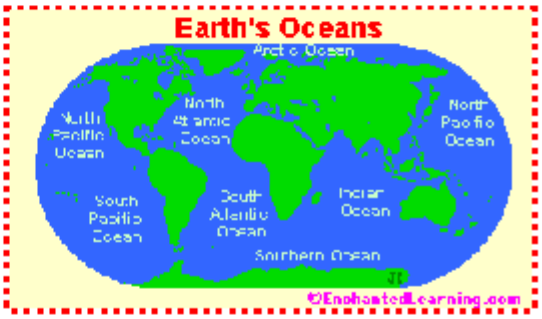


The Water Cycle

(SA Government)

CONCEPTS

1. Water can have three different forms
   - Water vapour
   - Liquid water
   - ice
2. Water takes on one of these three forms in different parts of the water cycle.
3. Water vapour is stored in the air and is measured as humidity.



SENTENCES

1. Water is continually changing its form.
2. Water evaporates into the air from the oceans and the land. Evaporation increases with higher temperatures.
3. Water vapour is stored in the air and is measured as humidity.

The earth has a limited amount of water.

That water keeps going around and around in what we call the "Water Cycle".

This cycle is made up of four main parts:

- evaporation (and transpiration)
- condensation
- precipitation
- collection in oceans and lakes

Figure 6.4.3 An Example of a Scaffold Designed for Primary School Stage 2

7 Methodology

Students with ASD are increasingly being educated in inclusive school settings (Simpson, de Boer-Ott & Smith-Myles, 2003). "The goal of clinical research in autism is to make interventions as effective as possible" (Mesibov & Shea, 2011). However, research which aims to establish the most effective strategy for students with ASD is limited. What there is suggests that "there is no single approach that fits every situation or individual child" (Jordan, 2005, p.111). There is, therefore, a need for classroom teachers in inclusive primary school settings to regularly ask the questions:

> Does the student with ASD require the support of an intervention in order to comprehend the curriculum content?
>
> If an intervention is provided, is it effective in supporting student comprehension of the curriculum?

In order to research these questions, the current researcher developed and assessed the effectiveness of a visual language scaffold to support student comprehension of vocabulary contained in curriculum topics.

This chapter will present an overview of the research design, methodology rationale, research procedure and relevant ethical considerations. While the study was designed to provide specific data on the classroom performance of a particular category of students, that is, those with ASD, participants in the study were also assessed before and after the intervention phase of the study using normalised tests of receptive and expressive vocabulary, which have been standardised over the general population and may be applied to the primary school situation.

Students with ASD typically display the many different symptoms of the disorder to widely varying degrees. Indeed, for students with ASD "diversity appears to be the norm" (Prior, 2003, p.298). Due to this diversity, the study was conducted as a within subject design. Such a design provided a better comparison of a participant's scores between phases than would a matched pair comparison between two different students. The variability of each participant's responses was measured before and after the intervention. In single subject research, the participant's performance prior to the intervention becomes the baseline measure or control (Egel & Barthold, 2009). A comparison between two different students with ASD would have introduced multiple variables of language skills, deficits and schooling history, affecting the internal validity of the study. The within subject comparison minimised these variables

and focused the research upon the scaffolded intervention which is the key element of change for the individual student.

The within subject design, called a single-case, multiple baseline across content study was also chosen because of the small number of participants available for the study. Such a design is useful for studying changes in participant behaviour over time and can provide a close look at the effectiveness of an intervention when applied to specific participant circumstances, such as occurs in the sub-group of students represented by those students with ASD. Such an in-depth examination can be lost in large-group studies.

Throughout the baseline and intervention phases, when the teacher was instructing the class in a specific topic, the participant was tested ten times on the topic vocabulary. The point of intervention was varied throughout the classroom instruction period in order to highlight the intervention as the cause of any improvement in the participant's learning outcomes (Bulté & Onghena, 2009; Zhan & Ottenbacher, 2001).

Given the tendency of students with ASD for atypical behaviour such as an intense concentration on a single area of interest, sensitivity to noise and other sensory issues, the study also collected data to evaluate whether use of the intervention led to any change in the amount of time the participant was engaged with classroom learning.

The researcher conducted parent, teacher and student pre and post questionnaires. This was because each group was in a unique position from which to observe or experience how the student responded to classroom learning. Parents are the prime source of information about their child's development and functioning (Janzen, 2003). The classroom teacher observes and interacts with the student across different topics and different learning situations.

In this study the results were analysed in three steps. Firstly, the data were analysed using visual analysis techniques. Secondly, the data were reviewed using trend (celeration) lines developed for the baseline phase (Phase A) and the intervention phase (Phase B). Thirdly, the data were analysed using non-parametric randomisation tests which have been developed specifically for single case studies (Edgington, 1996).

7.1 Participants

The participants in the study were eight primary school students who each had a diagnosis of ASD. The diagnoses had been made by either a psychologist or a paediatrician. Four of the participants had been diagnosed in the eighteen months prior to commencing school.

The other four participants had been diagnosed within eighteen months of beginning school. Of the eight participants, two had been diagnosed with Asperger Syndrome, two with Autism, three with Autism Spectrum Disorder and one with High Functioning Autism.

One participant was in Kindergarten, three participants were in Year 1, one participant was in Year 2, two were in Year 3 and one was in Year 3/4. At the commencement of the pre-intervention assessments, the participants were aged between five and ten years and attended three different inclusive primary schools in Sydney. The three schools, located within ten kilometres of the central business district were of similar socio-economic status. The identities of the participants have been concealed by the use of pseudonyms.

Seven of the eight participants had had an intellectual assessment on either the Griffiths Mental Development Scales or the Wechsler Preschool and Primary Scale of the Wechsler Intelligence Scale [WPPSI- III] or the Wechsler Intelligence Scale for Children – Fourth Edition [WISC – IV] . The second youngest participant, Luis, a year 1 student had not had a psychometric assessment because his very low receptive and expressive language scores would have made engagement with the testing process very difficult. Assessment was to be delayed until the end of year 2. The kindergarten participant (Julia), and a year 1 participant (Jane) scored in the borderline range of a psychometric assessment. Participants in year 1 (Connor), year 2 (Rhys) and year 3 (Danielle) were all recorded by their paediatricians as being at least in the average range of intellectual ability. A year 3 participant (Stewart), achieved an IQ score in the high average range. The oldest of the participants (Jack), achieved average to high average scores on all subtests of a psychometric assessment, except the processing speed test. A Speech and Language assessment on the Clinical Evaluation of Language Fundamentals (CELF 4) had been carried out on seven of the eight participants. Details of these assessments are set out in the individual case studies (Chapter 9). Stewart, in year 3, showed excellent language skills and was therefore not regarded as needing an assessment on the CELF 4.

Depending on their class level, each of the eight participants had taken part in their school's Special Needs program for between five months and five years. The year level and gender of each of the participants are set out in Table 7.1.1 below.

Table 7.1.1 Table showing Year Level and Gender of research participants

Year Level	Number of participants and gender
Kindergarten	1 female
Year 1	2 male 1 female
Year 2	1 male
Year 3	1 male 1 female
Year 3/4	1 male

In each of the schools, the Special Needs program offers the student approximately two hours of individual support each week. This support may be within the inclusive classroom or on a withdrawal basis. The withdrawal program enables intensive instruction in language, mathematics and social skills. All of the participants were involved as a group in a weekly forty minute, explicit social skills lesson. In addition, six of the participants attended structured social play opportunities which were offered three days a week in the two schools where the researcher was employed. Within each participant's special needs program, language instruction had previously targeted broad areas of weakness such as those indicated by a Speech Pathologist in the CELF 4 Speech and Language Assessment. Instruction had not previously involved any topic specific intervention. The intervention program represented an extension to each participant's current special needs program. It sought to lessen the classroom cognitive load for the participant with ASD.

7.2 Intervention Material

The intervention material consisted of a printed A4 page, divided vertically and containing the critical information required for the participant to understand not only the topic but also what the teacher was asking the class to do with the information. The intervention contained vocabulary, written explanations and pictures or diagrams relating to the topic. The purpose of the intervention was to support the participants and hence it has been referred to as a scaffold. The intervention contained images of the curriculum material because most of the participants were visual learners and therefore the intervention has been referred to as a visual scaffold. Figure 7.2.1 on page 66, provides an

example of a visual scaffold designed to support a student whose class was studying a science topic about the honeybee.

Information on the left side of the page was grouped under headings of Vocabulary, Concepts and Sentences. The vocabulary contained ten key words associated with the topic material. Under the heading of Concepts were listed the three or four ideas identified by the teacher as being central to the understanding of the topic. Sentences were the types of statements identified by the classroom teacher as being a focus for repeated reference within the classroom lesson.

The right hand side of the page was dedicated to images – photos, drawings or very short summary sentences – which highlighted and demonstrated the key information. Approximately, fifty percent of the photos were taken by the researcher and the remaining photos were obtained from the internet or other sources.

Once the participant had been instructed in the use of the scaffold, he/she retained it for academic support in the classroom. The scaffold was provided to the participant in both A4 size and pocket size.

Throughout this research, educational material delivered by the classroom teacher from specific areas of the syllabus will be referred to as a classroom topic or simply a topic. These topics are taken from the following areas within the NSW curriculum – English (text type writing), Mathematics, Human Society and its Environment (HSIE) and Science.

Topic: The Honeybee

Student: Jane **Year: 1** **Stage: 1**

VOCABULARY	
Classification Insect Queen bee Drone bee Worker bee Three body parts head thorax abdomen Six legs Two antennae Nectar and pollen Habitat A colony of bees	

CONCEPTS Bees are insects. This means they have, a. three body parts – head, thorax and abdomen. b. six legs. c. two antennae. Bees live in a beehive. There are three types of bee – queen, drone and worker bees. Each bee has a special job. The queen bee lays eggs which hatch into larvae.	
SENTENCES Bees are insects. They have a body that has three parts and they have six legs. There are three types of bees – queen bee, drone bee and worker bees. Bees live and work in a beehive. Bees collect nectar and pollen from flowers to make honey.	

Figure 7.2.1 An example of a visual scaffold on the topic of *The Honeybee*

7.3 Design and Measurement

A single subject multiple baseline design across content was used in order to minimise the emphasis upon such variables as may have existed between the participants and focus the research upon the visual scaffold which was the key intervention. Applying the intervention across a number of classroom topics provided multiple baselines for each participant.

For each of the topics, the intervention was introduced at a different point within the classroom delivery period. Thus, in Topic 1, the intervention was implemented after the third topic test. In Topic 2, the intervention was implemented after the fourth topic test. And so on until in Topic 6 the intervention was implemented after the eighth topic test. This was done to determine whether change was directly related to the intervention rather than to such variables as normal learning development or increasing maturity of the participant.

Data for both the baseline and the intervention phases were obtained from the scores of the ten vocabulary tests administered to each participant on each of their six classroom topics. Scores obtained in this testing provided the base data for the study. Ten questions were asked in each test. These were taken directly from the ten items of vocabulary listed on the scaffold. The same questions were asked in each of the ten test sessions on each topic. Table 7.3.1 below shows the direct relationship between the vocabulary section of the scaffold, the test questions and the marking schema for the topic *The Honeybee.*

The marking schema was agreed upon by both the researcher and the classroom teacher as a benchmark indicating a correct or incorrect answer. The underlined words in the marking schema were the key words which the participant had to include in his/her reply in order for the response to have been marked as correct.

The study examined the results from eight participants. The study was conducted during classroom delivery of six topics for each participant. Each topic was tested ten times. Participants were tested before and after the intervention.

Table 7.3.1 Marking schema for language scaffold *The Honeybee*

Vocabulary for *The Honeybee*	**Vocabulary Test Questions**	**Marking Schema – suggested answers**
Classification	Classification What do we do when we classify animals?	Means to place animals into groups that have the same features.
Insect	Insect Can you describe insects?	Insects are small animals that have a hard body, three body parts and three pairs of legs (or 6 legs).
Queen bee	Queen bee What is the job of the queen bee in a bee hive?	The queen bee lays eggs.
Drone bee Worker bee	Worker bee, drone bee What are the names of the other types of bees found in a bee hive?	Worker bees and drones.
Description	Description If I ask you to describe something, what do you have to do?	Means to list the important things about that animal.
Three body parts, Head, Thorax, Abdomen	Three body parts Name the three body parts of bees?	Head, thorax, abdomen
Six legs	Six legs How many legs does a bee have?	Six or three pairs..
Two antennae	Two antennae How many antennae does a bee have?	Two
Habitat	Habitat When we talk about the habitat of an animal. What do we mean?	Habitat is where an animal lives.
Colony Bee Hive	Colony or bee hive What is a colony of bees?	A colony of bees is another name for a bee hive containing many bees.

7.4 Instruments used pre- and post-intervention

Preschool Language Assessment Instrument (PLAI-2)

The Preschool Language Assessment Instrument, 2nd Edition (Blank, Rose & Berlin, 2003) is a diagnostic tool for the assessment of children's discourse skills. The PLAI-2 was developed for children aged three years through to five years eleven months and has standardised and non-standardised assessments.

The standardised subtests assess a child's receptive and expressive vocabulary skills across four levels of abstraction.

The subtests are:

Matching

Selective Analysis

Reasoning

Reordering

The non-standardised assessment within this study included use of the PLAI-2 which provides for normed scores of discourse skills for participants up to age five years and eleven months. Even though six of the eight research participants were outside the age range for which the normed scores apply, the basic constructs of the PLAI-2 remain relevant for many students with ASD throughout their early Primary School years. This was considered valid for students with ASD because, in their case, 'language may develop divorced from its role in communication' (Jordan & Jones, 1999) and their receptive language skills often lag behind their expressive language skills (Kjelgaard & Tager-Flusberg, 2001; Luyster, Kedlec, Carter & Tager-Flusberg, 2008). Therefore, this study will consider PLAI-2 results as relevant but non-standardised.

Peabody Picture Vocabulary Test, 4th Edition (PPVT-4)

The Peabody Picture Vocabulary Test (Dunn & Dunn, 2007) is a norm-referenced measure of receptive vocabulary of children and adults. There are two hundred and twenty eight test items which are grouped into nineteen sets of twelve items. The sets are arranged in order of increasing difficulty so the tester may administer only those sets appropriate for the student's vocabulary level or critical range.

Expressive Vocabulary Test, 2nd Edition (EVT-2)

The Expressive Vocabulary Test (Williams, 2007) is an individually administered, norm-referenced measure of expressive vocabulary and word retrieval for children and

adults aged from two-and-one-half years to ninety years. The EVT measures expressive vocabulary knowledge with two types of items, labelling and synonym. The use of single word, oral responses in EVT-2 requires that the participant knows a word and is able to recall that word from memory. The EVT-2 scores, therefore, may be interpreted as being measures of the individual's level of expressive vocabulary as well as the additional construct of word retrieval ability (EVT-2, 2007, p.69). The participant's word retrieval ability can be evaluated by comparing expressive and receptive vocabulary skills using standard score differences between EVT-2 and the co-normed PPVT-4. Parallel test forms facilitate the test-retest research model that measures change over time. Use of this measurement to evaluate vocabulary recall is discussed in the case studies.

Questionnaires

The qualitative part of the study used structured interviews based on a set of questions. Interviews were conducted so that the researcher could gain participant, parent and teacher perspectives on each individual participant's learning, engagement and school enjoyment.

Table 7.4.1 below summarises the instruments used for participant testing in the periods before the baseline phase and after the intervention phase (Stages 1 and 3).

Table 7.4.1 Instruments used in pre- and post-intervention tests

Standardised		Administration Time
Receptive Vocabulary	Peabody Picture Vocabulary Test, Fourth Edition, [PPVT-4], (Dunn & Dunn, 2007)	15 minutes
Expressive Vocabulary	Expressive Vocabulary Test, Second Edition, [EVT-2], (Williams, 2007).	15 minutes
Non-Standardised		
Four levels of language abstraction.	Preschool Language Assessment Instrument, [PLAI-2], (Blank, Rose & Berlin, 2003).	15 minutes
Questionnaires	Informal pre- and post-intervention researcher/participant interview	Approx. 1 hour
	Pre- and post-intervention questions discussed in researcher/parent interview.	Approx. 1 hour
	Pre- and post-intervention questions discussed in researcher/teacher interview.	Approx. 1 hour

7.4.1 Assessor

Topic vocabulary testing was undertaken by the researcher and a Speech Pathologist. The Speech Pathologist conducted approximately half of the standardised assessments. This provided some objectivity to the assessment process. The Speech Pathologist worked at each of the schools for one day each week and was therefore familiar to the participants. Questionnaires requiring parent, teacher and participant responses were facilitated by the researcher.

7.4.2 Delivery of Intervention

As the Special Needs Teacher, the researcher worked with each participant on a one-to-one basis in the Special Needs room. Delivery of the intervention took the form of three twenty minute sessions using the visual scaffold for the particular topic. The researcher explicitly taught the participant the vocabulary listed on the scaffold. The researcher and participant then read through the concepts / sentences section of the scaffold. The main emphasis within the three sessions was on the vocabulary meanings. Following the three sessions, the participant retained the scaffold for classroom use, to be placed on the desk for the particular lesson. The

research participant attended all lessons in the inclusive classroom throughout the period of instruction in a particular topic. Classroom instruction comprised a series of lessons typically extending over several weeks.

7.5 Procedure

The study was designed and implemented in four stages, a preliminary stage, an assessment stage, an implementation stage and a review stage. Activities preliminary to the study included ethics approval, delivery of information sessions to teachers and parents and consent from parents. In the assessment stage, the researcher established a baseline for participant language competency. The assessment stage was followed by the implementation or classroom delivery stage. During implementation, the intervention was introduced into the classroom topic delivery for each participant and data was collected on the effectiveness of the intervention. The study was completed with a final assessment or review stage of the participants' generalised language competencies.

Details of the procedure will be considered in four stages – a Preliminary Stage followed by Stages 1, 2 and 3. Table 7.5.1, p. 76 sets out the testing and intervention schedule for each participant.

Preliminary Stage

The preliminary stage established the administrative base for the study. In this stage, the researcher obtained ethics approval from Flinders University Social and Behavioural Research Ethics Committee (Appendix 1). Ethics approval was also obtained from the researcher's employer, the Catholic Education Office in Sydney (Appendix 2). Following ethics approval, the researcher conducted information sessions for all teachers, school principals and parents of potential participants. Consent for the conduct of the research was obtained from each of the school Principals. Appendix 3 shows the letter of introduction from the researcher's supervisor to school Principals. The Principals indicated approval by signing the bottom of this letter. Consent was obtained from the parents of each participant for their child's participation in the study (Appendix 4).

Stage 1

Stage 1 represented the assessment stage of the study and contained the test procedures for determining important baseline measurements.

These were, firstly, measurement of the participants' generalised language competencies using two standardised tests to evaluate each participant for his/her level of expressive and receptive language competency. These tests were the *Expressive Vocabulary Test*, 2nd Edition (EVT-2) and the *Peabody Picture Vocabulary Test*, 4th Edition (PPVT-4).

Secondly, Stage 1 included testing to determine the participant's level of language abstraction using a standardised test the *Preschool Language Assessment Instrument*, 2nd Edition (PLAI-2). Assessment using the PLAI-2 resulted in a raw score, a percentile rank and an age equivalent score for each of the four levels of language abstraction. Within this research PLAI-2 is regarded as being non-standardised because the instrument was designed for a preschool population aged 4 – 5 years and the ages of the participants in the study ranged from five to ten years. However, for the purposes of this study, the test is considered appropriate as the participants are students with ASD, who often exhibit language delay.

Thirdly, the researcher also conducted interviews with each research participant, the parents of each participant and each participant's class teacher. In each of the interviews, the researcher worked with the participant (Appendix 11.8), the parent (Appendix 7) or the class teacher (Appendix 6) to complete a questionnaire about their perception of the state of the participant's classroom learning before any intervention had been introduced. The questions and presentations were identical for both parent and teacher questionnaires. In the participant questionnaire, however, the questions were similar but the presentation included extensive use of visuals from *Boardmaker* software (Boardmaker, 2003). The same questionnaires were used in the interviews conducted after completion of the intervention phase.

Stage 2

Stage 2 contains the procedures for delivery of the intervention and collection of data.

To implement Stage 2, the researcher discussed the timing of the program with classroom teachers and decided on appropriate topics. Choice of topics depended on which topics the teacher had programmed and planned to teach during that particular school term. The study was conducted over six topics for each of the eight participants. Each participant was tested ten times on the vocabulary for each topic.

The researcher prepared the visual scaffold, as the intervention, for each topic in readiness for delivery. In preparing each topic scaffold, the researcher selected ten key vocabulary words, three or four key concepts and three or four sentences nominated by the teacher as being commonly used within that teacher's topic delivery. The researcher also prepared the ten vocabulary test questions and a marking schema, with which to evaluate the answers.

Each teacher's level of instructional language was assessed using the following method. Approximately six hours of the teacher's instructional language was audio

recorded. Recordings took place across four subject areas – English, Mathematics, Science and HSIE – and across an approximate time period of six months. The recordings were then transcribed by the researcher and each teacher utterance was analysed relative to each of Blank et al.'s four levels of language abstraction. It was then possible to express the teacher's use of each level of language abstraction as a percentage of the whole.

After commencement of classroom instruction in a topic, the researcher administered the ten tests at regular intervals throughout the topic delivery period. The researcher introduced the intervention to the participant on a one-on-one basis in the Special Needs teacher's room.

Timing of delivery of the intervention was varied across topics. In Topic 1, the intervention was introduced after three tests, which provided for three data points before the intervention and seven data points after the intervention. For each following topic, delivery of the intervention was delayed by an additional test period. Thus for Topic 2, the intervention was introduced after four test periods, which provided for four data points before the intervention and six data points after the intervention. And so on up to Topic 6 when the intervention was introduced after eight test periods, providing for eight data points before the intervention and two after.

Engaged Learning Time

Observations were made of each participant's engagement with classroom learning. The observations were made before and after the intervention and were recorded by the researcher at ten second intervals over a period of ten minutes in each topic. Observations were recorded within the first twenty minutes of the class lesson. See Appendix 9 Blueprint of schedule used to measure Engaged Learning Time.

Stage 3

Stage 3 contains the procedures for re-testing of participants' generalised language competencies, again using both standardised EVT-2 and PPVT-4 instruments and the non-standardised PLAI-2.

The researcher again conducted interviews of classroom teachers, parents and participants and requested that they complete a questionnaire about their perception of the participant's learning following the study.

Table 7.5.1 Testing and intervention schedule for each research participant

Preliminary	Approval from Ethics Committee. Information sessions for all research participants, school staff and parents. Consent from School Principals, staff and parents.
Stage 1	Measurement of level of instructional language for classroom teacher. Parent, teacher, participant learning questionnaire. Pre-intervention testing of language: PPVT-4, EVT-2 and PLAI-2.
Stage 2	Participant provided with and instructed in use of language scaffold for each curriculum topic. For each topic, the intervention was delivered at a different point within the classroom delivery period. Classroom delivery of six topics.
Stage 3	Post-intervention testing: PPVT, EVT and PLAI -2. Parent, teacher, participant questionnaire. Comparison Stage 3 results with Stage 1 results.

A positive result would be shown by an increase in participant competency in any of the following areas,

- Results of ten key word non-standardised vocabulary tests delivered pre- and post-classroom intervention (Stage 2, Phases 1 and 2),
- Increase in observed level of participant engagement within the classroom or
- Increase in scores on the standardised language tests administered pre- and post-research program (Stages 1 and 3),

A positive result would have ramifications for classroom planning for students with ASD.

7.6 Ethical Considerations

It is essential that researchers consider the values and principles that apply to ethical conduct in human research (*The National Statement on Ethical Conduct in Human Research*, 2007). Within this research, the following ethical issues were addressed – risk and benefit, informed consent, researcher bias, privacy and confidentiality and data storage.

All students, including Special Needs students, undergo testing throughout their school career. The testing required in this research was of a similar type to that which would normally be administered by a professional such as a Speech Pathologist or Special Needs Teacher. Testing for this study produced academic results only and did not seek to diagnose any personal disability. The testing conducted was comparable to that often undertaken in school settings and the participants did not display any additional stress related to the testing undertaken. There was, however, the potential benefit of improved student learning outcomes as set out in Section 2.3, *Research Hypotheses*. Possible benefits to students were hypothesised to be an increase in understanding of vocabulary meanings and an increased level of engaged learning time in the classroom.

In accordance with the ethical principle of beneficence (*Ethical Principles and Guidelines for the Protection of Human Subjects of Research: The Belmont Report*, 1979) this study aimed to maximise the possible benefits to participants' classroom learning by the incorporation of research findings into the planning and delivery of more effective learning support for students with ASD.

Consent to participate in the study was voluntary and "based on sufficient information and adequate understanding of both the proposed research and the implications of participation in it" (The National Statement, 2007, p.19). Parents and students were a part of both the information session and the consent process. The student participants ranged in age from five to ten years. 'Adequate understanding' was therefore relative to the student's age. In the present study, written consent was obtained from the parents of each participant. Written consent was also gained for assessment responses to be recorded.

There is widespread agreement that the consent process should focus upon information, comprehension and the principle of voluntary consent (National Statement on Ethical Conduct in Human Research, 2007; The Belmont Report, 1979; Neuman, 1997).

As the first step in the consent process, the following information was given to School Principals, staff, participants and their parents:

- The nature of the research
- Research aims
- The role of participants in the research
- Proposed methods of data collection
- Risks
- Anticipated benefits
- In-confidence feedback to each parent about their child's test scores and performance
- An understanding that it will be possible to ask questions or withdraw from the study at any time
- The final thesis will be available for community access from the University's library.

When Ethics approval from Flinders University had been given (Appendix 1), approval from the three school Principals was sought (Appendix 3). Each principal was given a full description of what was involved with the study. Where parental approval was obtained (Appendix 5), individual student results were filed with confidential school records.

"Every researcher brings preconceptions and interpretations to the problem being studied" (Denzin, 1989, p.23). It was therefore important that, prior to the intervention stage, the researcher stated her interpretation of both the problem being studied and the definitions of key terms used in the research. "The trustworthiness of the data is tied directly to the trustworthiness of the evaluator who collects and analyses the data" (Patton, 1990, p.476). The current researcher's interpretation of the problem is set out in Section 2.1. Definitions of key terms are listed in Section 3.6.

Privacy and confidentiality are key considerations in any research. In relation to privacy, Glesne and Peshkin (1992, p.117) commented that participants have a right to expect that the researcher "will protect their confidences and preserve their anonymity". The issue of privacy became a key consideration when reporting the results of the study. To protect the

anonymity of participants, the written results of the research used only pseudonyms when referring to participants.

In order to protect participants' privacy, all research data were securely stored in a locked cabinet, or on a personal computer which was only accessible to the researcher.

Ethical conduct of research is facilitated by various codes of ethics and ethics committees established by institutions and professional bodies. Details of the study were presented for approval to the Flinders University Social and Behavioural Research Ethics Committee.

After this approval had been given, staff and parents were asked to consent to participation in the program after attending an information session presented by the researcher. Separate information sessions were conducted for i) school principals and staff and ii) parents. These sessions provided details about the rationale, procedure and assessment schedule involved in the study. Staff and parents were also informed of the additional time commitment required of them in completing questionnaire responses. Teachers were asked to consent to having their classroom utterances recorded and assessed according to Blank, et al.'s (2003) four levels of instructional language.

8 Presentation and Discussion of Results

The results of the topic testing of each participant are presented in both tabular and graphical forms in the following pages. The tables of results show the scores achieved by each participant when answering questions about the topics taught in the classroom.

In the tables of test results (Table 8.1.1 - Table 8.8.1) the post-intervention results are shown with a shaded background. In graphical form (Figure 8.1.1 - Figure 8.8.1) the point of intervention is indicated by a vertical dashed line, which also separates the results of the two phases.

The results of topic testing will firstly be considered by examining the tabulated data and then the graphical data.

Following presentation of results of tests for individual participants, the data will be further analysed and reviewed using the following parameters; Mean score before intervention, Mean score after intervention, Mean Baseline Increase (MBLI) at the point of intervention, Percentage of Full Score data (PFSD), Percentage of Zero Data (PZD) and Percentage of Non-overlapping data (PND).

Most of the tests contained ten questions. However, two of the tests, namely the test of Topic 4 for Rhys and the test of Topic 6 for Danielle, contained only five questions. This will affect the value of the scores for Rhys and Danielle relative to the other participants. However, the effect has been ignored for two reasons. Firstly the results for the percentage data (PFSD, PZD and PND) are not affected and secondly the effect is minor, making an error of only two decimal points, and the error is in the direction of making less pronounced any beneficial effect of the intervention.

In Sections 8.9 - 8.16, the graphical data will be re-presented with trend lines drawn and examined using visual characteristics of level, trend, variability and slope. The formulae for the celeration lines were calculated using Microsoft Excel.

In discussing the test scores for participants, scores of 1, 2 or 3 will be referred to as low level and scores of 8, 9 or 10 will be referred to as high level scores. Scores 4 and 5 will be referred to as moderately low and scores 6 and 7 as moderately high.

8.1 Discussion of visual inspection of test results for Julia

Table 8.1.1 Table showing results of Vocabulary Testing for Julia

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Test 1	2	0	0	0	0	0
Test 2	3	0	0	0	0	0
Test 3	5	0	2	0	0	0
Test 4	8	1	1	3	0	1
Test 5	9	8	3	2	1	3
Test 6	9	10	8	2	0	4
Test 7	10	8	8	6	1	3
Test 8	9	10	8	9	8	5
Test 9	10	9	9	9	10	10
Test 10	10	10	10	10	10	10

The following features of Julia's scores support the hypothesis that use of the scaffold improves learning outcomes.

- Prior to the intervention, Julia attained low level scores in Topics 2, 3, 4 and 5 and with one exception (a score of six in Test 7 of Topic 4) attained high level scores in all topics after the intervention.
- In all topics, Julia achieved high scores of either nine or ten in the final two tests. This was notable, as only in Topic 1, did her pre-intervention results display a trend that could have indicated possible achievement of high level scores without intervention.
- After the intervention, Julia achieved and maintained high level scores with little variability, indicating consolidation of learning.
- The intervention was always followed by a step increase in test scores.

The results of Julia's vocabulary testing are presented graphically in Figure 8.1.1. The graphs highlight the step increase at the intervention point and the improved scores after the intervention. The graphs also illustrate the effectiveness of the intervention when administered at different points throughout the test period. This result separates the effect of the intervention on Julia's learning from the effects of normal classroom development

and from any improved results that may have resulted from normal increase in maturity with increasing age.

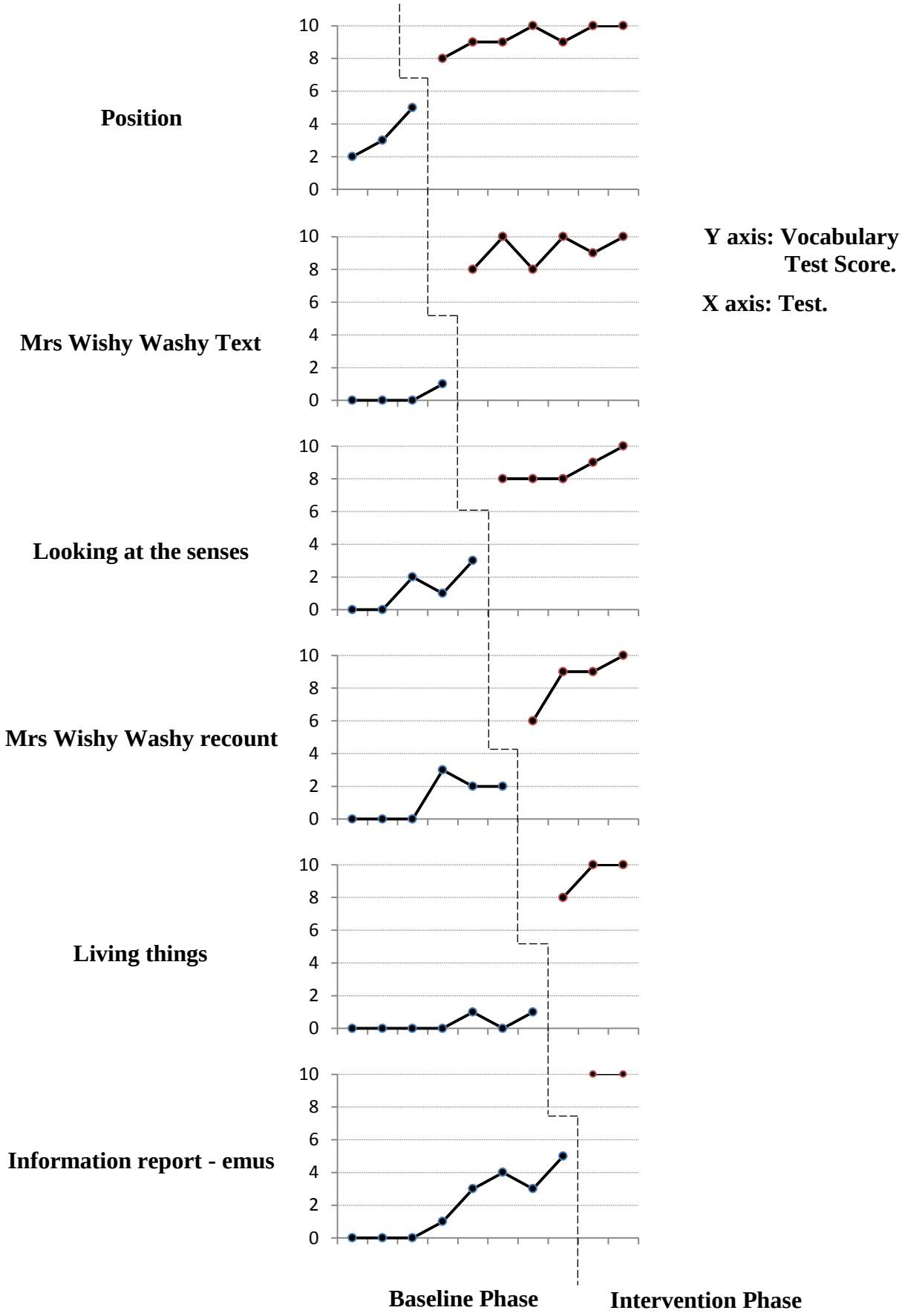


Figure 8.1.1 Graphs showing results of Vocabulary Testing for Julia

8.2 Discussion of visual inspection of test results for Jane

Table 8.2.1 Table showing results of Vocabulary Testing for Jane

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Test 1	0	0	0	0	0	1
Test 2	3	0	0	0	0	1
Test 3	3	1	0	0	2	1
Test 4	8	5	0	0	1	2
Test 5	7	9	0	1	2	4
Test 6	8	10	8	2	3	4
Test 7	9	10	9	8	3	4
Test 8	9	10	10	9	7	5
Test 9	9	10	10	10	9	9
Test 10	8	10	10	10	10	10

The following features of Jane's test scores support the hypothesis that the scaffold led to improved learning outcomes.

- Jane's test scores stabilised at low levels in Topics 1, 3, 4 and 5 before the intervention and at high levels after the intervention, with the one exception of Test 8 in Topic 5 in which she attained only a moderately high score of 7.
- Jane achieved high level scores in tests 9 and 10 in all topics. In Topic 2, Jane's pre-intervention results displayed a trend which could possibly have led to high level scores within the test period. In the other topics, the trends of Jane's pre-intervention results would not have led to scores of 9 or 10 in tests within the test period.
- Jane's scores all increased at the point of intervention. This increase exceeded the increases between the results of any two consecutive tests conducted in the pre-intervention period.
- Of the thirty-three tests conducted before the intervention, Jane achieved only low level scores in twenty-eight of those tests and scored no higher than five in the other five tests. After the intervention, Jane attained high level scores in all tests except for two in which she scored a moderately high level of seven.

The graphs on the following page illustrate that the intervention is effective when applied at different points throughout the test period.

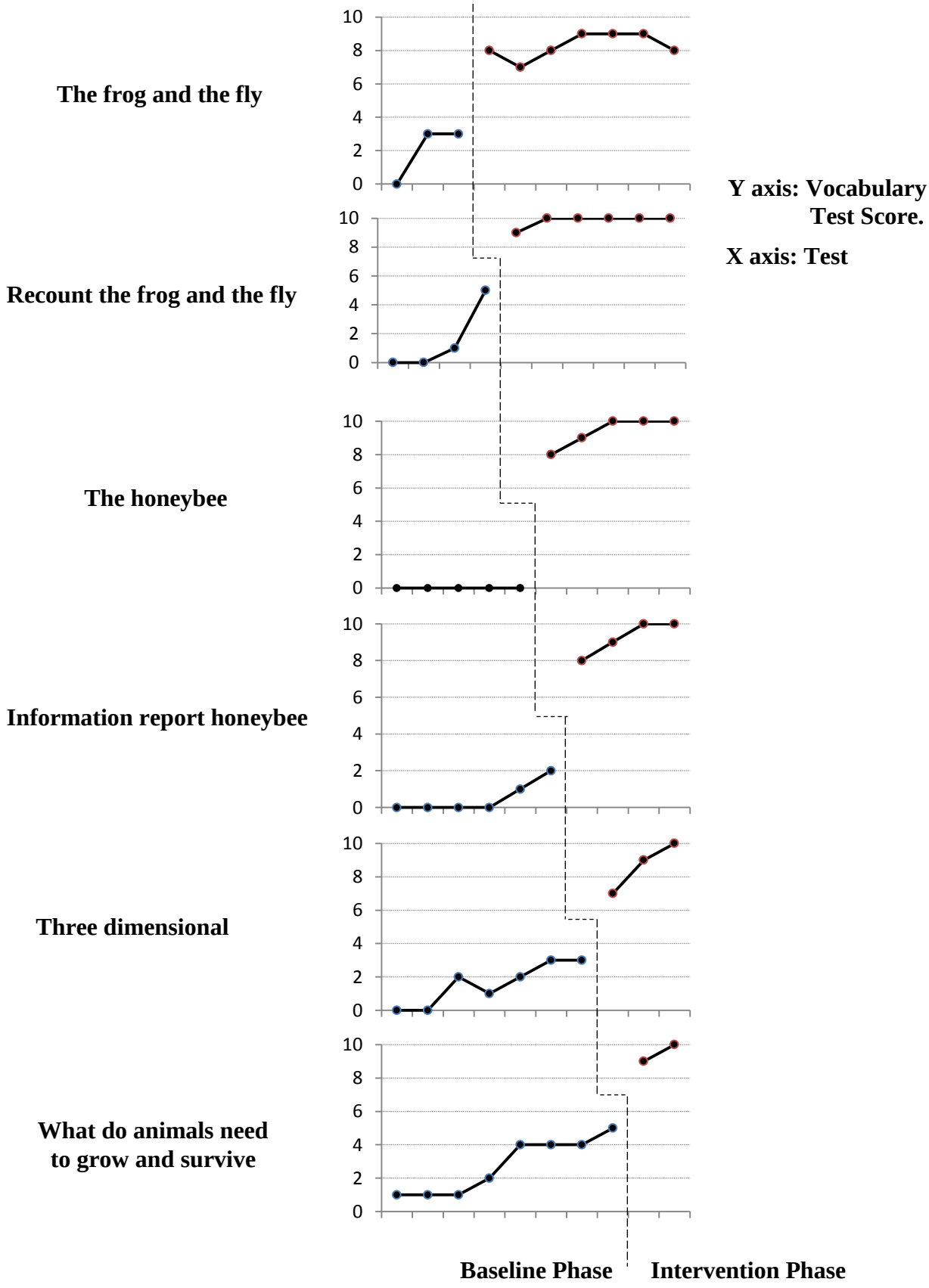


Figure 8.2.1 Graphs showing results of Vocabulary Testing for Jane

8.3 Discussion of visual inspection of test results for Connor

Table 8.3.1 Table showing results of Vocabulary Testing for Connor

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Test 1	1	2	0	3	2	1
Test 2	1	3	1	2	3	2
Test 3	1	2	2	4	2	1
Test 4	8	3	2	2	2	1
Test 5	7	9	2	4	3	1
Test 6	7	10	8	5	3	1
Test 7	6	10	9	10	3	2
Test 8	8	9	8	8	9	2
Test 9	8	10	9	10	9	7
Test 10	8	10	9	10	9	8

The following features of Connor's test results support the hypothesis that the intervention was effective in increasing learning outcomes,

- Connor's pre-intervention test scores were all at a low level with the exception of the results in Topic 4.
- In the eighteen post-intervention tests in Topics 2, 3, 4 and 5, Connor consistently achieved high level scores.
- In each of the pre-intervention tests in Topic 1, Connor achieved a score of only one and in Topic 6 a maximum score of two. In post-intervention tests in these two topics, Connor achieved moderately high to high scores.
- Connor's pre-intervention scores in Topics 2, 3 and 5 showed some evidence of classroom learning but tended to stabilise at scores of three or less.
- At the point of intervention, Connor's scores increased by between five points and seven points. This can be regarded as a large increase given a total possible score of only ten points and exceeds the increases between the results achieved in any two other consecutive tests.

Only in Topic 4 was the trend in Connor's pre-intervention results sufficient to have possibly led to high level scores within the test period, without any intervention.

The results are shown graphically in Figure 8.3.1. The graphs highlight the increase in Connor's scores at the point of intervention compared to other increases throughout the test period.

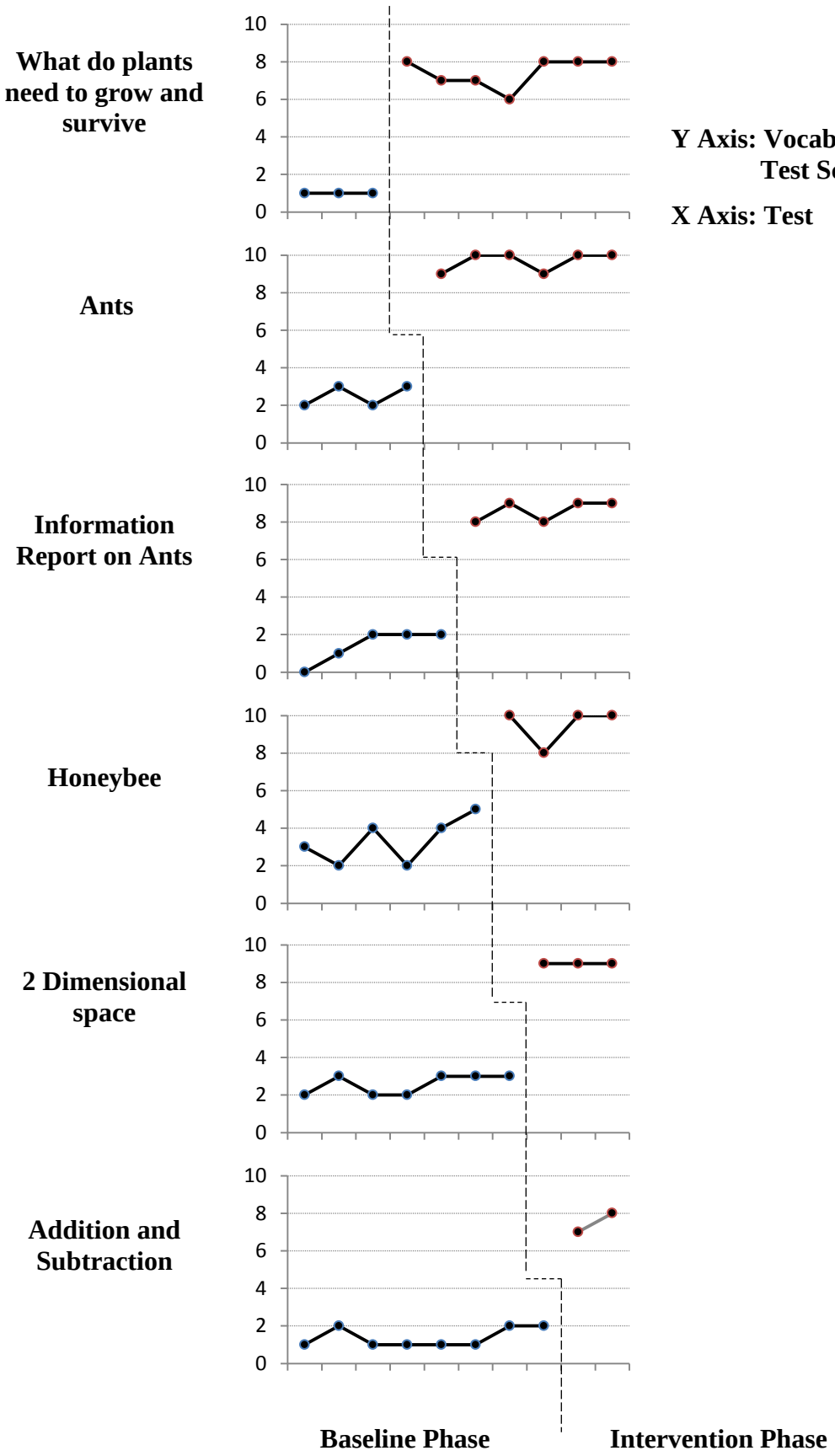


Figure 8.3.1 Graphs showing results of Vocabulary Testing for Connor.

8.4 Discussion of visual inspection of test results for Luis

Table 8.4.1 Table showing results of Vocabulary Testing for Luis

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Test 1	2	1	2	1	0	1
Test 2	0	0	2	1	1	1
Test 3	1	0	1	0	1	1
Test 4	7	0	2	3	1	3
Test 5	3	1	1	2	2	1
Test 6	3	7	7	0	3	1
Test 7	8	2	5	7	3	3
Test 8	9	4	7	8	8	6
Test 9	10	6	8	8	10	7
Test 10	9	6	10	9	10	7

The results for Luis were the most variable of all the participants. The following features of Luis's test results support the hypothesis that the intervention was effective in increasing learning outcomes.

- Luis's scores in 97% of his tests (thirty-two out of thirty-three) before the intervention were at a low level. One score only was at a moderately high level, that is, the result in Test 8 of Topic 6.
- After the intervention, Luis achieved 40% of his scores (eleven out of twenty-seven) in the high level range. He achieved a perfect score of ten in 14% of his results (four out of twenty seven).
- In Topics 3, 4 and 5 Luis's results showed a pattern of low scores in pre-intervention tests followed by increases of six, seven and five points respectively. He maintained moderately high or high level scores in the twelve tests after the intervention with the exception of Test 7 in Topic 3, in which he scored five points. This illustrates a positive increase in his results and some stability at a high level after the intervention.
- Luis's results in Topics 1 and 2 also show low scores pre-intervention, with improvement after the intervention, however with some variability.

- In general it can be observed that regardless of the variability in Luis's post-intervention results, his scores post-intervention are higher than his pre-intervention scores.

In Topics 1 and 2, the variability in Luis's scores, after intervention, makes interpretation more difficult. It indicates that, for Luis, the intervention was not as successful in "locking in" learning as it was for the other participants. In Topic 6 the data could be interpreted as showing some classroom learning pre-intervention which carried over to the increase of only one point in his scores in the two tests post-intervention. Luis also had fewer perfect score results, than the other participants. He had two topics where the intervention resulted in an increase in score of only one point.

In summary, Luis's results in Topics 3, 4 and 5 support the hypothesis that the scaffold was an effective learning tool, however the results of Topic 6 are inconclusive while the results of tests in the first two topics are open to the interpretation that there was some external effect leading to inconsistency and variability in Luis's performance.

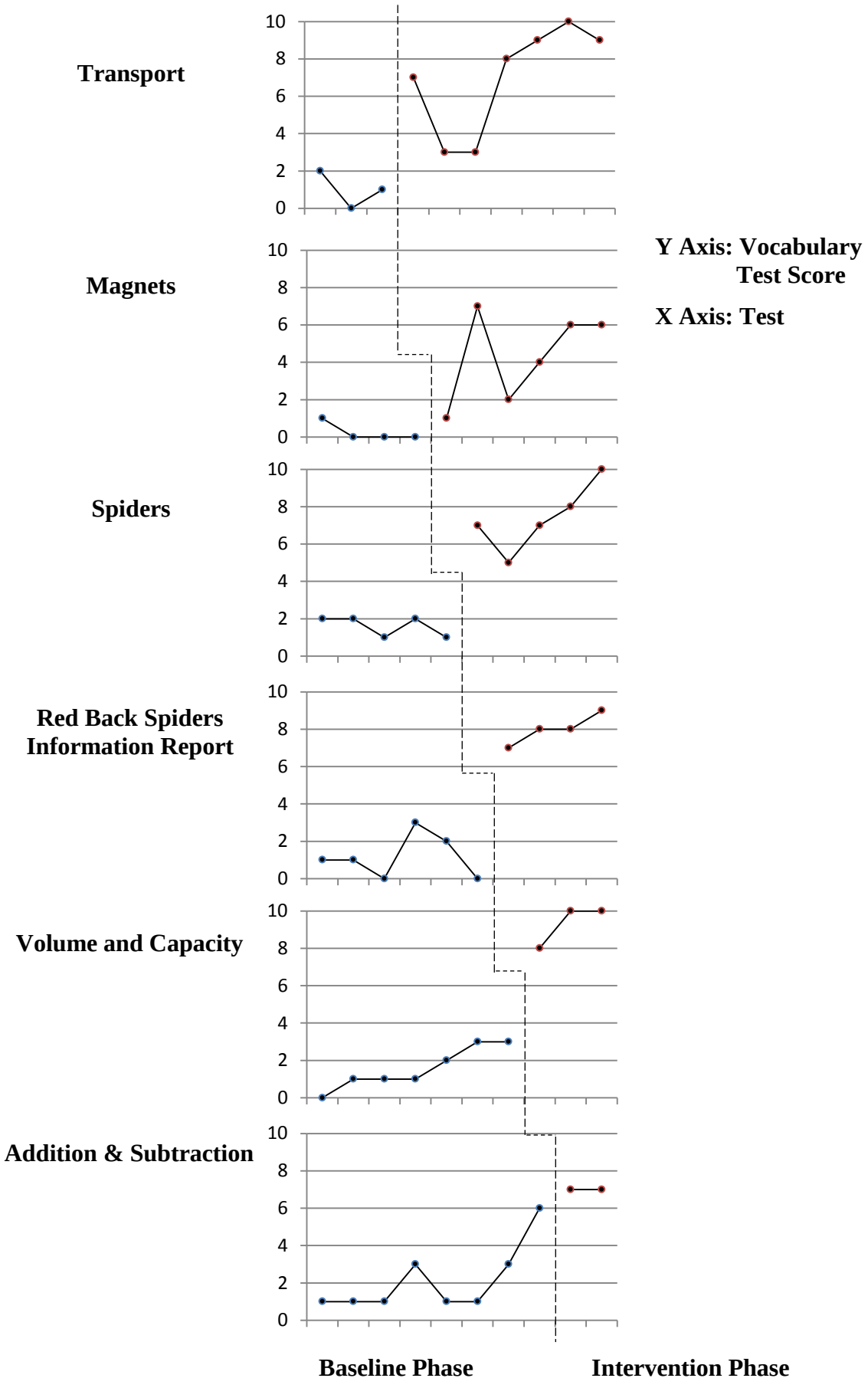


Figure 8.4.1 Graphs showing results of Vocabulary Testing for Luis

8.5 Discussion of visual inspection of test results for Rhys

Table 8.5.1 Table showing results of Vocabulary Testing for Rhys

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Test 1	4	0	0	0	1	0
Test 2	4	1	0	0	2	0
Test 3	5	2	0	0	1	0
Test 4	7	2	0	0	3	0
Test 5	7	8	0	0	3	0
Test 6	10	10	6	0	3	0
Test 7	10	9	8	2	4	1
Test 8	9	9	9	4	8	6
Test 9	10	10	9	4	9	10
Test 10	10	10	9	5	10	9

The following features of Rhys's test results support the hypothesis that the intervention was effective in increasing learning outcomes.

- Rhys's pre-intervention scores stabilised at low levels in Topics 2, 3, 4 but achieved high levels for those topics in Tests eight, nine and ten. (Note:- Topic 4 had only five questions).
- Rhys's scores all increased at the point of intervention. There was a large increase of six in Topics 2 and 3.
- Rhys's scores in Topic 5 displayed evidence of classroom learning but not enough to have achieved high level scores within the test period.
- Rhys's results for post-intervention testing were all greater than those for pre-intervention testing.

The results in Topics 1 and 6 do not show the effect of the intervention as clearly as in the other topics. Topics 1 and 6 both display evidence of normal classroom learning which could have accounted for Rhys's high level scores in Tests 9 and 10.

Results are presented graphically in Figure 8.5.1. The graphs illustrate that the intervention was effective when applied at varying stages throughout the test period.

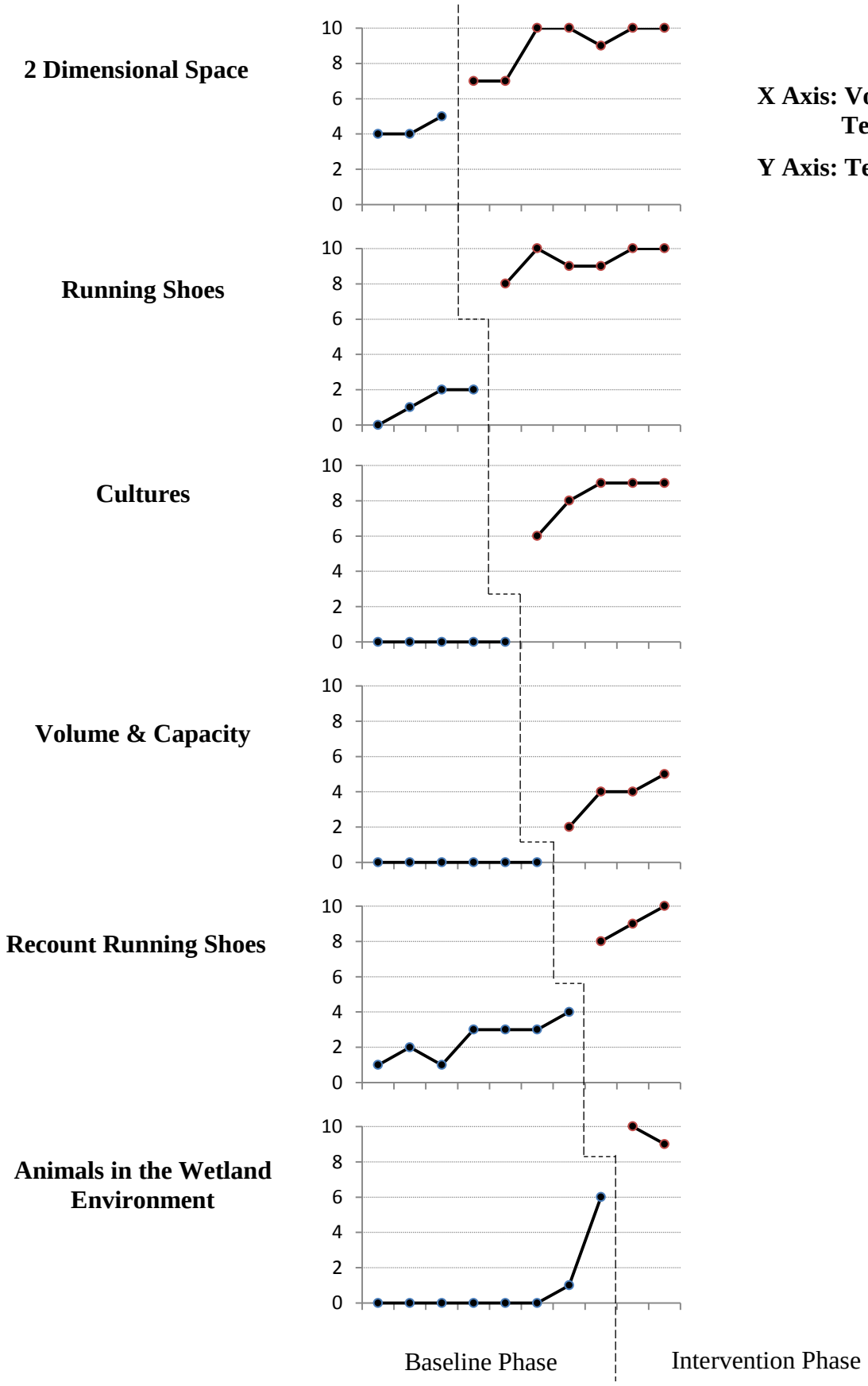


Figure 8.5.1 Graphs showing results of Vocabulary Testing for Rhys

8.6 Discussion of visual inspection of test results for Stewart

Table 8.6.1 Table showing results of Vocabulary Testing for Stewart

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Test 1	1	0	1	3	1	0
Test 2	2	0	0	5	0	0
Test 3	2	0	0	3	0	0
Test 4	10	0	1	2	3	0
Test 5	10	8	2	5	4	0
Test 6	10	8	7	6	4	1
Test 7	10	8	10	10	4	5
Test 8	10	10	6	10	9	3
Test 9	10	10	10	10	10	9
Test 10	10	10	10	10	10	9

The following features of Stewart's test results support the hypothesis that the intervention was effective in increasing learning outcomes.

- In Topics 1, 2 and 3 Stewart achieved only low level scores in all pre-intervention tests but a perfect score of ten in 72% (thirteen out of the eighteen) of his post-intervention tests. Stewart achieved moderately high to high results in the remaining five tests.
- Stewart's scores in Topic 4 show evidence of classroom learning pre-intervention. However his scores jumped by four points after the intervention and he achieved perfect scores of ten points in each of the four tests after the intervention.
- Stewart's scores in Topics 5 and 6 follow a similar pattern to those of Topic 4, that is, he achieved only low to moderately low scores before the intervention but an increase immediately after the intervention (four points in Topic 5 and six points in Topic 6). He maintained very high or perfect scores in each of the remaining tests.

In Topics 4 and 5, Stewart's results show evidence of positive learning before the intervention. Stewart's pre-intervention results in Topic 5 appear to have stabilised at a score of four but his Topic 4 results have a positive trend which may have allowed Stewart to have achieved a 100 % score within the test period without any intervention.

Stewart's test results are shown graphically in Figure 8.6.1.

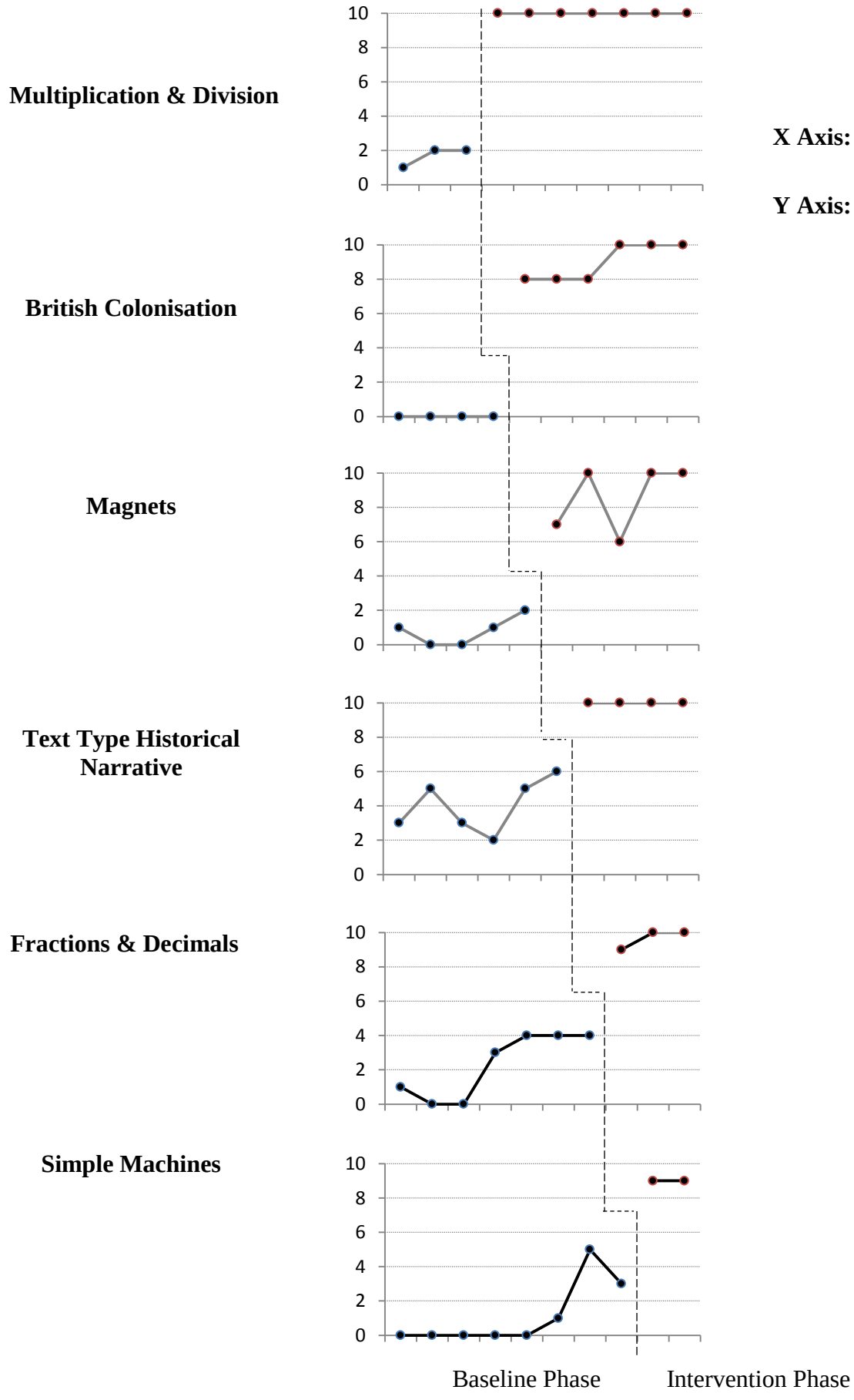


Figure 8.6.1 Graphs showing results of Vocabulary Testing for Stewart

8.7 Discussion of visual inspection of test results for Danielle

Table 8.7.1 Table showing results of Vocabulary Testing for Danielle

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Test 1	0	0	0	0	0	0
Test 2	0	0	0	0	0	0
Test 3	0	1	0	1	0	0
Test 4	1	0	0	2	1	0
Test 5	7	7	0	1	0	1
Test 6	10	10	8	1	1	1
Test 7	10	9	8	9	2	0
Test 8	10	9	10	9	10	1
Test 9	10	9	10	10	10	5
Test 10	10	10	10	9	10	5

The following features of Danielle's test results support the hypothesis that the intervention was effective in increasing learning outcomes,

- Danielle achieved very low scores in all of her pre-intervention testing. Of the thirty-three tests pre-intervention, Danielle scored zero in twenty-two of them, she scored one in nine of the tests and two in the remaining two tests.
- In Topics 5 and 6, Danielle's scores increased from low level to 100% correct immediately following the intervention. It should be noted that Topic 6 was one of the few topics, throughout the programme, in which only five questions were asked.
- In Topics 3 and 4, Danielle's scores increased by eight points and in Topic 2 by seven points, immediately after the intervention. The increase of eight points in Topic 3 followed zero scores in each of the five previous tests.
- In Topic 1, Danielle's pre-intervention results were all zero. Following the intervention, Danielle achieved a 100% score after two tests and her results remained at 100% for the remainder of the test period.

Danielle's results are shown graphically in Figure 8.7.1 and demonstrate a large increase in test scores at the point of intervention compared to pre-intervention trends in her other test scores.

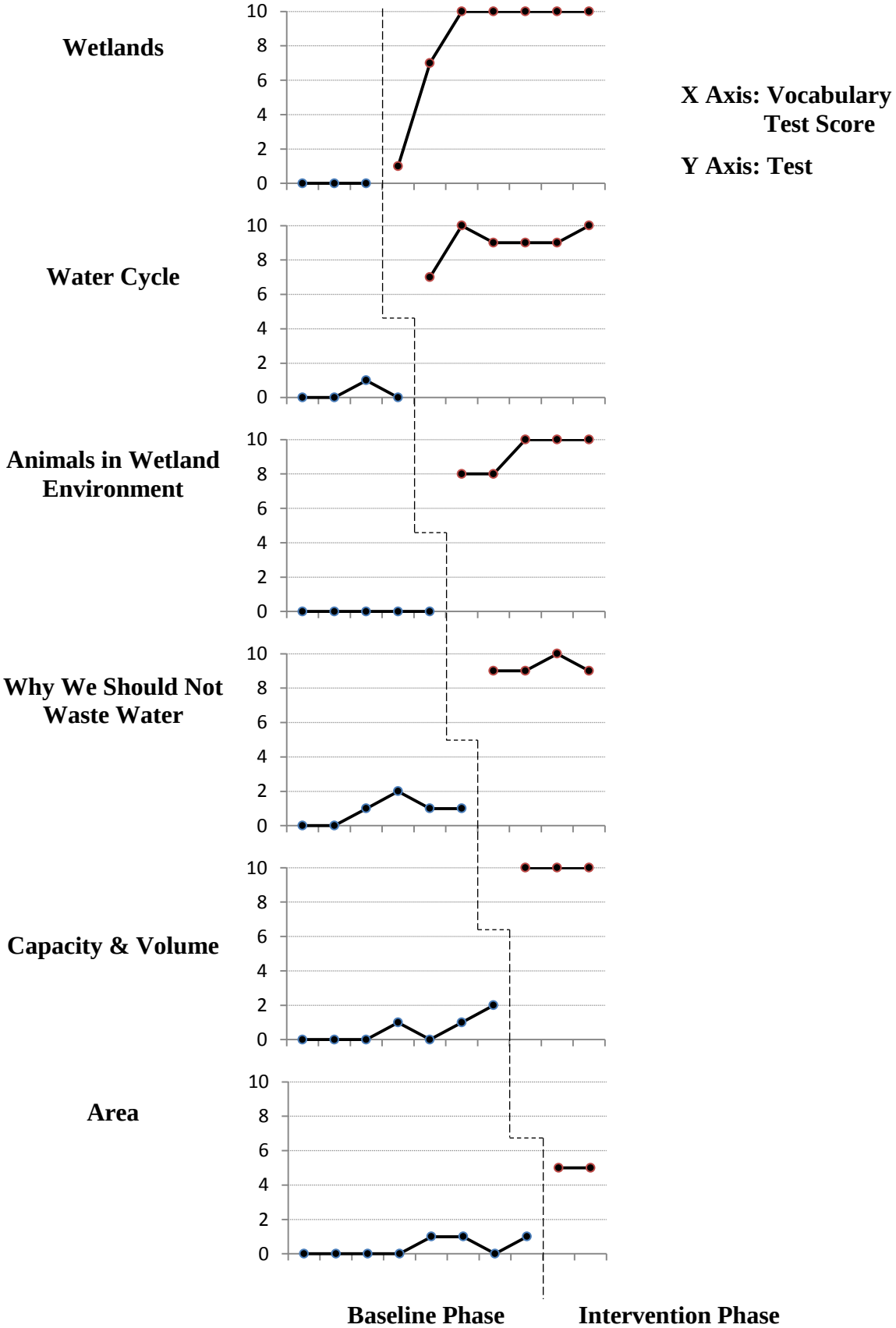


Figure 8.7.1 Graphs showing results of Vocabulary Testing for Danielle

8.8 Discussion of visual inspection of test results for Jack

Table 8.8.1 Table showing results of Vocabulary Testing for Jack

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
Test 1	0	1	0	0	0	0
Test 2	1	0	0	1	0	0
Test 3	1	0	0	0	0	0
Test 4	1	1	0	0	0	0
Test 5	4	10	0	1	2	0
Test 6	7	10	9	0	0	0
Test 7	9	10	9	9	0	0
Test 8	10	10	8	9	10	1
Test 9	9	10	9	10	10	10
Test 10	9	10	9	10	9	10

The following features of Jack's test results support the hypothesis that the intervention was effective in increasing learning outcomes,

- Jack achieved very low scores in pre-intervention testing, scoring zero in twenty-five out of the thirty-three tests in Phase A, or 75% of the Phase A tests.
- By way of comparison, Jack scored ten points in thirteen out of twenty-seven post-intervention tests, or 48% of his tests in Phase B.
- In Topics 2, 3, 4, 5 and 6, Jack achieved a 100% score in twelve out of twenty tests post-intervention and high level scores in the remaining eight tests.
- In Topics 2, 3, 4 and 6, Jack's scores increased by nine points immediately following the intervention and in Topic 5 by ten points.

In Topic 1, Jack achieved low level scores in the first four tests which included the test immediately following the intervention. In Tests 5 and 6 of Topic 1, Jack achieved scores in the moderate range, followed by scores in the high level range for the final four tests. However, his results for the final four tests in Topic 1 showed some variability and Jack was not able to sustain a score of 100%. Although Jack's pre-intervention scores stabilised at low levels, it could be argued that later improvement in Jack's Topic 1 results reflected normal classroom learning and was not entirely due to the intervention.

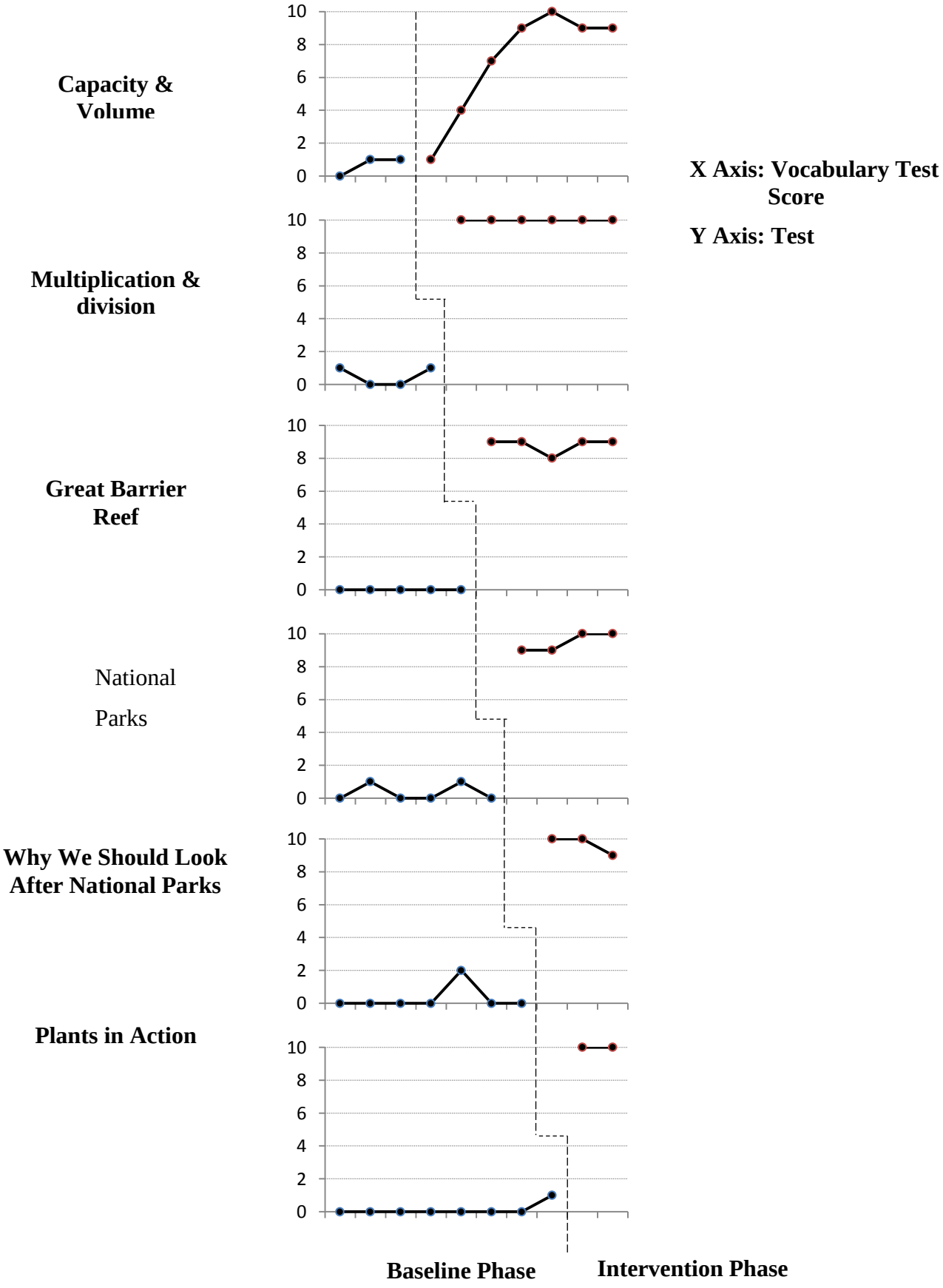
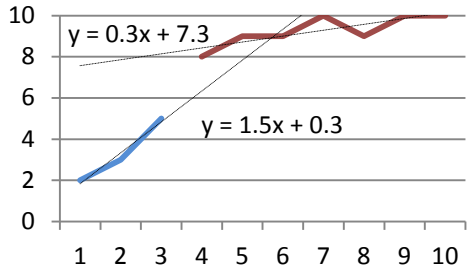
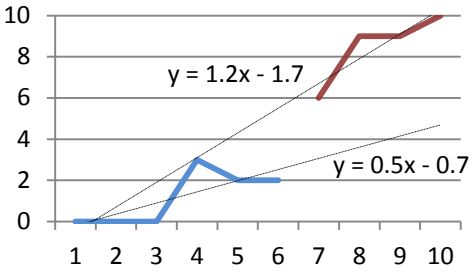


Figure 8.8.1 Graphs showing results of Vocabulary Testing for Jack

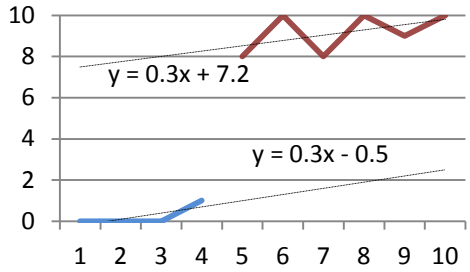
8.9 Discussion of graphical results for Julia



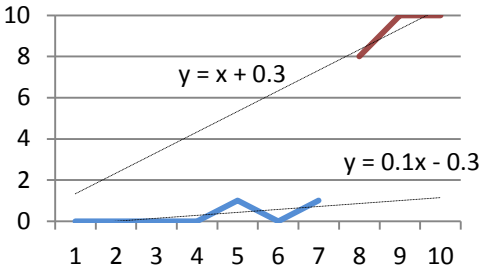
Topic 1 *Position*



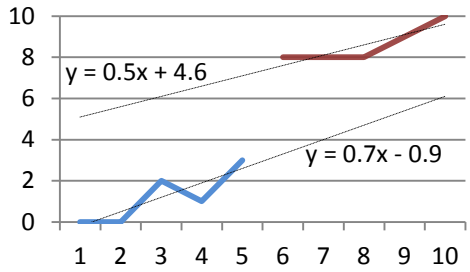
Topic 4 *Mrs Wishy Washy Recount*



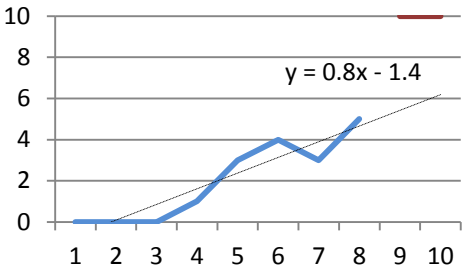
Topic 2 *Mrs Wishy Washy Text*



Topic 5 *Living Things*



Topic 3 *Looking at the Senses*



Topic 6 *Information Report on Emus*

Figure 8.9.1 Graphs and trend lines showing results of vocabulary testing for Julia

LEVEL Julia's test scores pre-intervention did not exceed five. Julia achieved post-intervention scores of eight or above in all topics except Topic 4 in which her scores ranged from six to ten.

TREND Julia achieved a positive trend in all results both before and after the intervention, indicating continued learning in both phases.

VARIABILITY There was little variability in any of Julia's results.

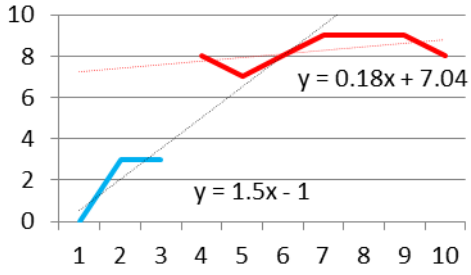
SLOPE Julia's pre-intervention results all show positive slope indicating normal classroom learning. Only in Topic 1, however, was the slope large enough to indicate the

potential for her to have achieved a maximum score, within the test period, without the intervention.

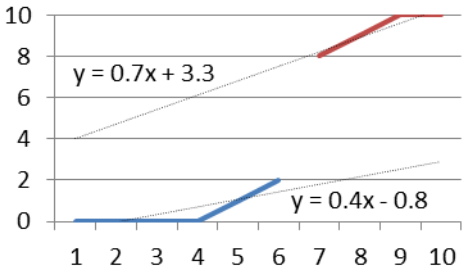
The slope of Julia's results post-intervention was limited by the fact that the maximum possible score was ten and also by the fact that post-intervention the lower intercept had increased due to learning of the topic material in the pre-intervention phase. In Topic 6, the slope of Julia's results post-intervention was zero as both post-intervention scores were at the same level of ten points. Interpreting slope in this case would be misleading as the slope was zero even though Julia achieved a 100% score in each test.

Examining the levels of Julia's results supports the hypothesis that the intervention was successful in increasing learning outcomes. The trend of Julia's results was more difficult to interpret as supporting the effectiveness of the intervention. The trend of Julia's results pre-intervention showed evidence of normal classroom learning and whilst the trend of Julia's results post-intervention was positive (except for Topic 6 as discussed), the limitation on the upper and lower values of the dependent variable meant that the trend did not reveal much information.

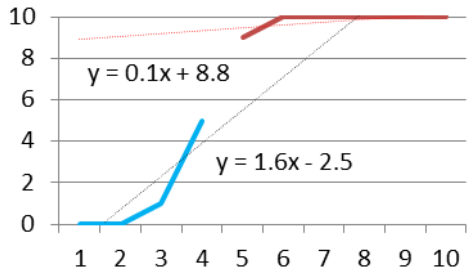
8.10 Discussion of graphical results for Jane



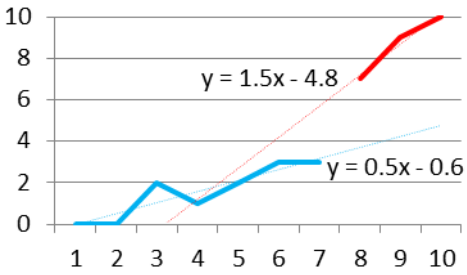
Topic 1 *The Frog and the Fly*



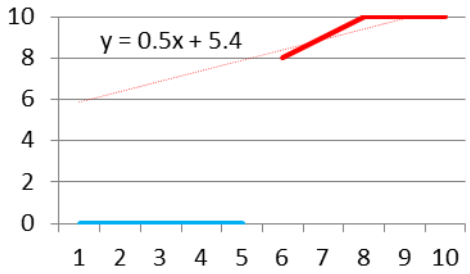
Topic 4 *Information Report on Honeybee*



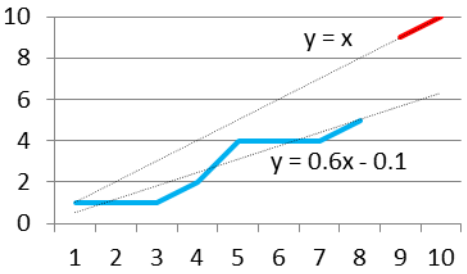
Topic 2 *Recount Frog and Fly*



Topic 5 *3D Space*



Topic 3 *Honeybee*



Topic 6 *How Do Animals Grow & Survive*

Figure 8.10.1 Graphs and trend lines showing results of vocabulary testing for Jane

LEVEL Jane's test scores pre-intervention did not exceed five points. Post-intervention, Jane achieved scores of eight or above, in twenty-five out of twenty-seven tests and seven in the other two tests. It can be observed that all of Jane's post-intervention scores were greater than her pre-intervention scores. In the case of topics 3 and 4, her post-intervention scores were greater than her pre-intervention scores by a minimum of six points and eight points respectively. In Topic 3 the change in scores from zero in the first five tests to eight or above in the five tests after the intervention, supports the effectiveness of the intervention.

TREND Jane achieved a positive trend in all results after the intervention and in all topics before the intervention, except for Topic 3 in which she scored zero in all five pre-intervention tests. This indicates continued learning in both phases of all topics, with the exception of Phase A in Topic 3.

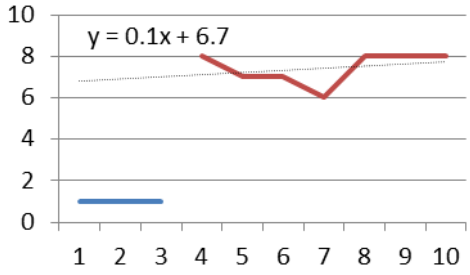
VARIABILITY Jane's results followed the trend line with little variability.

SLOPE Whilst Jane's pre-intervention results, except for Topic 3, all showed a positive slope indicating normal classroom learning. However, only in Topics 1 and 2 was the slope of the pre-intervention trend lines large enough to indicate the potential for her to have achieved a maximum score of ten, without the intervention and within the classroom instruction period. With the benefit of the intervention, Jane achieved a maximum score of ten within the classroom instruction period in each of Topics 2 to 6.

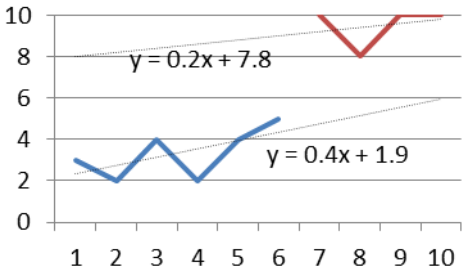
The slope of Jane's post-intervention results was greater than that of her pre-intervention results in Topics 3, 4, 5 and 6. In Topic 2 the slope of Jane's post-intervention results was limited by the fact the she had achieved a perfect score of ten which limited values for the upper intercept. In these topics, the increased slope post-intervention, supports the premise that the intervention increased learning. In Topic 1, the slope of Jane's scores does not support the premise that the intervention was effective in increasing learning although the level of Jane's scores does support the premise.

The effectiveness of the intervention in leading to better learning outcomes was supported by the comparative levels of Jane's test scores pre- and post-intervention, by the greater slopes of trends in Jane's test scores and by the fact that with the assistance of the scaffold, Jane achieved 100% scores in five out of six topics in the test period, when her pre-intervention results indicated that a score of 100% would have been possible in only two of the topics. A notable result in support of the effectiveness of the scaffold was in Topic 3, where Jane scored zero in each of the five pre-intervention tests, but was able to achieve a full score of ten in the second test following the intervention.

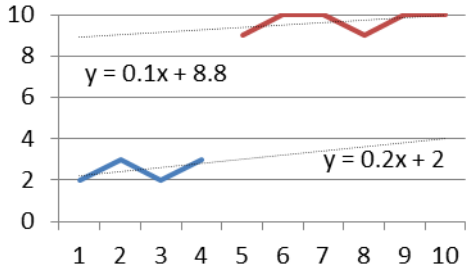
8.11 Discussion of graphical results for Connor



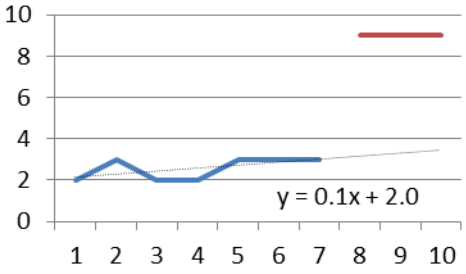
Topic 1 *What Plants need to Grow*



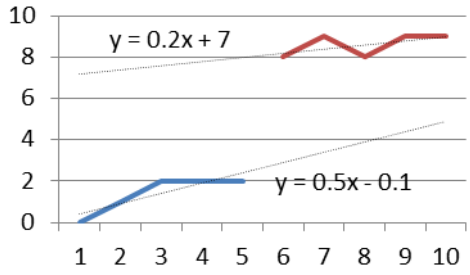
Topic 4 *Honeybee*



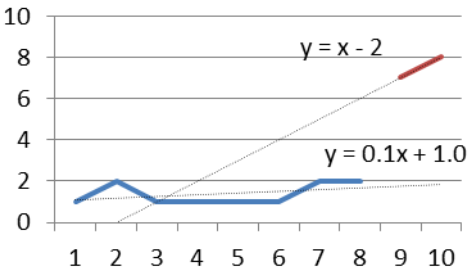
Topic 2 *Ants*



Topic 5 *2D Space*



Topic 3 *Information Report Ants*



Topic 6 *Addition and Subtraction*

Figure 8.11.1 Graphs and trend lines showing results of vocabulary testing for Connor

LEVEL In pre-intervention tests Connor gained a maximum of only three points, with the exception of pre-intervention testing in Topic 4, in which he gained a score of four in two tests and five in another. In post-intervention tests, Connor gained high level scores of eight, nine or ten in Topics 2, 3, 4 and 5. In post-intervention tests, in Topic 1, Connor gained a maximum of eight points and a minimum of six points. This was a higher level than the three pre-intervention scores of one point that he achieved for Topic 1. In Topic 6, Connor's pre-intervention scores did not exceed two points, however his post-intervention scores were at the higher level, of seven and eight points.

TREND The trend of Connor's scores in pre-intervention testing indicated some classroom learning in Topics 3 and 4 but stabilised at low or very low levels (zero in

Topic 1) in the other four topics. The trend of Connor's post-intervention scores was positive indicating continued learning and consolidation of what had been learnt.

VARIABILITY The largest variability in Connor's results was in Topic 4, where his results varied between two and four points throughout the first five tests. In the next test, Connor consolidated his results with an improved score of five and then improved again with a score of ten points in Test 7, following the intervention. In other Topics, Connor's results displayed low variability around the trend lines.

SLOPE The slopes of the trend lines of Connor's pre-intervention scores in Topics 1, 2, 5 and 6 are either zero or very low, indicating a low level of learning in the pre-intervention phase. The trend lines of Connor's post-intervention scores also displayed low slopes indicating that learning had stabilised at a high level. Connor achieved full scores of ten points only in Topics 2 and 6. Connor's post-intervention results in Topic 6 show a slope of one, however, this was from a small sample of only two data points, which makes interpretation difficult as normally at least three data points would be required to form a trend.

In conducting the research, the intervention was administered once only, after which the participants were able to keep the hard copy scaffold with them in the classroom for further reference throughout the remainder of the topic delivery period.

Even with the aid of a scaffold, Connor failed to achieve a full score of ten points in Topics 1, 3 and 5. This could be interpreted to mean that he had difficulty with one or two particular questions in the tests for those topics. Indeed, reference to the score sheets for those topics shows that in none of the tests did Connor give the correct answer to the following questions.

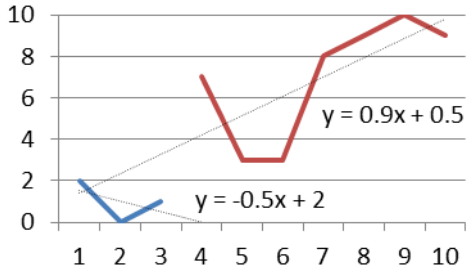
Topic 1, Q6, What is a seed coat?
Q7, What are we doing when we conduct an experiment?

Topic 3, Q4, What is included in the introduction to an Information Report?

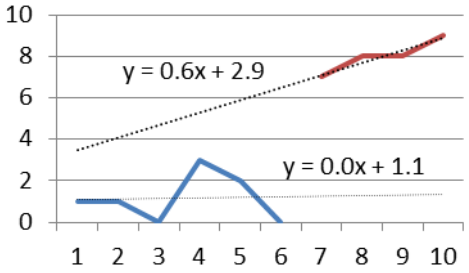
Topic 5, Q9, Draw a rhombus.

If a scaffold were introduced into standard classroom practice, then its use combined with vocabulary testing would reveal such deficits in a student's knowledge, which could then be addressed by the teacher.

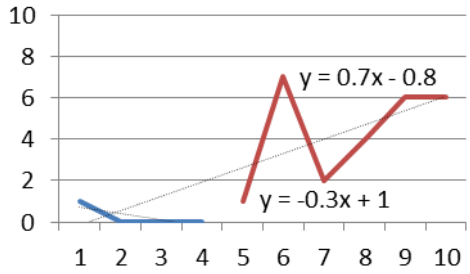
8.12 Discussion of graphical results for Luis



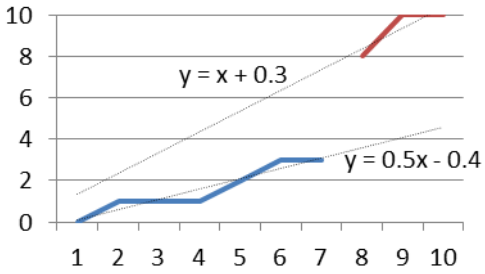
Topic 1 *Transport*



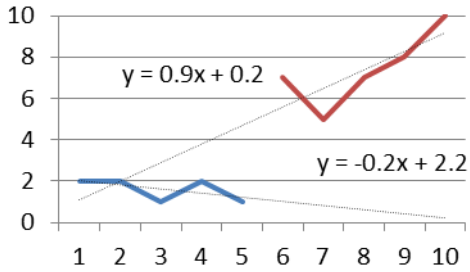
Topic 4 *Spiders Information Report*



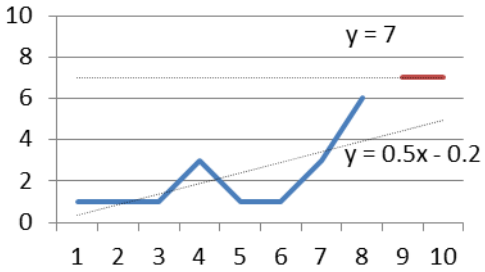
Topic 2 *Magnets*



Topic 5 *Volume & Capacity*



Topic 3 *Spiders*



Topic 6 *Addition & Subtraction*

Figure 8.12.1 Graphs and trend lines showing results of vocabulary testing for Luis

LEVEL Luis achieved low level scores of three points or less in every pre-intervention test, in Topics 1 – 5. In Topic 6 Luis showed evidence of learning before the intervention, achieving a maximum score of six points. In the two remaining tests in Topic 6 Luis was able to increase his score by one point only to seven.

Luis's post-intervention scores were higher than his pre-intervention scores apart from Test 5 of Topic 2. However, Luke was able to achieve a maximum score of ten points in only three tests in all six topics.

TREND The trend of Luis's learning in the first four topics was negative or zero. That is, he was not achieving any positive learning outcomes. The trend of Luis's pre-intervention

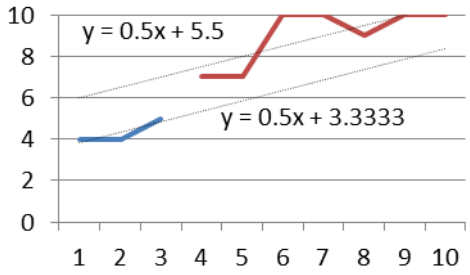
scores in Topics 5 and 6 was positive but not sufficient for him to have reached high level scores within the test period.

VARIABILITY Luis's post-intervention scores in Topics 1 and 2, vary by several points around the trend line and to a lesser extent in Topic 3. This would indicate that Luis was struggling to gain control of the material.

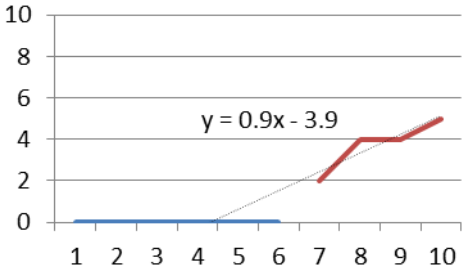
SLOPE Luis's pre-intervention results show a negative or zero gradient in Topics 1 to 4, indicating his difficulties in learning the material. However Luis's post-intervention results in Topics 1 – 4 show a positive slope indicating progress in learning. In Topic 5, the trend line of Luis' post-intervention results displayed a greater slope than his pre-intervention results. As was the case for other participants, the slope of the post-intervention scores in Topic 6 was difficult to interpret with only two points.

The hypothesis that use of a scaffold has a positive effect on learning was supported by the following observations. The level of Luis's post-intervention scores was higher than his pre-intervention scores, except for Topic 2 in which he scored one point in tests 1 and 5. Luis's learning displayed a negative trend in pre-intervention Topics 1 to 4, but the trend of his post-intervention results in those topics was positive. The slope of the trend line for Luis's post-intervention results in Topic 5 was greater than that of his pre-intervention results. Luis's post-intervention results always displayed a positive slope although with some variability. Overall, the intervention always supported Luis's learning and had a positive effect on his results.

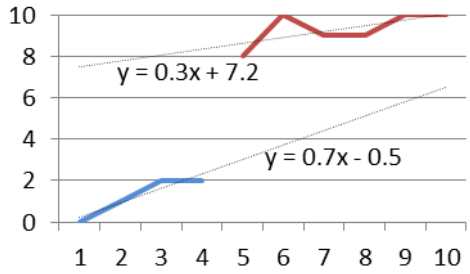
8.13 Discussion of graphical results for Rhys



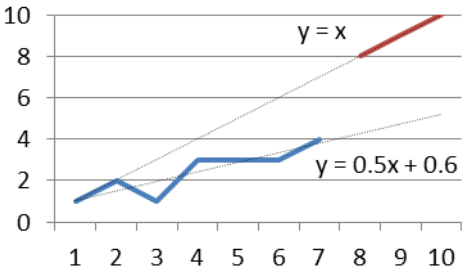
Topic 1 *2D Space*



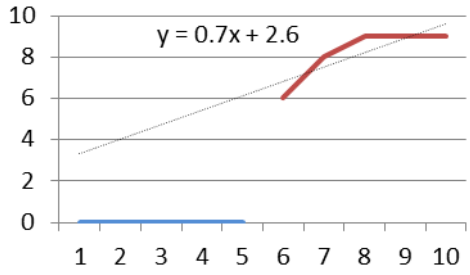
Topic 4 *Volume & Capacity*



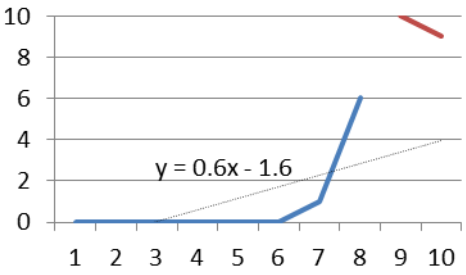
Topic 2 *Running Shoes*



Topic 5 *Recount Running Shoes*



Topic 3 *Cultures*



Topic 6 *Animals in Wetland Environment*

Figure 8.13.1 Graphs and trend lines showing results of vocabulary testing for Rhys

LEVEL In the thirty-three tests, pre-intervention, Rhys achieved one score of six, one score of five, and all his other scores were four or less, including eighteen scores of zero (i.e. eighteen out of thirty-three or 54% of his pre-intervention scores were zero). It should be noted that Topic 4 contained only five questions, not ten, as in all the other tests. Of the twenty-three post-intervention tests in Topics 1, 2, 3, 5 and 6, Rhys scored eight or above in all except three tests, whose results were 6, 6 and 7 (i.e. twenty out of twenty-three or 86% of his post-intervention scores were at the high level of eight or above). In Topic 4, Rhys's results increased from zero, pre-intervention, to four (from a maximum of five), at the second test after the intervention. He achieved a score of five out of five within the test period.

TREND Rhys achieved a positive trend in all pre-intervention results, with the exception of Topics 3 and 4, which had a zero trend, showing no learning was occurring. Rhys achieved a positive trend in all results post-intervention, with the exception of Topic 6. In Topic 6, Rhys's results showed a negative trend but it is suggested this is due to there being only two data points after the intervention and a what maybe a small variability actually appears as a negative trend.

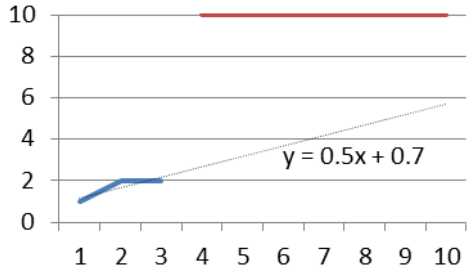
VARIABILITY There was little variability in any of Rhys's results.

SLOPE Rhys's pre-intervention results all show a positive slope indicating progress in normal classroom learning, in Topics 1, 2, 5 and 6. In none of the pre-intervention results, was the slope of the trend line of his results great enough for him to have achieved a perfect score of ten, within the test period, without the intervention (although Topics 1 and 6 show a slope that would have led to high level scores). Except for Topic 2 (and Topic 6 as discussed under Trend), Rhys's post-intervention results all display a slope greater than or equal to the slope of his pre-intervention results indicating learning at a greater rate. In Topics 1 and 2 the slope of Rhys's post-intervention results were limited by the fact that he achieved high level scores. This places an upper limit on the values of the dependent variable and hence on the slope of the results.

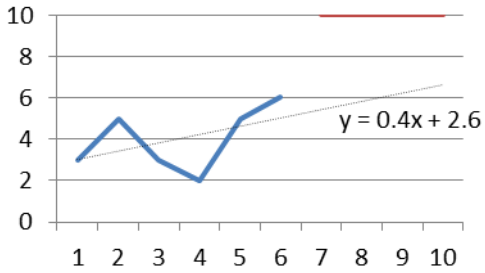
That the use of the scaffold leads to increased learning outcomes was supported by the fact that all Rhys's post-intervention results are greater than his pre-intervention results and by the fact that his results increased immediately following the use of the scaffold. It is noted that in two of the topics, Rhys's pre-intervention results had stabilised at a score of zero but moved to high levels by the end of the test period, following the intervention.

Examining the levels and slopes of Rhys's results supports the hypothesis that the intervention has been successful in increasing learning outcomes.

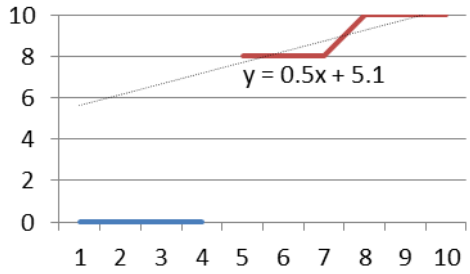
8.14 Discussion of graphical results for Stewart



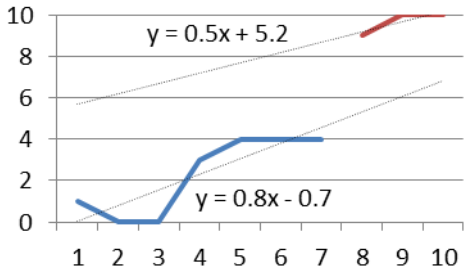
Topic 1 *Multiplication & Division*



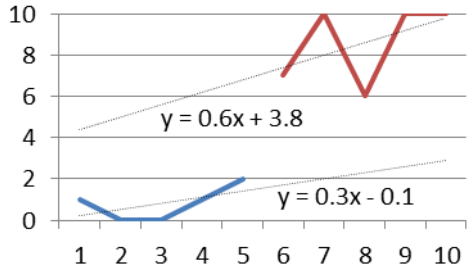
Topic 4 *Text Type Historical Narrative*



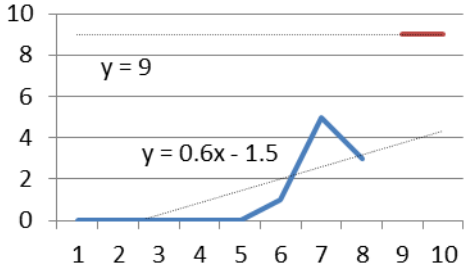
Topic 2 *British Colonisation*



Topic 5 *Fractions & Decimals*



Topic 3 *Magnets*



Topic 6 *Simple Machines*

Figure 8.14.1 Graphs and trend lines showing results of vocabulary testing for Stewart

LEVEL Stewart's pre-intervention results were generally at the low level, the exceptions being three moderately low scores in Topic 4 and one score in Topic 6. Stewart's post-intervention scores were all at high levels of eight, nine or ten points with the exception of Topic 3, in which his post-intervention scores varied between six and ten.

TREND Stewart's results displayed positive trends before and after the intervention, indicating positive learning in both phases.

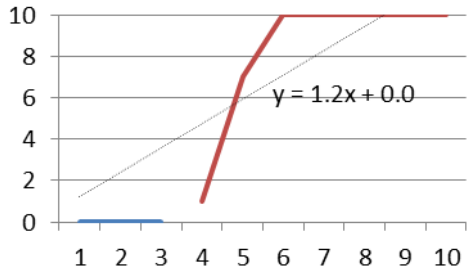
VARIABILITY Stewart's results showed some variability in Phase A of Topics 4 and 6 and in Phase B of Topic 3. The variability in Phase A in Topics 4 and 6 suggested difficulty grasping the concepts for the topic. In the case of Topic 4, the variability of Stewart's pre-intervention scores should be compared with a score of ten in each of the

four tests after the intervention. This would suggest the intervention was successful in assisting with improving and consolidating learning outcomes. The variability in Stewart's post-intervention scores in Topic 3 would suggest difficulty in consolidating learning.

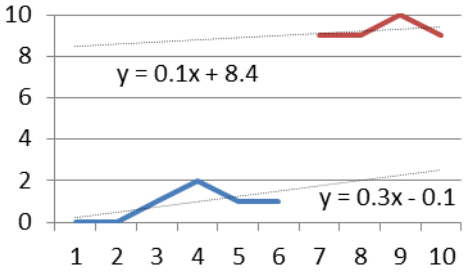
SLOPE In Topic 2, all Stewart's pre-intervention scores were zero. In Topics 1 and 4, Stewart's scores were ten in all post-intervention tests. In these cases, the results had a zero slope. Zero scores indicated no learning and scores of ten with zero slope indicated no further learning possible in the intervention phase. In the other topics, Stewart's scores displayed a positive slope indicating learning was taking place, both before and after the intervention.

The following points support the hypothesis that the scaffold improves learning outcomes. The levels of all of Stewart's post-intervention scores were higher than his pre-intervention scores. In Topics 1, 2, 4, and 5 the slopes of the trend lines of Stewart's post-intervention scores were limited by the number of times he achieved ten points. However, Stewart achieved ten points in the majority of his post-intervention tests in topics 1, 2, 4 and 5. In Topic 3 the slope of the trend line of Stewart's post-intervention scores was greater than that of his pre-intervention scores supporting an increased rate of learning.

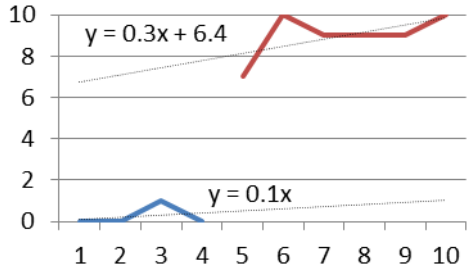
8.15 Discussion of graphical results for Danielle



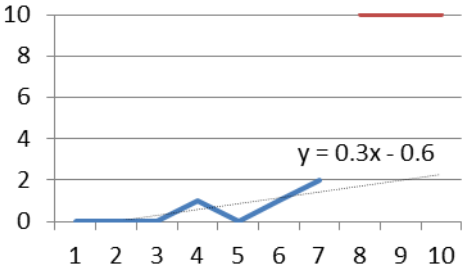
Topic 1 *Wetlands*



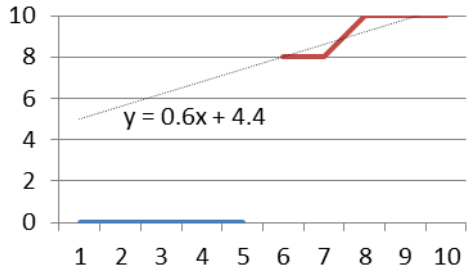
Topic 4 *Why we should not waste water*



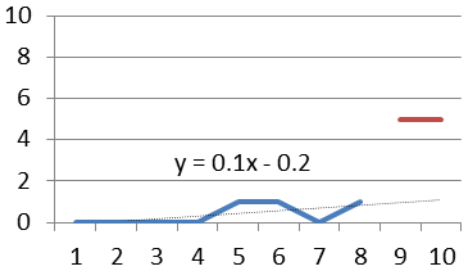
Topic 2 *Water Cycle*



Topic 5 *Capacity & Volume*



Topic 3 *Animals in Wetland Environment*



Topic 6 *Area*

Figure 8.15.1 Graphs and trend lines showing results of vocabulary testing for Danielle

LEVEL Twenty-two out of thirty three (or two thirds) of Danielle's pre-intervention scores are zero. The remainder of her pre-intervention scores are either one or two. Danielle's post-intervention scores are at a high level of eight, nine or ten except for three scores of one and seven, in Topics 1 and 2. (Danielle's post-intervention scores in Topic 6 are five but that is because only five questions were asked).

TREND Danielle's pre-intervention scores show a zero or very low positive trend. The trend of her post-intervention scores was positive but also limited by her achievement of high or very high scores, which limits the upper value of the independent variable. In topics 1 and 3 before the intervention, Danielle scored zero in all tests but had very low

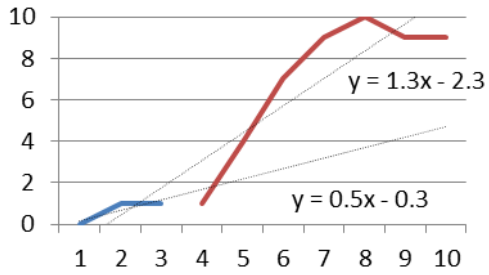
trends in the slopes of her test results in other topics. Apart from Topics 1 and 3, this indicates a positive but very low rate of learning.

VARIABILITY There was little variability in any of Danielle's results.

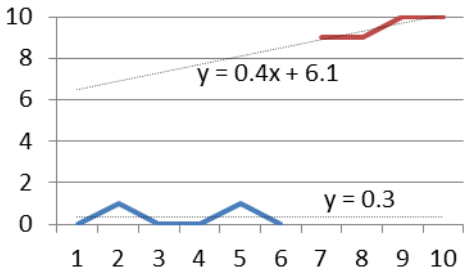
SLOPE The very low slopes in the trend lines of Danielle's pre-intervention results indicate a low level of learning apart from Topics 1 and 3, in which her scores of zero indicated no learning at all. In sixteen out of twenty-seven post-intervention test results, Danielle scored full marks. This limits the value of the upper intercept of the dependent variable and hence limits the slope of the trend of her results. However, the slopes of Danielle's post-intervention results are all positive in those topics in which she did not achieve a full score for all tests. This indicates continued learning and suggests the effectiveness of the intervention, in leading to improved learning outcomes.

In Topic 1, Danielle improved her results from zero scores to scores of ten within two tests following the intervention. This, plus the large contrast between Danielle's low level scores in pre-intervention topics and her high level scores in post-intervention topics supports the hypothesis that the intervention was effective in leading to improved learning outcomes.

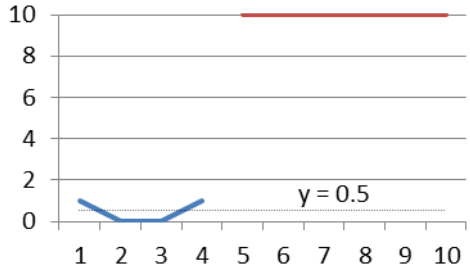
8.16 Discussion of graphical results for Jack



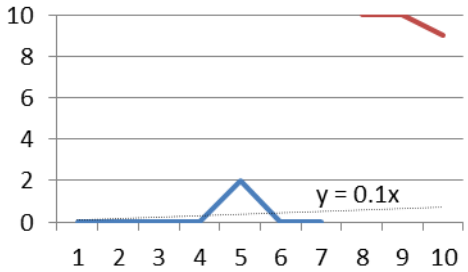
Topic 1 *Volume & Capacity*



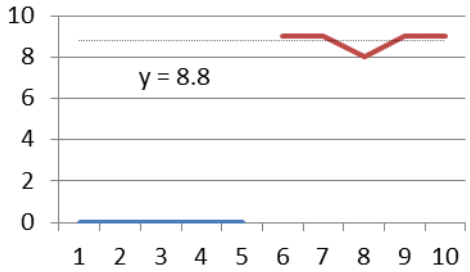
Topic 4 *National Parks*



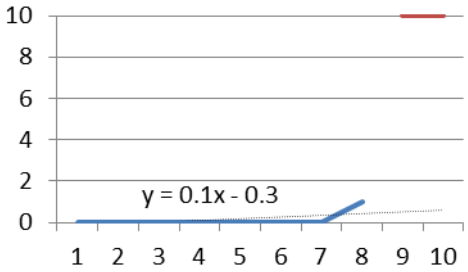
Topic 2 *Multiplication & Division*



Topic 5 *Why Look After National Parks?*



Topic 3 *Great Barrier Reef*



Topic 6 *Plants in Action*

Figure 8.16.1 Graphs and trend lines showing results of vocabulary testing for Jack

LEVEL Jack scored zero or only one point, in thirty-two of the thirty-three pre-intervention tests and two points in the other test. In post-intervention tests, Jack scored either nine or ten points in nineteen out of twenty tests, in Topics 2, 3, 4, 5 and 6 and eight points in the other test (Test 8 of Topic 3). Jack's Topic 1 results show a similar but more gradual increase in levels, between the pre-intervention and post-intervention results, though with a smaller increase at the point of intervention and continued learning in the tests immediately following the intervention.

TREND Jack's results show very low positive trends before the intervention and positive trends after the intervention indicating continued learning. The negative trend in Jack's results in Topic 5 could be interpreted as being due to variability.

VARIABILITY Jack's results show little variability around the trend lines.

SLOPE Apart from Topic 1 Jack's pre-intervention test results show almost no positive trend, indicating a very low level of learning. Apart from Topic 1, Jack's post-intervention results are all at high levels; this limits the positive slopes in the trend lines of his results. In Topic 1, Jack's results show a strong positive learning trend post-intervention, increasing over four tests to levels of nine or ten, then remaining at high levels.

The large difference between the levels of Jack's pre-intervention results and his post-intervention results, in all topics except Topic 1, argues for the effectiveness of the scaffold in improving learning outcomes.

8.17 Discussion of Mean Scores and Mean Baseline Increase

Table 8.17.1 Table showing Mean of Test Scores before and after the Intervention and the Mean Increase in Scores at the Intervention Point

	Mean Score - Phase A (before Intervention)	Mean Score - Phase B (after Intervention)	Mean Increase in Score at the Intervention Point
Julia	1.3	9.1	5.3
Jane	1.5	9.1	5.2
Rhys	1.3	8.2	4.0
Connor	2.1	8.6	5.8
Danielle	0.4	8.7	5.5
Jack	0.3	8.9	7.7
Stewart	1.8	9.4	6.0
Luis	1.4	6.9	4.3
Aggregate	1.3	8.6	5.5

The figures in the table above show the means of the scores achieved by each participant, in Phase A and Phase B. In each case, it can be seen that a positive increase has occurred as a result of the intervention. The aggregate increase was 7.3 (8.6 – 1.3). Given that the maximum score for each test was 10 points, an aggregate increase of 7.3 can be interpreted as supporting the hypothesis that use of the scaffold increased positive learning outcomes.

Another way of looking at the effect of the use of the scaffold is to consider the increase in level of scores at the intervention point. This data is shown in the final column above. Given that the maximum score for each test was 10 points, a mean increase in score of 5.5 at the point of intervention, supports the hypothesis that the use of the scaffold increased positive learning outcomes.

8.18 Discussion of Non-Overlapping Data

Another measure that was used to understand the effect of an intervention and for comparison between data in Phase A and data in Phase B was the Percentage of Non-Overlapping Data. In this study there were 480 data points, that is, eight participants undertaking ten tests, in each of six topics.

There was only one instance where the data overlapped between Phase A and Phase B, and that was in Jack's results for Tests 3 and 4 in Topic 1, *Capacity & Volume*. The intervention was applied after Test 3 and Jack achieved a score of one point in each of Tests 3 and 4. However, Jack's scores increased in subsequent tests and he maintained scores of either eight or nine points in the final four tests.

There were two instances where there was an increase in test score of only one point following the intervention and that was for Danielle in Topic 1, *Wetlands* and for Luis in Topic 2, *Magnets*. In subsequent tests, Danielle's scores increased and she maintained scores of ten points in each of the final five tests. Luis's scores are more variable, but he was able to maintain mid-range scores, with the exception of Test 7 in which he scored two points out of ten.

For all other participants an increase in scores was achieved and maintained following the intervention. The percentage of non-overlapping data was therefore very high being 479 datum points out of 480 measurements.

Table 8.17.1 in Section 8.17 shows that aggregated across all participants, the mean increase in score at the intervention point was 5.5. This together with the fact of there being only one instance of overlapping data out of 480 data points supports the hypothesis that use of the scaffold leads to better learning outcomes.

8.19 Discussion of Results for PZD and PFSD

Table 8.19.1 Table showing Results of Vocabulary Testing and the Percentages of Tests where Participants obtained a Zero Score or a Full Score of Ten Points

	PZD - Percentage Zero Data		PFSD - Percentage Full Score Data	
	Before Intervention	**After Intervention**	**Before Intervention**	**After Intervention**
Julia	48%	0%	0%	44%
Jane	42%	0%	0%	44%
Rhys	54%	0%	0%	33%
Connor	3%	0%	0%	26%
Danielle	67%	0%	0%	52%
Jack	75%	0%	0%	48%
Stewart	39%	0%	0%	70%
Luis	21%	0%	0%	15%
Aggregate	44%	0%	0%	56%

The data tabulated above, illustrated that the results for all participants included zero scores in 44% of tests before the intervention. However, following the intervention none of the scores was zero. The table also illustrates that, whereas no participant achieved a full score of ten points before the intervention, full scores were achieved in 56% of the outcomes, after the intervention.

These data provided strong support for the hypothesis that the use of the scaffold leads to an increase in learning outcomes.

8.20 Statistical Analysis of Test Results

The results for each participant's vocabulary testing were analysed using SPSS, *Premium Graduate Pack*, Version 20.0, for Windows.

A small-n design has been used because large-n design can disguise the effect of an intervention if examined over a large population, which includes participants whose characteristics are not under study. A large-n study will necessarily provide an aggregated result for a whole population. Whereas, a small-n was useful in this instance because the research was studying change over time for the participants who occupy a particular portion of the autism spectrum. Given that autism has a wide spectrum of presentations, the study needed to capture information specific to the participants' situation which was inclusive primary school education.

Internal validity has been achieved by following a small-n model and choosing participants with stable personal circumstances over the time of the study. Internal validity also requires randomisation of results and this was achieved in the selection of topics for testing. In fact the only criterion used to select classroom topics was that they were chosen from the four main topic areas of the education syllabus, namely, English, Mathematics, Human Society and Its Environment (HSIE) and Science. Otherwise, the topics used in the study were the topics being studied by each participant's class at the time of the study. This also meant that the classroom topics were randomly allocated to each participant. Topics were not selected based on a participant's abilities, for example, a good student of Mathematics had no bias applied in either the selection or non-selection of Mathematics topics. Internal validity was also strengthened because the intervention was applied at varying times throughout the delivery period of each participant's six topics. This was done to highlight any effect that intervention may have had on the participant's learning. Delayed introduction of the intervention, for example, provided the opportunity to illustrate that learning was also delayed until the intervention had been administered. Internal validity was further strengthened by the fact that the participants were selected at random. In this study the participants were those students who were attending the schools at which the researcher was teaching and to that extent they represented a random sample of students with autism in inclusive primary schools.

Table 8.20.1 Table showing Results of Statistical Analysis of Participants' Vocabulary Test Scores

Participant	p Value	Significance level
Julia	4.998×10^{-4}	0.001
Jane	4.998×10^{-4}	0.001
Connor	4.998×10^{-4}	0.001
Luis	3.498×10^{-3}	0.01
Rhys	4.998×10^{-4}	0.001
Stewart	4.998×10^{-4}	0.001
Danielle	4.998×10^{-4}	0.001
Jack	4.998×10^{-4}	0.001

8.21 Discussion of PPVT Results

The results of the testing for receptive vocabulary, using the PPVT-4 test, are set out in the two tables below. For five of the participants, the increase in their age equivalent scores was greater than the increase in their chronological ages. Given that there was no change in the environment of the participants, that is, no change in personal or school circumstances, apart from increasing age, it is hypothesised that use of the scaffold assisted not just with improved vocabulary knowledge in the particular classroom topics tested, but also in the broader assessment of their receptive vocabulary, as measured by the PPVT-4.

Two of the participants achieved a neutral result where the difference between chronological age and age equivalent was only one month. It is suggested that these two participants maintained their development relative to the standardised population. Therefore no conclusion may be drawn about the generalisation of receptive vocabulary development as a result of the use of the scaffold.

One participant achieved a result which showed a reduction in his standard score, indicating that the level of his performance, relative to the rest of the population, had decreased. Over the test period, his chronological age increased by seven months, however, his age equivalent score increased by only one month. This participant had a very low level of engagement with classroom learning, as recorded in Table 8.24.1. For this participant, it is not possible to make any conclusions regarding the generalisation of receptive vocabulary development as a result of the use of the scaffolds. In total, five of the participants displayed an increase in age equivalent over and above the increase in their chronological ages. Two maintained their position relative to the rest of the students of the same age and one fell behind the standardised population.

Table 8.21.1 Table showing Receptive Language Scores as Measured by PPVT-4

	Before Beginning Classroom Topic Testing			After Completion of Classroom Topic Testing		
	Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
Julia	76	6.1	3.10	80	6.7	4.8
Jane	84	6.2	4.11	85	6.9	5.5
Connor	100	6.5	6.5	108	7.0	7.11
Luis	84	6.7	5.2	81	7.2	5.3
Rhys	78	7.6	5.3	84	8.3	6.7
Stewart	111	8.6	9.9	137	9.0	14.5
Danielle	106	8.7	9.3	110	9.1	9.6
Jack	80	9.6	6.9	85	11.0	8.8

Table 8.21.2 Table showing analysis of Receptive Language scores as measured by PPVT-4

	Change in Standard Score	**Increase in Chronological Age (Months)**	**Increase in Age Equivalent (Months)**	**Analysis**
Julia	4	6	10	Increase in age equivalent greater than increase in chronological age
Connor	8	7	18	
Rhys	6	9	16	
Stewart	26	6	56	
Jack	5	18	23	
Jane	1	7	6	Neutral result
Danielle	4	6	7	
Luis	-3	7	1	Increase in age equivalent less than increase in chronological age

8.22 Discussion of EVT Results

The results of the testing for expressive vocabulary, using the EVT-2 test, are set out in the two tables below. For the oldest research participants, the increase in their age equivalent score was greater than their increase in chronological age. For these participants, gains were also achieved on the PPVT-4 test, suggesting that gains in receptive vocabulary scores were reflected in their expressive vocabulary scores.

Three of the participants achieved a neutral result, where the difference between their chronological age and their age equivalent score was zero or one.

Three of the participants achieved a result which showed a reduction in their age equivalent score relative to their chronological age.

Table 8.22.1 Table showing Expressive Vocabulary Scores as measured using EVT-2

	Before Beginning Classroom Topic Testing			After Classroom Topic Testing		
	Standard Score	Chronological Age	Age Equivalent	Standard Score	Chronological Age	Age Equivalent
Julia	81	5.10	4.3	80	6.6	4.8
Jane	82	6.2	4.6	82	6.9	5.0
Connor	103	6.5	6.7	110	7.0	8.2
Luis	90	6.7	5.7	84	7.2	5.7
Rhys	88	7.6	6.3	86	8.3	6.8
Stewart	107	8.6	9.6	123	9.0	13.5
Danielle	107	8.6	9.6	107	9.1	10.0
Jack	83	9.6	6.6	86	10.11	8.5

Table 8.22.2 Table showing Analysis of Expressive Vocabulary scores as measured by EVT-2

	Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalent (Months)	Analysis
Stewart	16	4	47	Increase in age equivalent greater than chronological age
Jack	3	17	23	
Jane	0	7	6	Neutral result
Connor	7	7	7	
Danielle	0	7	6	
Julia	-1	8	5	Increase in age equivalent less than chronological age
Luis	-6	7	0	
Rhys	4	9	5	

8.23 Discussion of PLAI-2 Results

The results of PLAI-2 analysis of both the teachers' and participants' levels of language abstraction are presented in the tables below.

Table 8.23.1 Table showing Teacher's Level of Language Abstraction as measured by PLAI-2

	Julia (K) %	Jane (Yr 1) %	Connor (Yr 1) %	Luis (Yr 1) %	Rhys (Yr 2) %	Stewart (Yr 3) %	Danielle (Yr 3) %	Jack (Yr 3/4) %
Matching	4.7	0.8	0.0	5.8	NA	9.5	4.6	6.8
Selective Analysis	22.8	20.2	19.5	21.5	NA	11.7	16.5	21.6
Reordering	53.9	63.5	62.5	58.5	NA	44.5	45.3	43.3
Reasoning	18.9	15.5	18.0	14.2	NA	34.3	33.5	28.3
Recording time (Hours)	7.5	2.0	4.0	3.5	NA	5.5	8.0	4.5

Table 8.23.2 Table showing Participant's level of Language Abstraction as measured by PLAI-2

		Julia		Jane		Connor		Luis		Rhys		Stewart		Danielle		Jack	
		Pre-Interv'n	Post-Interv'n	Pre-Interv'n	Post - Interv'n	Pre-Interv'n	Post - Interv'n	Pre-Interv'n	Post - Interv'n	Pre-Interv'n	Post - Interv'n	Pre-Interv'n	Post - Interv'n	Pre-Interv'n	Post - Interv'n	Pre-Interv'n	Post - Interv'n
Matching	Percentile rank relative to age 5.11	16^{th}	$\geq 63^{rd}$	$\geq 63^{rd}$	$\geq 63^{rd}$	50^{th}	$\geq 63^{rd}$	16^{th}	25^{th}	$\geq 63^{rd}$	$\geq 63^{rd}$	$\geq 63^{rd}$	$> 63^{rd}$	$\geq 63^{rd}$	$\geq 63^{rd}$	$\geq 63^{rd}$	$\geq 63^{rd}$
Selective Analysis	Percentile rank relative to age 5.11	2^{nd}	75^{th}	9^{th}	37^{th}	5^{th}	$\geq 37^{th}$	2^{nd}	37^{th}	25^{th}	63^{rd}	25^{th}	$\geq 75^{th}$	$\geq 75^{th}$	$\geq 75^{th}$	$\geq 75^{th}$	$\geq 75^{th}$
Reordering	Percentile rank relative to age 5.11	1^{st}	9^{th}	9^{th}	16^{th}	25^{th}	95^{th}	1^{st}	9^{th}	50^{th}	91^{st}	75^{th}	$> 95^{th}$	37^{th}	84^{th}	75^{th}	91^{st}
Reasoning	Percentile rank relative to age 5.11	2^{nd}	84th	5^{th}	50^{th}	2^{nd}	98^{th}	1^{st}	9^{th}	75^{th}	95^{th}	84^{th}	$> 99^{th}$	84^{th}	99^{th}	63^{rd}	75^{th}

Between pre and post assessment on the PLAI(2), each participant increased their percentile rank (relative to age 5.11) against all four levels of language abstraction.

Julia, Jane and Luis, three of the younger participants, achieved least increase in reordering of perception. Their difficulty at the reordering level was also evident in their scaled scores pre and post the intervention.

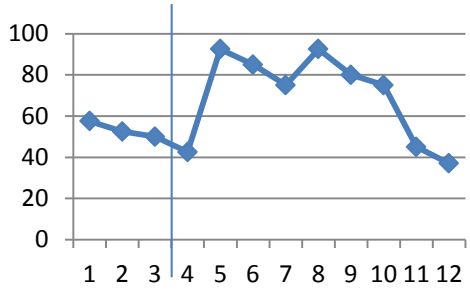
There are no figures shown in Table 8.23.1 for Rhys's teacher's level of language abstraction because the teacher did not record any of her utterances.

8.24 Discussion of Engaged Learning Time

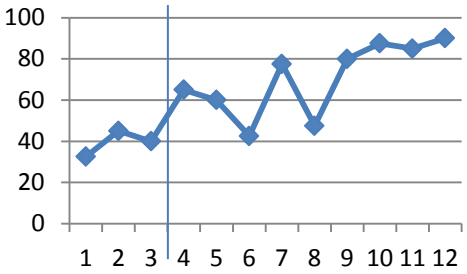
Table 8.24.1 Table showing results of Engaged Learning Time Observations

Engaged Learning Time (%)								
Observation Number	**Julia**	**Jane**	**Connor**	**Luis**	**Rhys**	**Stewart**	**Danielle**	**Jack**
1	57.5	32.5	27.5	Teacher report: close to 0%	32.5	37.5	42.5	12.5
2	52.5	45.0	40.0		27.5	32.5	57.5	22.5
3	50.0	40.0	48.1		35.0	52.5	60.0	27.5
4	42.5	65.0	57.0	Teacher report: never more than 10%	32.5	55.0	82.5	27.5
5	92.5	60.0	70.0		47.5	60.0	95.0	55.0
6	85.0	42.5	72.5		45.0	82.5	85.0	50.0
7	75.0	77.5	80.0		95.0	65.0	95.0	65.0
8	92.5	47.5	78.0		67.5	72.5	35.0	72.5
9	80.0	80.0	82.0		80.0	92.5	70.0	75.0
10	75.0	87.5	79.5		20.0	85.0	65.0	72.5
11	45.0	85.0	84.0		27.5	92.5	92.5	85.0
12	37.0	90.0	85.5		10.0	85.0	95.0	80.0

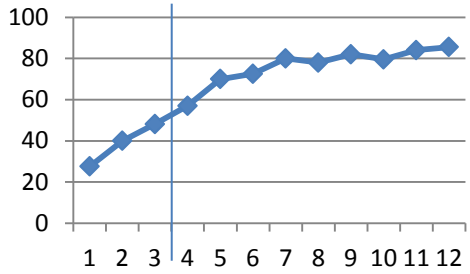
Note: Shaded cells indicate those readings taken after delivery of the intervention



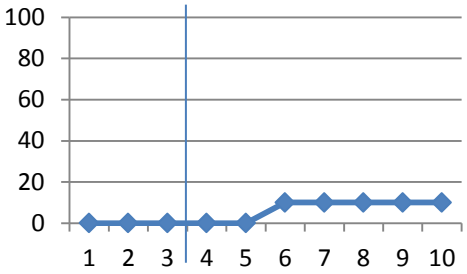
% Engaged Learning Time for Julia



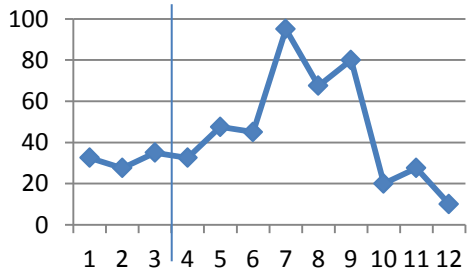
% Engaged Learning Time for Jane



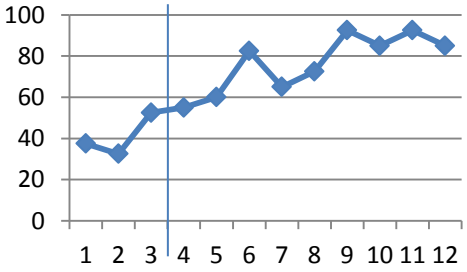
% Engaged Learning Time for Connor



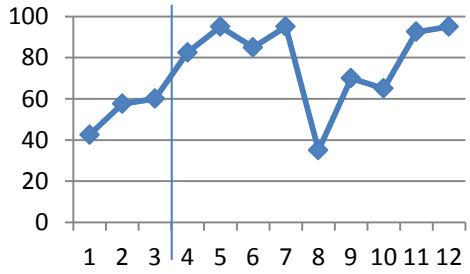
% Engaged Learning Time for Luis



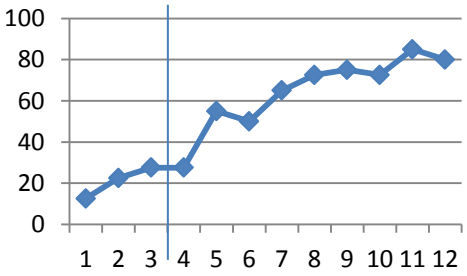
% Engaged Learning Time for Rhys



% Engaged Learning Time for Stewart



% Engaged Learning Time for Danielle



% Engaged Learning Time for Jack

Figure 8.24.1 Graphs showing percentage of engaged learning time before and after the intervention for each participant

Figure 8.24.1 presents each participant's Engaged Learning Time results in graphical form. Three points should be noted.

a) Observations of engaged learning time were begun three lessons before the intervention was introduced. These observations were made by both the researcher and the Special Needs Aide in order to eliminate researcher bias in the results. The researcher and the aide used an individual recording sheet to classify and record the behaviour every ten seconds over a ten minute time period. Following the first two observation sessions, it became evident that each observer was operating against a different definition of *engaged learning*. Following this, Engaged Learning was more specifically defined as the participant oriented to the teacher, involved in discourse with the teacher, focussed on visual instruction or asking a question. Any of these four criteria satisfied the requirement for *engaged learning*. Inter-rater reliability was then calculated when both observers conducted a second observation. The results were entered into the formula,

$$\text{Inter-rater reliability} = \frac{\text{No. of agreements}}{\text{No. agreements + No. Disagreements}} \text{ x } 100\%$$

The inter-rater reliability for this second observation was calculated to be 93%. Following this, each observer then began to make their own observations at appropriate times. As the inter-rater reliability was at an acceptable level, the data from each observer was able to be combined for each participant.

b) Luis attended a different school to most of the other participants and this made regular classroom observations impractical in his case. As a result, there was no formal measurement of Engaged Learning Time for Luis. The engaged learning time results for Luis were established after discussion with his classroom teacher. For this reason, a graph of Luis' Engaged Learning Time is presented but the data for the graph have been excluded from the comments and analysis. Luis' low score for engaged learning time was consistent with his being the most affected, of any of the participants, by learning difficulties associated with ASD. Luis' learning disability is also reflected in the greater variability of his vocabulary test scores and in the fact that the statistical analysis of Luis' vocabulary tests produced a result significant to the 0.01 level whereas the other participants had results significant to the 0.001 level.

c) Participants Julia and Rhys are brother and sister. Their results for later measurements of engaged learning time both showed a reduction over their earlier results. The timing of these later results coincided with their father having been hospitalised following a serious motor accident.

The mean Engaged Learning Time prior to the intervention was 39.7%. The mean after the intervention was 69.2%. (These figures have been calculated excluding the results for Luis, but they do include the figures for Rhys and Julia whose engagement with the classroom learning was reduced for the final lessons, as discussed above).

This outcome is consistent with the hypothesis that use of a visual scaffold will assist those students with ASD to achieve greater engagement with classroom learning and hence lead to better learning outcomes.

The results for Engaged Learning Time do not show step increases at the point of the intervention as did the vocabulary tests. Two reasons are suggested for this. Firstly, Engaged Learning Time measures the percentage of time a participant was concentrating and paying attention in class. That is, Engaged Learning Time was measuring a behavioural response and change of behaviour (for example as caused by the intervention) may take some time to become established. Test results for vocabulary on the other hand represent specific knowledge acquisition and would tend to show more immediate change once the material has been learned, as assisted by the scaffold. The second reason why Engaged Learning Time results did not show an immediate response to the intervention may relate to the accuracy of the observations. Having ASD, the participants were often having to cope with sensory issues and may have displayed signs of restlessness while still paying attention to the lesson.

8.25 Results of Parent and Teacher Questionnaires

This section presents the results and discusses the responses to questionnaires completed by the parents and teachers of the participants (See Appendices **Error! Reference source not found.** and **Error! Reference source not found.**). The questionnaires were completed twice; once before any research activity had commenced and again after the study had been completed. The questionnaires sought to gauge the participant's classroom learning needs, learning performance, learning engagement and student enjoyment of the learning experience from the perspective of parents and teachers. Question 5, in particular, sought to gauge the effectiveness of the use of a scaffold in supporting each participant's understanding of new classroom topics or concepts. Question 6 sought to gauge the effectiveness of the scaffold to increase a student's engagement with classroom learning.

Parents were asked to complete a questionnaire even though a number of questions referred to learning performance in the classroom. Parents have insights into their child's understanding of and perception of classroom learning from some of the work the children take home, parent-teacher discussions and from the child's general demeanour each afternoon after school. Some children can be very upset after the school day and parents witness the child's reaction to school based stress.

QUESTION 1. Compared to other students, does your son/daughter have particular learning needs? Yes ☐ No ☐.

Table 8.25.1 Table of results for Question 1 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	Yes	Yes	Yes	Yes
Jane	Yes	Yes	Yes	Yes
Connor	Yes (Language)	Yes	Yes	Yes
Luis	Yes	Yes	Yes	Yes
Rhys	Yes	Yes	Yes	Yes
Stewart	Yes	Yes	Yes	Yes
Danielle	Yes	Yes	Yes	Yes
Jack	Yes	Yes	Yes	Yes

The Question 1 responses confirmed that all participants had particular learning needs. This applied prior to and following the intervention.

QUESTION 2. What were [participant's name] particular learning needs?

Table 8.25.2 Table showing results for Question 2 of Parent and Teacher Questionnaire.

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	Language because language is everything	Language – but much better now.	Needs support to stay on task with her writing	Needs questions restructured verbally
Jane	Understanding and comprehension of classroom work; social.	To improve reading. To understand the work. Maths – she has no idea.	Great difficulty understanding any class topics.	Has difficulty with vocabulary and concepts not on her scaffolds.
Connor	Getting the information correctly.	Maintaining attention.	Processing and being off topic.	Processing the language.
Luis	Handwriting, letter formation, reading	Understanding what he reads. He is better with a scaffold.	Engaging with and focusing on class learning. Understanding what the topic is.	Focus on class topic and language comprehension.
Rhys	Decoding and understanding reading material, writing, bit of social.	Understanding the words and ideas more now.	ASD – Language, comprehension and social.	More focused and comprehending the work when has a scaffold.
Stewart	Social – he has been making silly, heavy breathing noises	Scaffolds have lessened the pressure on him but he still worries about decision making.	Needs explicit instructions.	Scaffolds have meant he understands the class work and what to do for follow-up.
Danielle	Understanding the language and eye contact.	She understands words much better now with scaffolds.	Still mastering word meanings.	Vocabulary and concept work made very clear by scaffolds.
Jack	Social and following social rules. He takes a long time to understand things.	Is getting better with the social. He has a friend.	Working in a group. He does not understand the work or how to act in a group.	He is able to get the information from the scaffold for group work. Needs to always use a scaffold.

Six out of eight pre-study parent responses indicated a learning difficulty with the understanding and comprehension of classroom learning. Five out of the eight post-study

parent responses indicated an improvement in the understanding of classroom learning following use of the scaffold as an intervention.

Seven out of eight pre-study teacher responses indicated a difficulty with comprehension of classroom learning. The post-study teacher responses indicated the need for a continued focus on the comprehension of learning. In addition, five out of eight post-study teacher responses indicated reliance upon the scaffold for comprehension of classroom learning.

QUESTION 3 When you are talking about or explaining a new idea to [participant's name], is it necessary for you to make adjustments to your language so that he/she understands you?

Table 8.25.3 Table showing results for Question 3 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	Yes	Not as much	Instructions must be clear and concise.	I use lots of visuals and practical demonstrations because she is a visual learner.
Jane	Yes. Simplify vocabulary, repetition of material and reassurance.	Sometimes	Yes. Explain vocabulary and use shorter sentences.	Yes – use shorter sentences. Vocabulary on scaffold.
Connor	Yes. I go to his level.	Language improved. Less adjustment.	Yes. Repeat information often.	Do not need to repeat. He has the scaffold.
Luis	Yes. Explain vocabulary. Shorter sentences.	Yes. Explain vocabulary. Shorter sentences.	Yes. Understanding vocabulary very difficult	Yes. He needs lots of visuals.
Rhys	Yes. Shorter sentences. Repeat the explanation.	Yes. Explain the vocabulary.	Yes	Yes
Stewart	Not really. He gets it fast. Is a worrier.	Explain in reassuring, calm manner to avoid anxiety for him.	He needed to get used to what the teacher required.	No
Danielle	Yes	Yes	Yes. Usually repeat the information.	Yes but less adjustment needed because of scaffold.
Jack	Yes	Yes. He asks a lot of questions so I know what he doesn't understand.	Delivery not altered but he needs to follow up for more explanation.	Yes – explicit language and visuals are on the scaffold.

Pre-study responses to Question 3 indicated that seven out of eight participants required the parent or teacher to make adjustments to their use of language to facilitate participant understanding of information being presented.

The post-study teacher responses indicated some lessening of the need to make adjustments to language and this was accompanied by heavy reliance on the use of the scaffold.

QUESTION 4 What adjustments do you need to make?

Table 8.25.4 Table showing results for Question 4 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	Shorter sentences and showing her.	Showing her.	Shorter sentences	Explain vocabulary. Repeat explanation. Shorter sentences
Jane	Explain vocabulary. Shorter sentences	Explain some vocabulary. Shorter sentences.	Explain vocabulary. Shorter sentences	Explain some vocabulary. Shorter sentences
Connor	Shorter sentences	Shorter sentences	Explain vocabulary. Shorter sentences	Adjustment need is less. Shorter sentences.
Luis	Shorter sentences	More work on word meanings.	Shorter sentences. Lower tone.	Shorter sentences. A lot of visuals.
Rhys	Sometimes explain six or seven times.	Explain more slowly.	Explain vocabulary. Use shorter sentences	Explain vocabulary. Give visuals.
Stewart	None really.	Maybe repeat explanation slowly.	None necessary.	Scaffolds provided. Avoids anxiety.
Danielle	Explain again quietly.	Not many unless asking for help.	Always explain new concepts. Usually repeat information.	Use visuals when possible.
Jack	Explain vocabulary and shorter sentences.	We explain many things to him.	Repeated explanations with visuals.	The adjustments – explicit language and visuals are on the scaffold.

The majority of the parent responses to both questionnaires indicated the need to use shorter sentences and to provide additional, often slower, explanation of the material to be learned. The majority of the teacher responses also indicated the need for additional or repeated explanation of instructions and vocabulary as well as the use of shorter sentences. Five of the eight indicated a reliance on the use of the scaffold as a learning aid. In the case of participant Stewart, the responses from parents and teachers indicated that adjustment to language was not essential but that the use of the scaffold reduced

anxiety in the participant. These results support the use of visual scaffolds to assist students with ASD in understanding the learning presented in inclusive classrooms.

QUESTION 5 On a scale of 1 – 10, compared to other students, how would you rate [participant's name] ability to understand new classroom topics or concepts? (1 = very poor and 10 = excellent).

Table 8.25.5 Table showing results for Question 5 of the Parent and Teacher Questionnaires

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	3	7	7	8
Jane	2	5	1	3
Connor	3	5	2	6
Luis	5	5	2	5
Rhys	5	7	3	6
Stewart	7	9	5	6
Danielle	7	9	5	9
Jack	6	9	6	7
Average	4.7	7.0	3.8	6.2

The following features of the results support the hypothesis that use of a scaffold assists students with ASD to achieve better understanding of classroom learning results,

- The averages of the post-study results are greater than the averages of the pre-study results.
- With one exception, each post-study result was greater than the corresponding pre-study result. In the case of Luis, the parent results remained the same across the study.

QUESTION 6 On a scale of 1 – 10 how would you rate [participant's name] engagement with classroom learning? (1 = very poor and 10 = excellent).

Table 8.25.6 Table showing results for Question 6 of the Parent and Teacher Questionnaires

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	5	7	7	8
Jane	3	4	1	3
Connor	1	3	2	4
Luis	6	6	2	7
Rhys	3	5	3	5
Stewart	7	9	6	7
Danielle	8	9	5	9
Jack	7	8	8	6
Average	5.0	6.3	4.2	6.1

The following features of the results support the hypothesis that use of a scaffold assists students with ASD to achieve better engagement with classroom learning,

- The averages of the post-study results are greater than the averages of the post-study results.
- One of the post-study results was less than the corresponding pre-study result and in one case the results were the same. The remaining post-study results were all greater than the pre-study figures.

The results for Luis present an interesting comparison between the parent and teacher responses. The pre-study and post-study parent results for Luis were the same. However, the post-study teacher results showed an increase of five points over the pre-study results from two points to seven. This increase was the largest of any increase between any of the pre-study and post-study results. Two possible explanations for these results are that the teacher has a more accurate idea of the student's engagement with classroom learning and secondly that responses to questionnaires rely on an individual's perception or interpretation of the concepts within the questions.

QUESTION 7 On a scale of 1 – 10 how would you rate [participant's name] enjoyment of classroom activities? (1 = very poor and 10 = excellent).

Table 8.25.7 Table showing results for Question 7 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	9	10	7	8
Jane	3	7	1	5
Connor	4	7	3	8
Luis	7	8	4	7
Rhys	7	9	3	5
Stewart	7	10	7	9
Danielle	9	9	5	10
Jack	7	9	6	8
Average	6.6	8.6	4.5	7.5

The following features of the questionnaire responses are consistent with participants enjoying classroom activities more, when learning is supported by use of a scaffold. In the following assessments changes of one or two points have been interpreted to indicate a weak correlation with the effects of the use of a scaffold,

- none of the post-study scores were less than the pre-study scores

- the averages of the post-study scores were greater than the averages of pre-study scores for both parent and teacher responses

- both parent and teacher responses for participants Jane and Connor, were consistent in showing an increase in classroom enjoyment over the period of the study.

- for participants Luis and Danielle teacher responses showed an increase in classroom enjoyment, even though corresponding parent responses showed no increase.

QUESTION 8 On a scale of 1 – 10 how would you rate [participant's name] engagement with other students? (1 = very poor and 10 = excellent).

Table 8.25.8 Table showing results for Question 8 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	2	7	6	8
Jane	3 Lacks confidence. Just follows	6	1	3
Connor	7	4	2	7 Now using peer's names.
Luis	7	7	2	5
Rhys	7	9	4	8
Stewart	8	10	6	8
Danielle	8	8	5	9
Jack	3	9	3	6
Average	5.6	7.5	3.6	8.7

The following features of the parent and teacher responses were consistent with participants engaging more with other students when learning was supported by use of a scaffold. This is consistent with greater participant enjoyment of learning especially as the modern syllabus, at times, requires students to engage by way of group presentations of academic work,

- the averages of the pre-study scores were greater than the averages of post-study scores for both parent and teacher responses,
- for participant Connor, the teacher response indicated an improvement with a comment that Connor was now able to use names of his peers when he addressed them (even though the parent response indicated a drop in engagement with peers between pre-study and post-study results),

- Teacher responses for participants Rhys, Danielle and Jack all showed an increase in score of three points or more (from a total of ten) between the pre-study and post-study results.
- Increases of two points or less have been taken to indicate a weak correlation with the positive effects of the use of a scaffold.

QUESTION 9 On a scale of 1 – 10 how would you rate [participant's name] enjoyment of morning tea and lunch sessions? (1 = very poor and 10 = excellent).

Table 8.25.9 Table showing results for Question 9 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	3	7	6	8
Jane	5	9	7	7
Connor	4	6	2	8
Luis	7	8	2	5
Rhys	9	9	10	10
Stewart	6	9	6	9
Danielle	3	5	6	10
Jack	3	8	5	8
Average	5.0	7.6	5.5	8.1

The increase in average score between pre-study and post-study results, for both parent and teacher responses regarding the participants' enjoyment of recess and lunch breaks, was consistent with the results that the participants were more comfortable with their situation, including their classroom learning when supported by use of a scaffold.

QUESTION 10 What does [participant's name] enjoy most about school?

Table 8.25.10 Table showing results for Question 10 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	The reading	The reading and drawing from the scaffolds.	Dress ups.	Art and craft.
Jane	When she gets a sticker for correct work.	Rewards in class for correct answers.	Play time.	Play time
Connor	Social connections.	Friendships.	Point system. Hands on activities.	Social. Concrete hands on.
Luis	The structure of the school day	The pictures in his favourite topics.	Sport when we have soccer.	The pictures on the scaffold.
Rhys	Planting seeds. Indian foods	His friends.	Drawing. Comic book stories.	Playing with friends.
Stewart	His friends. Sense of achievement.	All learning activities.	Reading, ICT, Games	Reading, drama, numeracy, ICT tasks.
Danielle	She loves learning and playing with her friends.	Playing with her friends.	She likes working in class when all is calm.	Understanding the work and positive feedback.
Jack	His friends. Computer work.	He loves the library.	Very interested in computer tasks – does not wander	Computer work and friends.

Parent and teacher responses to Question 10 covered one or more of three areas: learning, friendship and concrete measured feedback about learning such as stickers, rewards, point system and daily structure. The scaffold was designed to support classroom learning and hence enjoyment of learning.

QUESTION 11 What does [participant's name] not enjoy about school?

Table 8.25.11 Table showing results for Question 11 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	When she has no one to play with.	Enjoys everything.	Happy in all activities.	A happy student.
Jane	When she is overwhelmed with information.	When the lesson moves too fast.	Classroom work	Tasks that require more thinking and comprehension.
Connor	Getting here. He wants to play on the computer at home.	Getting ready and getting here.	Pen and paper tasks. Abstract things.	Reading groups. Pen and paper tasks.
Luis	Drama. Role play.	Anything abstract.	Any abstract topics.	Topics where there are no pictures.
Rhys	The physical act of writing and the content.	Having to get ideas on paper.	Sitting still.	Completing written tasks.
Stewart	The noise factor when a teacher raises their voice.	Swimming lessons	When he has no close friends to associate with.	Being moved away from his friend.
Danielle	When someone is mean to her – not very often	When she does not understand some work it upsets her.	Dislikes noise.	Dislikes noise and messy art work.
Jack	Pushing, joking – he does not understand.	Having to get all the written work done.	Jack dislikes the sun. He won't sit in full sun.	Anything perceived as boring.

Both parent and teacher responses to Question 11 indicated that participants were uncomfortable when the work was difficult, not understood, accompanied by a time pressure, abstract in nature or when the student did not understand accompanying social interactions. The scaffold was designed to assist participants in overcoming these difficulties by specifically listing key vocabulary and concepts with associated pictures.

QUESTION 12 What would help [participant's name] enjoy school more?

Table 8.25.12 Table showing results for Question 12 of Parent and Teacher Questionnaire

	Parent		Teacher	
	Pre-Study result	**Post-study result**	**Pre-Study result**	**Post-study result**
Julia	The social thing.	Fun club – establishment of a peer group.	A playground friend.	More hands on. Loves art
Jane	To understand the work. Be more confident.	To understand the Maths. It is hard.	To be able to understand the work so can work independently.	Scaffolds for each topic.
Connor	If he can grasp more information	Couldn't do more.	Looking at topics he relates to.	Continue scaffolds.
Luis	No changes to timetable.	More work on social skills.	Going through work before the class lesson.	Scaffolds with clear pictures.
Rhys	Increase academic level and confidence	Increase ability to get ideas on paper.	Hands on creative activities.	Improved concentration skills.
Stewart	More social skill practice.	More social skills because frustrated if others not engaged.	ICT learning tasks.	Challenging tasks. Use of ICT in learning.
Danielle	When she is accepted by everyone without judgement.	Not to be in class with ….. lowers her self-esteem.	A quieter classroom. Group work is too noisy.	Scaffolds for every topic so she understands the work.
Jack	Invitations. Social opportunities.	Friendship is important.	More understanding of topics to assist in group work – difficult for Jack to join in.	More knowledge around language and word meanings. Needs scaffolds.

The responses to question 12 presented an interesting comparison between the parent and teacher perspectives. Of the eight participants, five of the parent responses mentioned social factors as helping their child enjoy school more. Only three parental responses mentioned academic factors. In comparison, teacher responses were mostly related to academic factors. In their post-study responses, teachers specifically mentioned use of a scaffold as helping school enjoyment for five of the eight participants. For participant Danielle, noise and a quieter classroom were given as a response in the pre-study

questionnaire but the scaffolds were mentioned as needed for every topic in the post-study response. This was consistent with the hypothesis that use of a scaffold by students with ASD will increase their academic achievement and hence their enjoyment of school.

8.26 Results of Participant Questionnaires

This section presents the results and discusses the responses to questionnaires completed by the participants in the study. Participant questionnaires (Appendix 8) were completed before the study began and again after all research work had been completed. The questionnaires sought to gauge participant perspective on the effectiveness of the use of the scaffold and each participant's perspective about his/her understanding of new classroom topics or concepts and their engagement with classroom learning.

QUESTION 1. When the teacher was telling the class about name of topic, did you understand what she was telling you?

Table 8.26.1 Table showing answers to Question 1 provided by study participants.

	Pre-study questionnaire results.	Post-study questionnaire results.
Julia	No	Yes – I know all of it from the pictures on my scaffold.
Jane	No	Yes. The pictures help me.
Connor	Just a tiny bit - about ants	The pictures showed me what was going on. Pictures help me remember.
Luis	Transport – No. Magnets – Not really. Volume – last week – No	Spiders – yes. On the scaffold the pictures.
Rhys	No. There were too many things, diagonal, pentagon, rhombus – I don't know.	Yes – I had it written down on the scaffold and pictures.
Stewart	Yes. Australian aborigines. They kept on moving.	Yes I had the words and pictures in all of my brain.
Danielle	No and it was hard to ask questions because it's too long to say.	The first time I did exposition, it was hard for me, but when I read my scaffold every day I started to get the hang of it.
Jack	Not much or any.	I understand because it is on my scaffold.

All participant responses, prior to the study, indicated very poor comprehension of the classroom topic. In post-study responses, each participant indicated a marked improvement in topic understanding and every participant attributed this improvement to use of the scaffold.

QUESTION 2. The teacher told the class about name of topic. Can you tell me the most important thing you learnt about name of topic?

Table 8.26.2 Table showing answers to Question 2 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	Recited repetitive section by rote.	Described all the key concepts.
Jane	It means … I don't know.	Listed all key information about insects.
Connor	I don't know.	The three pictures helped me know the important things – outlined key information about bees.
Luis	The transport locks and won't be open.	Spiders – Described key information on the scaffold.
Rhys	The culture of China – I don't know.	Rhys talked about the key words and concepts about *Animals in the Wetland Environment*.
Stewart	The aborigines kept moving around and around. No details of topic.	Stewart outline the key information about *Fractions and Decimals* as listed on the scaffold.
Danielle	Volume and Capacity. We learnt how much is litres and millilitres. How much is the size.	Exposition on *Why we should not waste water*. Danielle described the main concepts based on the scaffold.
Jack	I don't know any more.	Jack explained all the key concepts as listed on the scaffold.

Question 2 required each participant to describe an important concept that the teacher had presented. Prior to the study, none of the participants was able to accurately describe a concept that they had learnt. Post-study, every participant was able to describe key concepts as listed on a particular scaffold.

QUESTION 3. When the teacher told the class about name of topic. She used the words 1…, 2 … 3 …. What do the three words mean?

Table 8.26.3 Table showing answers to Question 3 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	No	Yes. I have the pictures.
Jane	I don't know.	Jane gave correct meaning for habitat, climate and survive.
Connor	I don't know. It is confusing.	Habitat – where they live. Diet – what they eat. Label – the part you need to describe.
Luis	I have some volume at home – when you want to hear very well.	Luis gave correct meaning for spinnerets, abdomen and fangs.
Rhys	I don't know.	Yes. Rhys explained bamboo, monsoon and cockerel. I have drawn them from my scaffold.
Stewart	It was confusing. Terra nullius – I forgot, transportation means moving vehicles.	Stewart defined fulcrum, lever and inclined plane very clearly.
Danielle	Wetlands – Amphibians, marshes, ecosystem – I don't know what they look like.	Animals in the wetland – amphibian, mammal, incubate – Danielle explains the definition from the scaffold.
Jack	Ecosystem – where birds are helping to get some food. Fauna – animals. Species – I don't know.	Jack explained meanings of marine, hectare and midden.

In question 3, the participants were asked to define three key words used by the teacher in outlining the topic information. Prior to the intervention, some of the participants were able to define three key words. After the intervention, all of the participants were able to define three key words. They based their definitions on scaffold information.

QUESTION 4. What would make it easier for you to understand what you are learning in the classroom?

Table 8.26.4 Table showing answers to Question 4 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	I don't know.	I will use my scaffold.
Jane	I don't know.	I need a scaffold every time.
Connor	Pictures that are like interesting help me remember.	The hand was a bit tricky. Information Report – those two words are tricky. I don't like writing Information Reports.
Luis	I need a new 'i', 'u' and 'j'	The pictures show me.
Rhys	There is too much so I don't know.	I need the pictures. They tell me the answers.
Stewart	When I don't have to do it all in three or four minutes.	If I have a scaffold for each topic, it's easier because it's written down.
Danielle	It is kind of confusing when I change from one topic to another topic.	I get more information from the scaffold. I need more information when I talk about it with other children.
Jack	Knowing the questions before the lesson starts.	If the information is on the scaffold, I can understand what it says. If the teacher says it too fast and it's not written down, I don't know what the teacher is saying.

Question 4 focused upon participant perspective as to which adjustment or strategy would make classroom learning easier. Prior to the study, responses drew attention to the amount of material to be learned, classroom pace, difficulty changing from one topic to another and having an overview of the learning prior to classroom instruction. Post-study, all responses referred either to the valuable role of the scaffold or of the pictures on the scaffold.

QUESTION 5. When the teacher tells you new things, how well do you understand what she is telling you? Show me on your scale that goes from 1 to 10.

Table 8.26.5 Table showing answers to Question 5 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	6	7
Jane	2	4
Connor	4	10
Luis	2	4
Rhys	1	5
Stewart	4	7
Danielle	1	6
Jack	1	6
Average	2.6	6.1

The individual responses from participants all indicated an increase in understanding after having used the scaffolds in the classroom. Connor's assessment was that his understanding had increased by six points from a total of ten following the use of the scaffold. Danielle and Jack indicated that their understanding had increased by five points out of ten. The averages of all responses show an increase of 3.5 points (from 2.6 to 6.1). None of the responses indicated that classroom understanding was reduced following the use of the scaffold.

These responses are consistent with the hypothesis that use of the scaffold increases classroom understanding.

Increases of two points or less have been taken to indicate a weak correlation with the positive effects of the use of a scaffold.

QUESTION 6. When the teacher gives you work, do you understand what you have to do?

Table 8.26.6 Table showing answers to Question 6 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	6	6
Jane	1	2
Connor	1	9
Luis	2	3
Rhys	1	3
Stewart	5	8
Danielle	3	7
Jack	1	8
Average	2.5	5.7

With the exception of Julia, all participants reported an increase in understanding of teacher's instructions following the use of a scaffold throughout the study. It is noted that Julia was the youngest participant and in Kindergarten at the time of the study. Connor and Jack reported increases of eight and seven points respectively between the pre-study and post-study results. None of the participants' responses indicated a reduction in ability to understand the teacher's instructions. The averages for all responses showed an increase of 3.2 points (from 2.5 to 5.7). Increases of two points or less have been taken to indicate a weak correlation with the positive effects of the use of a scaffold.

These responses are consistent with the hypothesis that use of the scaffold increases classroom understanding.

QUESTION 7. Is school fun when you are learning in the classroom?

Table 8.26.7 Table showing answers to Question 7 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	Yes	Yes
Jane	Not really	Sometimes
Connor	No	Yes
Luis	Yes. Everything is quiet.	Yes
Rhys	Yes, sometimes.	Yes – I like to draw my own pictures from the scaffold.
Stewart	Maybe – it matters what we are going to do.	School is not actually fun – just a bit.
Danielle	Yes only a little bit.	Yes – I like Maths. The *Capacity and Volume* scaffold helped a lot.
Jack	Yes, sometimes. It is a little bit boring to come to school and do some work and Maths and English.	When I read the scaffold before the lesson it is fun because I know it is about.

Question 7 sought to gauge participant perspective of their own enjoyment or lack of enjoyment of classroom learning. Three participants – Rhys, Danielle and Jack – stated that the scaffold added to their enjoyment of learning.

QUESTION 8. Do you play with other students at morning tea and lunch? What games do you play?

Table 8.26.8 Table showing answers to Question 8 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	Oh no.	Not much.
Jane	Not much	Yes. Can't remember
Connor	No, I don't have someone to play with.	Yes – I made a friend. Play tag or star wars.
Luis	You can't take the golf clubs because it is too dangerous.	I play soccer.
Rhys	Yes, I play Leggo.	I play Leggo with Connor and some other friends.
Stewart	Sometimes on the equipment or other things.	Most times – Zoob at Lunch Club.
Danielle	It is hard. I don't know what to play.	I play handball and sometimes tip with my friends.
Jack	Yes or I walk on my own.	Yes, with my friends. We play cops and robbers.

Question 8 focused upon, firstly whether there was social connection between the participant and his/her peers on the playground and secondly what activity or game facilitated this connection. Four participants mentioned playing social games with a friend or friends during playground breaks.

QUESTION 9. Is school fun for you at lunch time when all the children are playing in the playground? What makes it fun/not fun?

Table 8.26.9 Table showing answers to Question 9 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	Yes	Sometimes it is sad when you have to go home.
Jane	Yes. I play with my friends.	Yes. I have three friends.
Connor	No – I feel sad because I don't have any friends.	Yes. You get to play everything you want to play.
Luis	Yes – but I won't get a school big enough.	Sometimes it is very loud.
Rhys	Sometimes Miss says I have to finish my work.	Yes because we play games that we like.
Stewart	Yes, a bit. Matters what game.	Only when people play with me. Sometimes they play with me.
Danielle	Yes, it is fun when they play fair.	Yes – playing on the equipment with my friends. It is a little bit exhausted.
Jack	Playing with my friends is fun. Playing rough is not fun. I race Nicole and Ben. I cried because I lost.	Yes. Playing with my friends. I play carefully.

Question 9 focused firstly upon each participant's enjoyment or lack of enjoyment of playground social time and secondly, those elements which made lunch time either fun or not fun. Results indicated that lunch time on the school playground could, at times, be difficult for most of the participants. Areas of difficulty included not having friends, the choice of game and play which was rough or not fair. Several participants linked having fun on the playground to their having a friend or friends.

QUESTION 10. What do you enjoy most about school?

Table 8.26.10 Table showing answers to Question 10 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	I don't know.	I know the teachers.
Jane	Playing.	When I play with my friends.
Connor	When I first came here.	There's no bullies and you don't have to do much homework.
Luis	Sport – Soccer. But I don't play soccer.	I like to go home.
Rhys	I like Pirate Lego.	I like to draw and do my stories.
Stewart	Fun Club and getting to see my friends.	Computer work and playing with my friends.
Danielle	Playing with my friends.	I like Maths, Art and Music.
Jack	Fun Club that's all.	Sometimes it is fun with my friends.

In both the pre- and post-study questionnaires three of the participants nominated friends as the key element to enjoying school.

Questions 8, 9 and 10 focused on the nature and quality of playground socialisation experienced by each participant. Social interaction and the issue of friends was perceived by each participant as being very important. Social interaction was an important aspect of this study because curriculum requirements place social demands on students such as when they must share learned information with their peers. Questions 8, 9 and 10 focused on social interaction outside the classroom and provided an indication of participant perspective of the importance of playground social to their enjoyment of school life.

QUESTION 11. What do you do at school that you do not like?

Table 8.26.11 Table showing answers to Question 11 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	No class.	I don't think of any.
Jane	Work that is hard.	When there are words I don't know.
Connor	No friends.	When I have to write a story.
Luis	I need to go home for a long long time.	It is too much noise sometimes.
Rhys	I do not like it when I miss out on playing Leggo.	I do not like it when I don't have a scaffold and the teacher talks and talks.
Stewart	Wet weather – it is too noisy. Doing lots and lots of work.	When you have to do lots and lots of work in three or four minutes.
Danielle	Sometimes I do not really have friends. Just all by myself. Then I play on my own.	Sometimes there are soccer balls and footballs and they are around me and they are about to hit me.
Jack	I don't like it when children play rough or are hitting.	I don't like it when the teacher is talking and talking and I don't have a scaffold. I need it written down.

Question 11 sought out any school activity that the participant did not like. Four out of the eight pre-study responses nominated social interaction that was not going well as a source of discomfort. In comparison, four out of the eight post-study responses nominated as difficult issues those related to learning such as the amount of teacher talk, the pace of classroom work and vocabulary which the participant does not understand. The scaffold was specifically designed to address these issues for students with ASD.

QUESTION 12. What can I do so you will like school even more?

Table 8.26.12 Table showing answers to Question 12 provided by study participants.

	Pre-study questionnaire results	Post-study questionnaire results
Julia	No.	I don't know.
Jane	More time to play.	I like the scaffolds. They make it easier for me.
Connor	When I get an award.	More Fun Club. When I play with my friends.
Luis	Soccer	Play soccer with my friends.
Rhys	More Leggo – time	The scaffolds are good. I can read it and the picture is in my head.
Stewart	Put Fun Club on more days – every day.	When I have a scaffold it helps me do all my work and I am fast.
Danielle	To play games with someone.	If there is pictures of things that I understand.
Jack	Tell the teacher when someone is doing a bad thing.	I need the writing and the pictures on the scaffold. The picture shows me how it looks like. In Maths, I don't know how the shapes look like if I don't have it – the picture.

Seven of the eight post-intervention responses to question 12 emphasised the scaffold, with its writing and pictures, and interaction with friends as the two main elements which would result in the participant liking school even more.

9 Case Studies

This chapter presents case studies for each of the eight participants involved in the research. The description and data that is presented covers the participant's particular diagnosis; pre- and post-test scores measuring the participant's level of language abstraction based on the PLAI-2 assessment; an analysis of the teacher's instructional language against the four levels of language abstraction used in the PLAI-2; a pre- and post-intervention, norm-referenced measure of the participant's receptive and expressive vocabulary; an evaluation of the participant's ability to retrieve words from memory and comment regarding the participant's change in both receptive and expressive skill level over time. Receptive vocabulary was measured using the PPVT-4 scale. Expressive vocabulary was measured using the EVT-2.

Word retrieval was evaluated by comparing expressive and receptive vocabulary skills using standard score differences between the EVT-2 and the co-normed PPVT-4. Measurement of change over time was facilitated by the test-retest research model. An additional measurement of change over time was applied to the participant's level of engagement with classroom learning.

The discussion of the data which were collected pre- and post- the intervention, was then linked to and compared with the descriptive information which was obtained as a result of pre- and post- parent, teacher and participant questionnaires. The data and descriptive information were then linked to the individualised design of scaffolds, across different curriculum topics, for the particular research participant. The case studies are presented in the age order of the participants. The age of each participant was their age at the commencement of the pre-intervention assessments.

The examiner's manual for Blank et al.'s PLAI-2 assessment instrument provides the conversion of subtest raw scores to percentile ranks and scaled scores only until age five years and eleven months. Children with ASD have delayed language development. This researcher has therefore used the conversion table for ages 5.8 through to 5.11 to convert subtest raw scores to percentile ranks and scaled scores for the student who was older than 5.11 years. Although no longer a standardised measure it does indicate change across the time period pre and post the intervention. Only one participant, Julia in Kindergarten, meets the 5.11 criterion but only for pre-intervention test results. Similarly, the table which sets out the conversion of subtest raw scores to age equivalents caters only until

age five years. This researcher has therefore used the 3 – 5 years columns for the matching and selective analysis scores conversion and the 4 – 5 years columns for reordering and reasoning scores conversion. These age equivalent scores have provided an indication of change across the time period pre and post the research intervention.

9.1 Case Study for Julia

At the beginning of the study, Julia was a five year old Kindergarten student who attended an inclusive primary school in Sydney. She had one brother, two years older, who was also a participant in the study.

At the age of two years, Julia was not using any words. Her parents were concerned by the delay in her language development and Julia commenced Speech Pathology intervention. The intervention worked on her speech sounds and shortly after beginning Speech Pathology, Julia uttered her first words.

At the age of two years and three months Julia was assessed by a clinical Psychologist and Paediatric Registrar at the Disability Specialist Unit at the Children's Hospital at Westmead in Sydney. Her parents were concerned about her poor language skills and her inability to interact socially with either adults or her peers. A Psychometric Assessment was administered using the Griffiths Mental Development Scales. The results of this assessment indicated a mild global developmental delay. Across the developmental area, the assessment indicated that Julia had relative strengths in her fine motor and gross motor skills and relative weakness in the areas of language, self-help skills and socialisation. Julia's presentation was considered to be consistent with a diagnosis of autism.

At the age of three years, Julia began to receive intensive behaviour therapy (ABA) at a child health and development treatment centre in Sydney which focused upon intervention programs for children with autism. A team of two therapists provided an average of six hours of one-to-one treatment each week. The goal of this program was to improve Julia's skills in the areas of play, socialisation, language, conceptualisation and self-help.

At the age of four years and two months Julia's progress was reviewed at the Disability Specialist Unit at the Children's Hospital, Westmead. The Griffiths Mental Developmental Scales were administered again. Julia's overall skill level fell in the mild developmental delay range. In contrast to the previous assessment which showed a fairly

even developmental profile, there was then evidence of a marked strength in Julia's non-verbal problem solving skills. These skills were developing within age expectations. Julia demonstrated relatively stronger skills in the fine motor and gross motor areas. However, she continued to demonstrate delays in the areas of social skill, practical reasoning and language development.

At the age of four years and ten months, Julia had a formal speech pathology assessment. The Clinical Evaluation of Language Fundamentals – Pre-school (CELF-P2 Australian) was administered. Julia's CELF-P index scores are set out in Table 9.1.1 below.

Table 9.1.1 Table showing CELF-P Results for Julia Aged Four Years and Ten Months

CELF-P Index Scores	Standard Score	Percentile Rank	Interpretation
Core Language Index	63	1	Severe Delay
Receptive Language Index	60	0.4	Severe Delay
Expressive Language Index	61	0.5	Severe Delay
Language Content	58	0.3	Severe Delay
Language Structure	63	1	Severe Delay

The Receptive Language Index is a cumulative measure of a student's receptive aspects of language including comprehension and listening skills. The Expressive Language Index is a cumulative measure of the expressive aspects of language including oral language expression. Language Content is a cumulative measure of semantic knowledge.

Julia was identified as having a severe receptive and expressive language delay. Her CELF-P scores placed her language development, receptively and expressively, at a level which was below the first percentile.

For one year prior to beginning school, Julia attended preschool for four days each week. Half way through the preschool year, staff at the preschool reported that Julia had mastered the names of colours, shapes and numbers. Socially, it was noted that Julia played alongside other children but needed support to initiate play. In the area of language skills, it was noted that Julia needed to have information and instructions

repeated several times. During this preschool year, Julia continued to receive home-based ABA as well as support or shadowing at the pre-school setting. Much of this support was language based. At the end of the preschool year, Julia was able to count to 100; count with correspondence; understand numerical concepts such as more/less and big/little; identify and write her name.

At the age of four years and eleven months, Julia had a medical and psychological review prior to beginning Kindergarten. The review was carried out by the Paediatric Registrar and the Clinical Psychologist at the Disability Specialist Unit of the Children's Hospital, Westmead. A cognitive assessment was completed using the Wechsler Preschool and Primary Scales of Intelligence – 3rd Edition (WPPSI – III). Julia's performance, on this occasion, indicated a significant discrepancy between her scores in the Verbal subtests which scored at the upper end of the mild disability range and the Performance Scales which were in the average range.

The results of this latest review of Julia's cognitive abilities had important implications for the understanding of Julia's academic and communication needs within the school setting. The report recorded Julia's strength in understanding information presented visually. It recommended the "use of visual supports at school and in preparation for Julia's transition to school such as visual schedules and social stories". The report expressed concern that "Julia's language difficulties will pose challenges for her in the classroom setting which often includes a significant verbal/spoken component".

Prior to the intervention phase of the study, both Julia's language and her teacher's classroom instructional language were analysed in terms of Blank et al.'s four levels of Language Abstraction. Table 9.1.2 below sets out Julia's pre- and post-intervention results for the PLAI-2.

Table 9.1.2 Table showing results of PLAI-2 Testing for Julia

Test: PLAI-2 – Preschool Language Assessment Instrument (2nd Edition)				
Participant : Julia				
Level of Language Abstraction	**Raw Score**	**Scaled score relative to age 5.11**	**Percentile Rank relative to age 5.11**	**Age Equivalent relative to age 5.11**
Pre-Intervention Test Results. Chronological Age: 5.11				
1. Matching	13	7	16th	3.9
2. Selective Analysis	8	4	2nd	3.6
3. Reordering	1	3	1st	2.9
4. Reasoning	5	4	2nd	3.9
Post-Intervention Test Results. Chronological Age: 6.6				
1. Matching	17	11	63rd	≥ 6.0
2. Selective Analysis	17	12	75th	> 6.0
3. Reordering	5	6	9th	4.3
4. Reasoning	14	13	84th	> 6.0

Table 9.1.3 below sets out the results of the analysis of the teacher's instructional language.

Table 9.1.3 Table showing analysis of Teacher's Level of Instructional Language for Julia

Matching	**Selective Analysis**	**Reordering**	**Reasoning**
4.7%	22.8%	53.5%	18.9%

The majority of the teacher's instructional language, 53.5%, was at the reordering or third level of language abstraction. This was Julia's weakest area of language abstraction. The PLAI-2 placed her performance in this area at the first percentile.

95.2% of the teacher's language was at the second, third or fourth levels of language abstraction. The PLAI-2 assessment placed Julia's performance in each of these areas at either the first or second percentile. An area of strength for Julia was the first level or 'matching perception' which was at the sixteenth percentile. However, only 4.7% of the

teacher's instructional language was at the 'matching perception' or first level of language abstraction.

In Julia's case there was a very wide disparity between the teacher's level of language abstraction and Julia's ability to comprehend language, based on Blank et al.'s (1978, 2003) four levels of language abstraction. This wide disparity suggested that Julia would have great difficulty comprehending the teacher's instructional language.

Julia's receptive language scores were measured using the PPVT-4 and her expressive vocabulary scores were measured using the EVT-2. Table 9.1.4 and Table 9.1.5, below, set out the scores for the PPVT- 4 and the EVT-2 as well as the analysis of any change in these test scores pre and post the intervention.

Table 9.1.4 Table showing PPVT- 4 Receptive Vocabulary Scores for Julia before and after topic testing

Results before classroom topic testing			**Results after classroom topic testing**		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
76	6.1	3.10	80	6.7	4.8

Table 9.1.5 Table of PPVT – 4 Receptive Vocabulary Results for Julia showing changes in parameters over the study period

Change in Standard Score	**Increase in Chronological Age (Months)**	**Increase in Age Equivalent (Months)**
4	6	10

In the six months between the pre and post assessment of Julia's receptive vocabulary skills, she made a gain of ten months calculated using age equivalent scores. Both pre and post intervention, Julia's receptive language scores were well below her chronological age. However, the increase in her age equivalent score was greater than the increase in her chronological age.

Table 9.1.6 Table of EVT- 2 Expressive Vocabulary Scores for Julia showing results before and after topic testing

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
81	5.10	4.3	80	6.7	4.8

Table 9.1.7 Table of EVT – 2 Expressive Vocabulary Results for Julia showing changes in parameters throughout the study period

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
-1	9	5

Prior to the intervention, Julia's expressive vocabulary score of 81 was higher than her receptive vocabulary score of 76. Following the research intervention, both scores were the same. In Julia's case, therefore, there was no indication of word retrieval difficulties either before or after the intervention. Rather, these scores suggested that for Julia the area of need was exposure to classroom topic vocabulary in order to increase the amount of vocabulary to which Julia was able to expressively respond.

This was reflected in both Julia's questionnaire responses prior to the intervention and in her scoring of zero out of ten on the classroom topic vocabulary testing prior to the intervention.

In the pre-intervention student questionnaire, Julia said she did not understand the story of *Mrs Wishy Washy*, even though she was able to accurately recite key repetitive sections of the story. "Look at you she screamed and in the tub you go said Mrs Wishy Washy and in went the cow wishy washy and in went the pig wishy washy and in went the duck wishy washy and they goed in the mud again. That is the end."

Julia's poor scoring in the classroom vocabulary testing prior to the intervention was not reflected in either the parent or teacher questionnaire responses prior to the intervention. The teacher rated Julia as having particular learning needs. However, she rated Julia's ability to understand new classroom topics as seven out of ten and her engagement with classroom learning as eight out of ten. When asked what led her to select these particular ratings, the teacher noted that "she needs to make sure her instructions are clear and

concise; Julia has a good understanding of most topics and she is usually well focused except when seated on the carpet".

In her remarks, the teacher has focused upon comprehension of instructions and the student's focus upon the teacher's actions rather than the student's comprehension of the curriculum material. Julia's mother rated her ability to understand new classroom topics as five out of ten.

In each of the graphs recording Julia's vocabulary testing, there was an increase in her test score of between three and seven points immediately after the intervention.

The final review of Julia's cognitive abilities, prior to her beginning school, recommended the use of visual supports such as visual schedules and social stories. There was no recommendation regarding support for Julia in her comprehension of curriculum topic material. The current study has focused upon this gap in support strategies. There were six visual scaffolds which were trialled as a means of increasing Julia's comprehension of classroom topic vocabulary.

For Julia, the six scaffolded curriculum topics were,

- Position (Maths)
- Mrs Wishy Washy (Story Comprehension)
- Communication – Looking at the Senses (HSIE)
- Recount Mrs Wishy Washy (English Text Type Writing)
- Living Things (Science)
- Information Report Emus (English Text Type Writing)

The six scaffolds are set out at the end of this section.

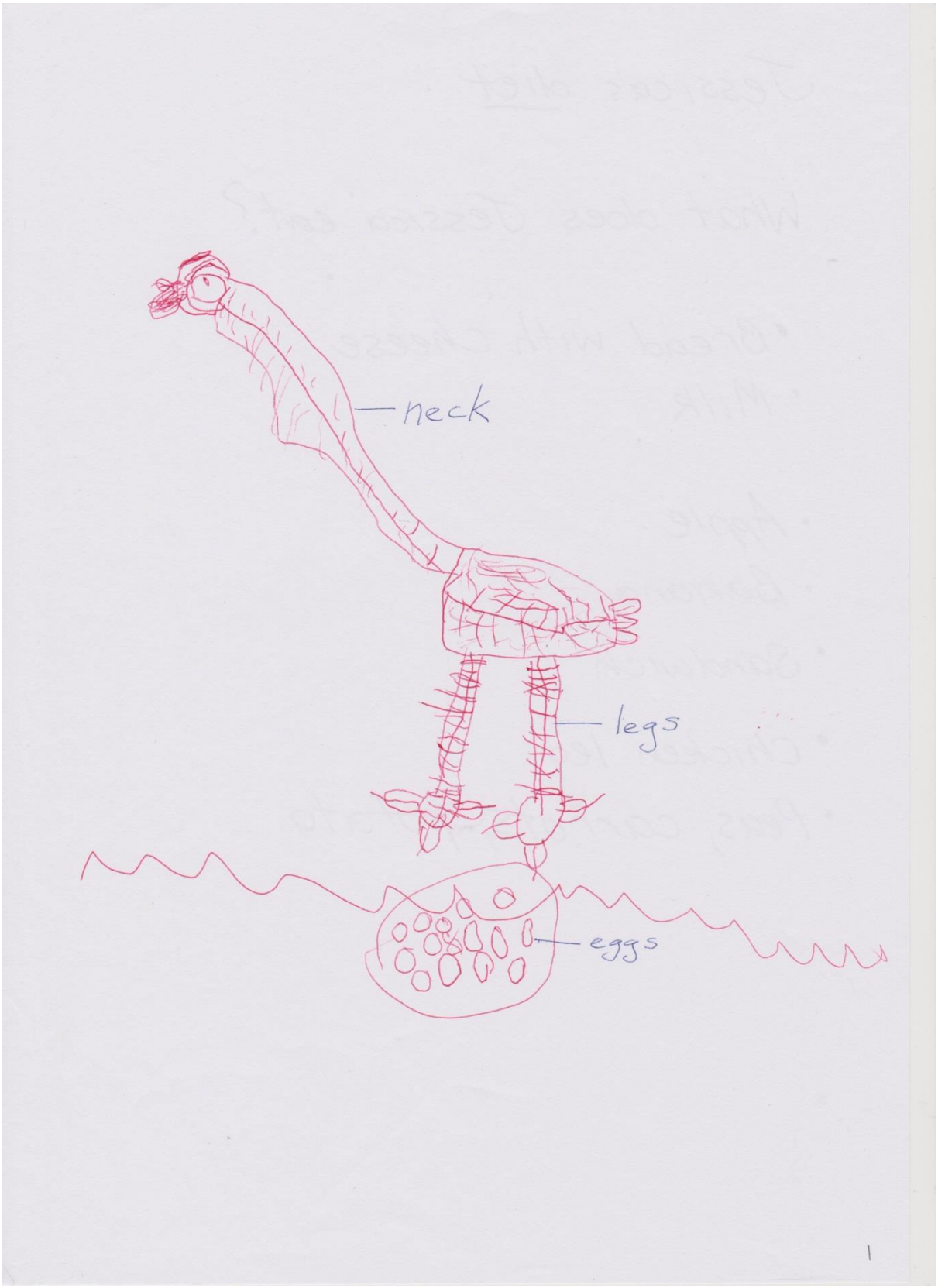
The focus was upon one scaffolded, curriculum topic at a time. Julia's strength in vocabulary comprehension was at Blank et al.'s first level of language abstraction – matching perception. This was reflected in the design of her scaffolds which focused on the single word label for things such as duck, tub, scarf and concepts such as diet or Information Report. The first scaffold focused on the concept of position and involved the use of manipulatives which were cut outs of a goose, a dog, a bird, a car, a bag, a book and the student in her school uniform. The second scaffold was based on the story of *Mrs Wishy Washy* by Joy Cowley. The emphasis of the scaffold was on 'matching perception'.

Julia was required to recall single word units such as ‘cow’, ‘pig’ or ‘tub’, discriminating one from the other and sequencing the order in which the animals placed themselves in the mud.

The scaffold involving the Recount of the Mrs Wishy Washy story required Julia to comprehend instructional language at Blank et al.’s third and fourth levels of language abstraction – reordering and reasoning. After learning the vocabulary meanings and application of words such as ‘recount’, ‘orientation’ and ‘conclusion’, Julia was then required to position that content within a set format that defined a ‘recount’. Julia found this topic very difficult until her individual sessions on the relevant scaffold.

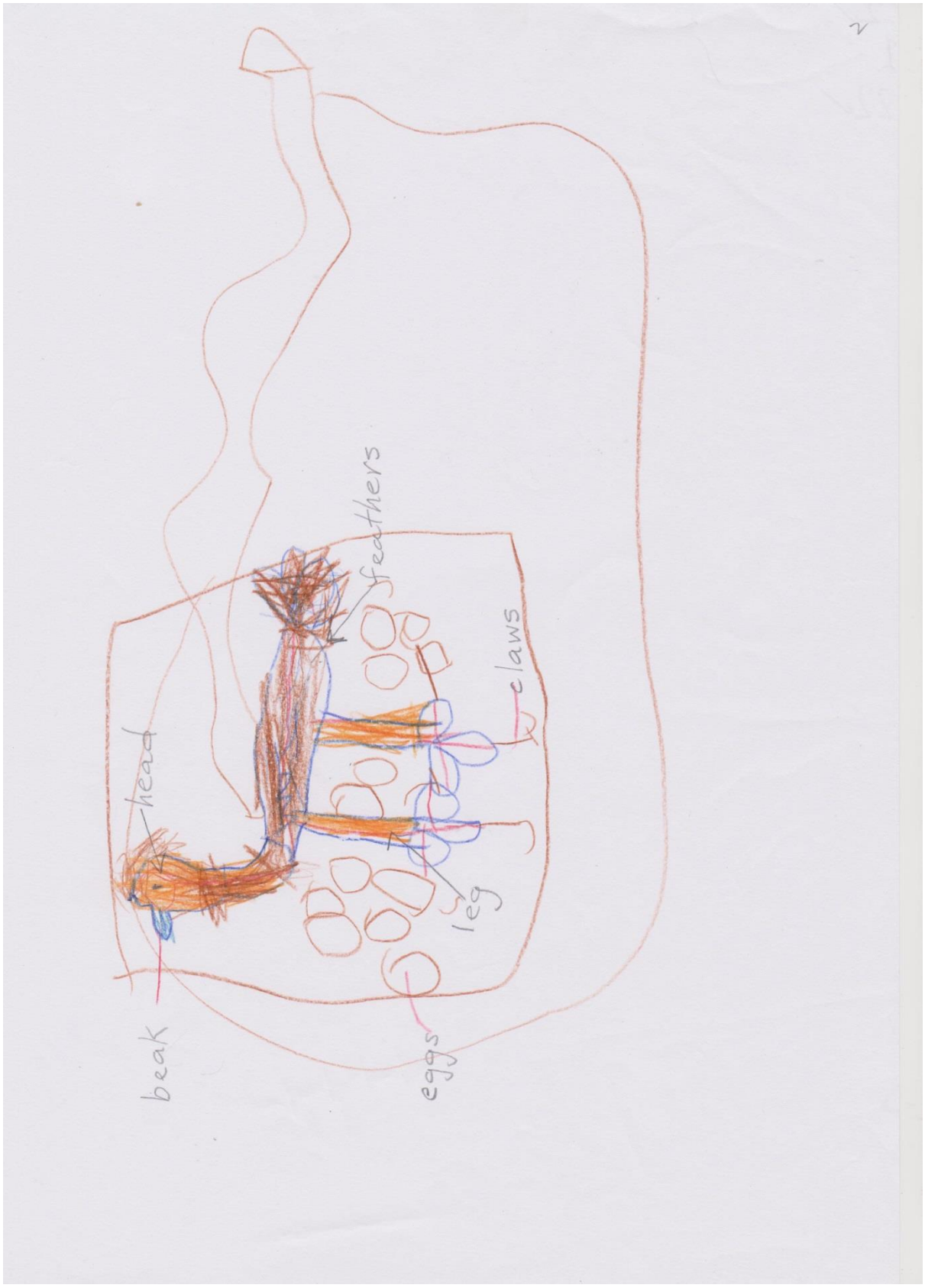
The Information Report on emus was particularly difficult for Julia. Structurally, the Information Report had five parts. This required her to manipulate the information learned about emus and place the facts under the correct heading. Having Julia’s five fingers represent the five text parts enabled her to manage what had been an overload of information.

Julia enjoyed using the scaffolds and began to request scaffolds for other class topics. When she was introduced to her first scaffold, Julia began drawing topic information for herself. Her labelling of these drawings focused upon Blank et al.’s second level of language abstraction – selective analysis. Drawing 9.1.1 below is Julia’s first drawing of an emu. In her second attempt, Drawing 9.1.2, more body parts are selected, a line is drawn to each item and Julia requested that the researcher record the written label of each part. Julia explained that her drawing, “put it in her head”.



Drawing 9.1.1 Julia's first drawing of an emu

Julia had just been given the scaffold on emus.



Drawing 9.1.2 Julia's second drawing of an emu.

Julia had been using the scaffold on emus for four days.

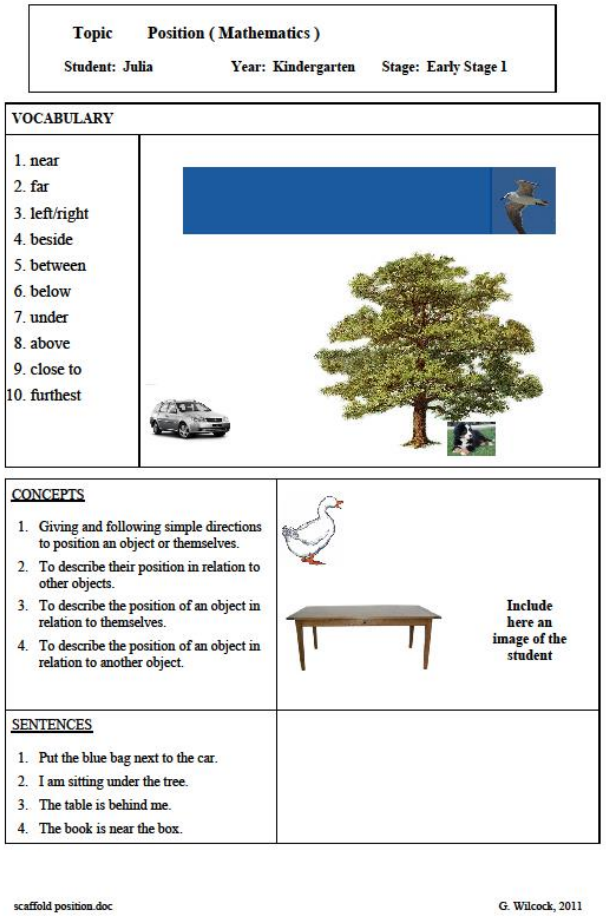


Figure 9.1.1 Scaffold – Position (Mathematics)

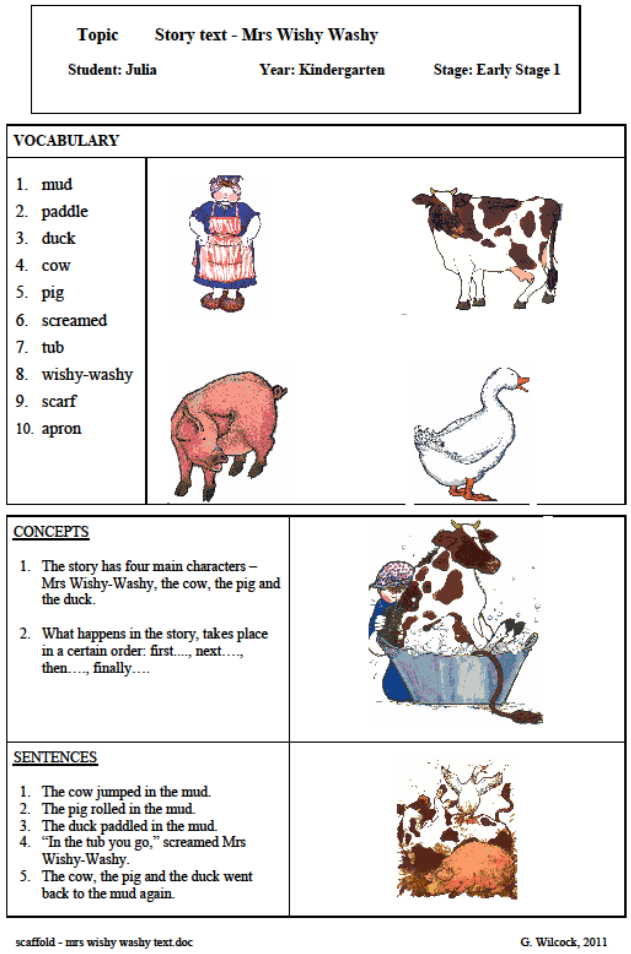


Figure 9.1.2 Scaffold – Mrs Wishy Washy (English)

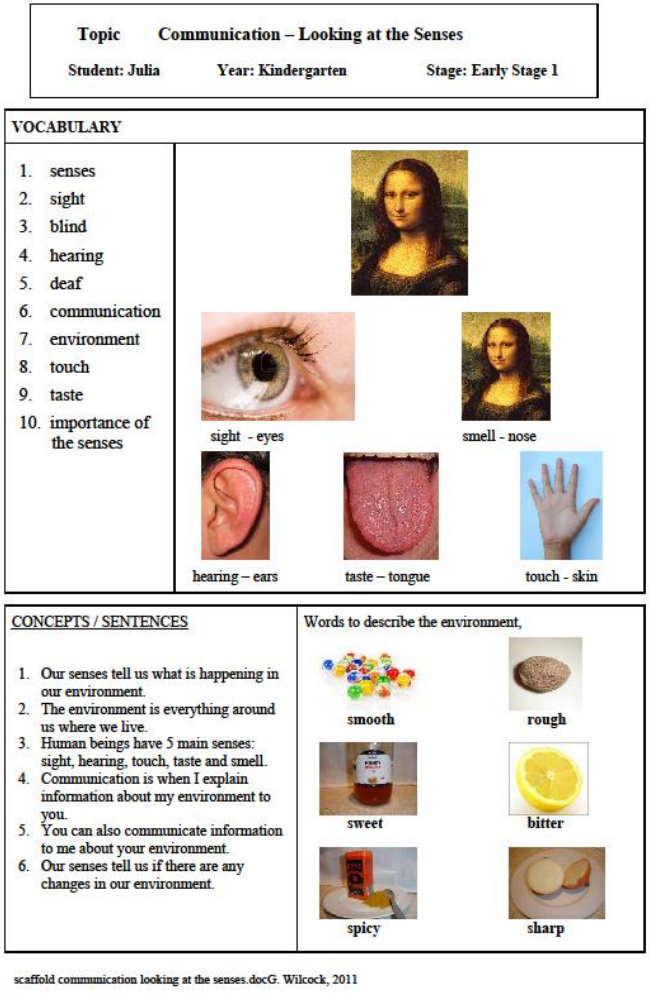


Figure 9.1.3 Scaffold– Looking at the Senses (HSIE)

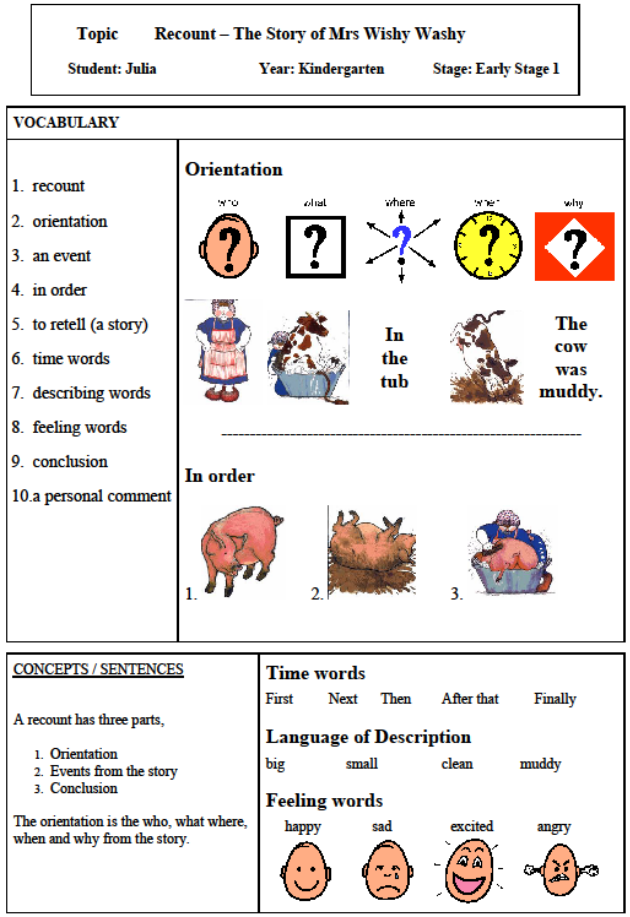


Figure 9.1.4 Scaffold– Mrs Wishy Washy Recount (English)

Topic Living Things

Student: Julia **Year:** Kindergarten **Stage:** Early Stage 1

VOCABULARY

1. living
2. non living
3. breathing
4. habitat
5. diet
6. mammals
7. reptiles
8. birds
9. fish
10. labels

Habitat


Bushland


Desert


Coral Reef

Diet


Native bushes


Grasshoppers

Mammals


horse,


whale,


lion

Reptiles


lizard,


snake,


crocodile

VOCABULARY

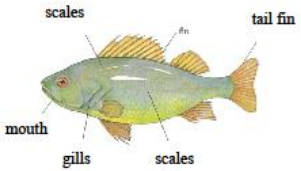
Birds


pelican


seagull


emu

Fish




bream

CONCEPTS / SENTENCES

1. In our world things can be living, like people and animals or non living, like rocks and water.
2. A thing that is living
   - eats
   - grows
   - breathes
3. Humans and animals breathe when they take air into their lungs.
4. Mammals are warm blooded, have hair, give birth to live young and feed their young.
5. Reptiles are cold blooded, they have scales and they lay eggs.
6. Birds are warm blooded, they have feathers and they lay eggs.
7. Fish are cold blooded, use gills to breathe and they lay eggs.
8. Habitat is where an animal lives.
9. Diet is what an animal eats.

Figure 9.1.5 Scaffold – Living Things (Science)

Topic **Information Report on Emus**

Student: **Julia** **Year:** **Kindergarten** **Stage: Early Stage 1**

VOCABULARY

information report
facts
introduction
appearance
diet
habitat
flightless
Information Report-5 parts
diagram
labels

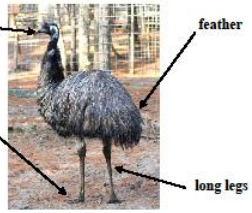


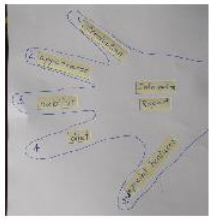
Diagram of an emu's body. The labels show the main parts.

CONCEPTS / SENTENCES

An information report on emus has 5 parts.

1. introduction – type of animal
2. appearance
3. habitat
4. diet
5. special features

1. **Introduction**
   Emus are birds.
2. **Appearance**
   Emus have,
   - Big brown feathers
   - A pointy beak
   - Two long legs
3. **Habitat**
   Emus live in bushland or near the coast.
4. **Diet**
   Emus eat insects and small plants. Also, grass, seeds and fruit.
5. **Special features**
   Emus cannot fly but they have long legs and can run very fast.



5 parts of an Information Report

An emu chick has black and white stripes on its back.

Figure 9.1.6 Scaffold – Information Report Emus (English)

Intentionally blank

9.2 Case Study for Jane

Jane was a Year 1 student who was aged six years and two months at the beginning of the study. When Jane began Kindergarten, at an inclusive primary school in Sydney, she found it very difficult to understand classroom instruction and engage with classroom learning. Social interaction with her peers was awkward for Jane. She also found it difficult to communicate with her teachers. After eight weeks in Kindergarten, both the school and Jane's parents sought a psychometric assessment because of the difficulties Jane was having both academically and socially. Prior to beginning school, Jane's vision and hearing had been assessed and found to be within normal limits. Jane was referred for a psychometric assessment in order to ascertain her learning potential and to assist with the planning of Jane's individual learning programme. Jane was administered eight subtests of the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-III). Jane's general cognitive ability was found to be within the borderline range of intellectual functioning with a percentile rank of three. Jane's general verbal abilities were in the borderline range and her general performance abilities were in the extremely low range. The psychologist recommended that Jane have a speech and language assessment because of her scores on the verbal comprehension tasks which were at the fifth percentile.

In the speech and language assessment, Jane presented with a mild receptive language delay, scoring at the fourteenth percentile, and a mild expressive language delay, scoring at the thirteenth percentile. The speech pathologist advised that Jane's difficulty with language comprehension and use would contribute to her ongoing difficulties with classroom learning.

After completion of the psychometric assessment and the speech and language assessment, Jane was assessed by a consultant paediatric physician as satisfying the DSM-1V criteria for autism. This was Jane's second visit to the paediatric physician. He had seen Jane twelve months prior to this visit because of parental concerns about Jane's learning and social development.

Table 9.2.1 below sets out Jane's pre and post intervention results for the PLAI-2. Table 9.2.2 sets out the results of the analysis of the teacher's instructional language.

Table 9.2.1 Table showing PLAI-2 Scores for Jane

Test: PLAI-2 – Preschool Language Assessment Instrument (2nd Edition)				
Participant : Jane				
Level of Language Abstraction	**Raw Score**	**Scaled score relative to age 5.11**	**Percentile Rank relative to age 5.11**	**Age Equivalent relative to age 5.11**
Pre-Intervention Test Results. Chronological Age: 6.2				
1. Matching	17	11	≥ 63rd	≥ 6.0
2. Selective Analysis	11	6	9th	4.6
3. Reordering	5	6	9th	4.3
4. Reasoning	6	5	5th	4.3
Post-Intervention Test Results. Chronological Age: 6.9				
1. Matching	17	11	≥ 63rd	≥ 6.0
2. Selective Analysis	14	9	37th	5.6
3. Reordering	7	7	16th	4.9
4. Reasoning	10	9	37th	5.6

* Jane achieved a perfect score in the matching test which placed her above the 63rd percentile. Jane's scaled score, percentile rank and age equivalent increased for each of the other levels of language abstraction.

Table 9.2.2 Table showing Analysis of Classroom Teacher's Instructional Language for Jane

Matching	**Selective Analysis**	**Reordering**	**Reasoning**
0.8%	20.2%	63.5%	15.5%

Table 9.2.3 to Table 9.2.6 below set out Jane's receptive vocabulary scores as measured by the PPVT-4; her expressive vocabulary scores as measured by the EVT-2; and the analysis of the change in these test scores pre and post the intervention.

Table 9.2.3 Table showing PPVT-4 Scores for Jane

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
84	6.2	4.11	85	6.9	5.5

Table 9.2.4 Table showing analysis of Change in PPVT-4 Scores for Jane

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
1	7	6

Table 9.2.5 Table showing EVT-2 Scores for Jane

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
81	6.2	4.6	82	6.9	5.0

Table 9.2.6 Table showing analysis of Change in EVT-2 Scores for Jane

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
1	7	6

Jane's receptive vocabulary score, both before and after the intervention, was higher than her expressive vocabulary score. This is typical of the wider population (EVT-2 Manual). There was, therefore, no indication of word retrieval difficulties.

For Jane, the six scaffolded curriculum topics were *Story text – The Frog and The Fly* (English); *Recount – The Frog and The Fly* (English – Text Type Writing); *The Honeybee* (HSIE); *Information Report on the Honeybee* (English – Text Type Writing); *3 Dimensional Space* (Mathematics); *What do Animals Need to Grow and Survive* (Science)? Jane's scaffolds are presented at the end of this section.

For Jane, the area of vocabulary need was the second level, selective analysis, because this level of vocabulary was at the ninth percentile for Jane, while her matching ability was at the sixty-third percentile. Jane's six scaffolds therefore focussed upon vocabulary which labelled selective aspects of a situation, object or concept.

The scaffold on the story text, *The Frog and the Fly*, focussed upon selective aspects of the story – the who, what, where and when details. The recount scaffold on *The Frog and the Fly* focussed upon the selective aspects which made up the parts of the recount – the orientation, events and conclusion. The specific aspects which make up the orientation for example – the who, what, where and when had already been emphasised in the scaffold on the text of the story. In the HSIE topic, *The Honeybee*, the focus included the three selective subgroups within the overarching honeybee category: queen bee, drone bee and worker bee. In addition, there was a focus on selective body parts of the honeybee such as the head, thorax, abdomen, antennae and six legs. The scaffold titled *Information Report on The Honeybee*, focussed on the five selective parts of an information report such as appearance, habitat and diet. The previous scaffold, titled *The Honeybee* focussed upon the selective body parts of the honeybee which then came under the heading 'appearance' within the Information Report scaffold. The mathematics scaffold, *3 Dimensional Space* focussed on the first two of Blank et al.'s four levels of language abstraction. Matching tasks such as identifying a cube, cylinder, sphere, cone or prism were followed by tasks requiring the participant to respond to selective aspects of the shape such as the faces or edges. In the scaffold, *What do Animals Need to Grow and Survive?* the classroom emphasis was on reasoning questions such as 'Why is a camel able to survive in the desert'? However, Jane's comprehension of vocabulary was only at the first of Blank et al.'s four levels of language abstraction. The emphasis within the scaffold was to provide the necessary information to enable Jane to progress to vocabulary comprehension at Blank et al.'s second level which was selective analysis.

These details are listed in the additional column, detailed vocabulary. These are the detailed aspects which explain for example the concept of survival in the desert, one of the ten items of general classroom vocabulary.

At the beginning of the study, Jane's inability to comprehend vocabulary at a level beyond 'matching' was recorded. For example, in the test questions for *The Frog and the Fly* scaffold, when asked "What is a log?" Jane answered

"A log is when you are sitting on a log."

This suggested that Jane was comprehending the word at the matching level but not at the selective analysis level which would have focussed on those attributes , which are required to define the word 'log' not simply to identify it. A matching level response was also given to the question "What is a pond?" Jane gave the answer,

"A pond is when you have your own pond for yourself."

Jane's matching level of vocabulary comprehension was reflected in her pre-intervention test scores which, with the exception of her scores in Topic 6 and Test 4 of Topic 2, were never above three out of ten (see Table 8.2.1).

Jane's level of engaged learning time increased after the scaffold was in place (see Table 8.24.1). However, the measured learning time may also reflect Jane's desire for compliance with classroom requirements. This was reflected in her mother's questionnaire response explaining what Jane did not enjoy about school. Her mother explained,

> "She has an underlying fear of someone being upset with her. This applies to her learning because you need so much patience with her to get her learning and if you get a bit cranky, she cries."

Her mother also reported that Jane did not like writing because her hand hurt. She did not understand what she was writing so, "It is two negatives".

Prior to the intervention, Jane's teacher rated both her ability to understand new classroom topics and her engagement with this learning as one out of ten. After the intervention, each of these measures was rated by the teacher as three out of ten.

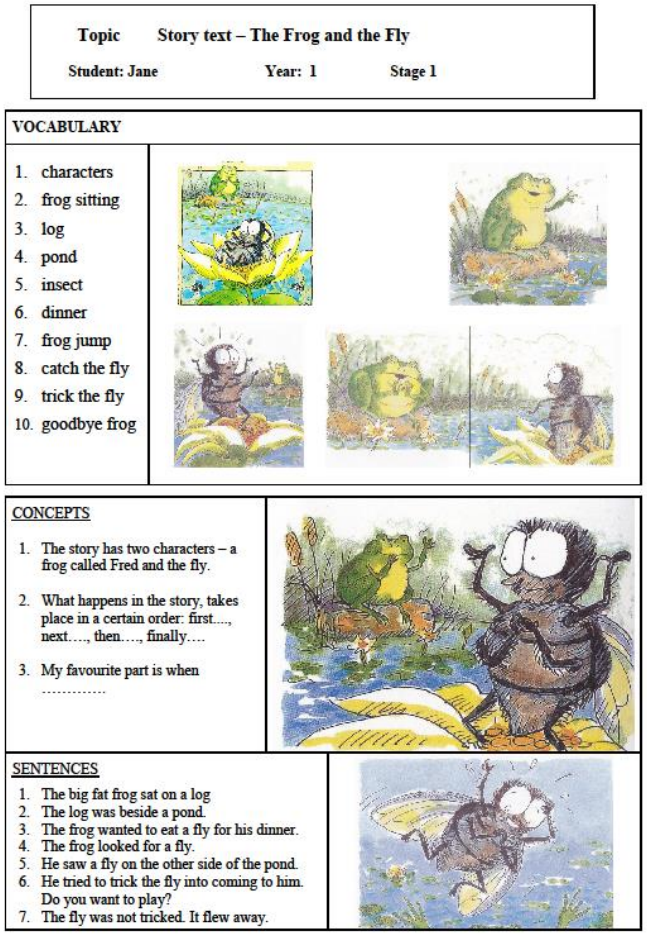


Figure 9.2.1 Scaffold – The Frog and Fly (English)

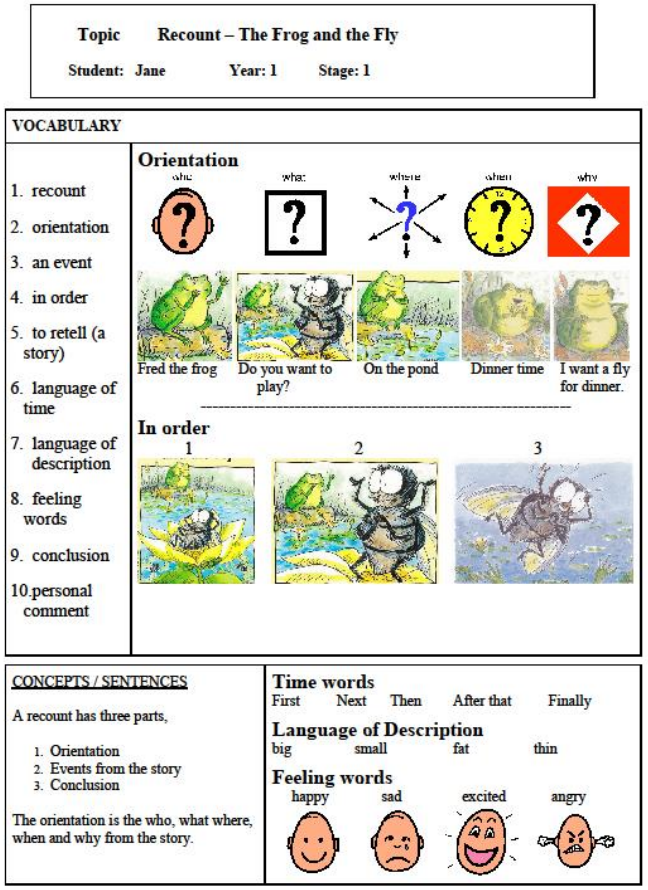


Figure 9.2.2 Scaffold – Frog and fly Recount (English)

Topic The honeybee

Student: Jane **Year:** 1 **Stage:** 1

VOCABULARY

- Classification
- Insect
- Queen bee
- Drone bee / Worker bee
- Three body parts
  1. head
  2. thorax
  3. abdomen
- Six legs
- Two antennae
- Nectar and pollen
- Habitat
- A colony of bees

CONCEPTS

1. Bees are insects. This means they have,
   a. three body parts – head, thorax and abdomen.
   b. six legs.
   c. two antennae.
2. Bees live in a beehive.
3. There are three types of bee – queen, drone and worker bees. Each bee has a special job.
4. The queen bee lays eggs which hatch into larvae.

SENTENCES

1. Bees are insects. They have a body that has three parts and they have six legs,
2. There are three types of bees – queen bee, drone bee and worker bees.
3. Bees live and work in a beehive.
4. Bees collect nectar and pollen from flowers to make honey.

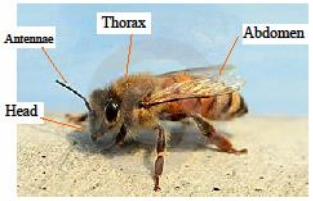
Figure 9.2.3 Scaffold – The Honeybee (Science)

Topic Information Report on the Honeybee

Student: Jane **Year:** 1 **Stage:** 1

VOCABULARY

- information report
- facts
- classification
- introduction
- appearance
- habitat
- diet
- parts of an information report
- diagram
- label



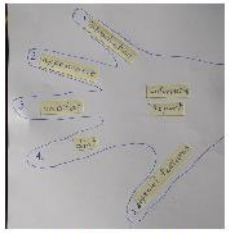
Labelled diagram of the parts of a bee's body

CONCEPTS / SENTENCES

An information report on bees describes 5 fabulous facts about bees.

1. introduction
2. appearance
3. habitat
4. diet
5. special features

1. **Introduction**
   Bees belong to the group called insects.
2. **Appearance**
   Bees have,
   - 3 body parts – the head, thorax and abdomen
   - 6 legs
   - 2 antennae
3. **Habitat**
   Bees live and work in a bee hive.
4. **Diet**
   Bees eat insects and dead animals.
5. **Special features**
   Bees perform a dance to tell other bees where to find nectar in relation to the position of the sun.



Five fabulous facts for Information Reports

Diagram of worker bees with eggs

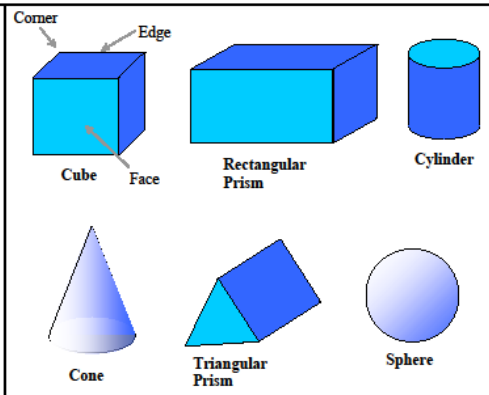
Figure 9.2.4 Scaffold – Honeybee Recount (English)

Topic Three Dimensional Space

Student: Jane **Year:** 1 **Stage:** 1

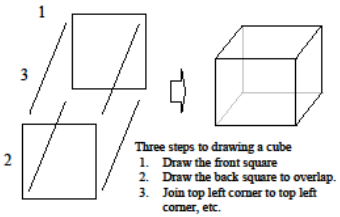
VOCABULARY

- Dimensions - length, width, height
- Plane shapes 2 dimensions – 2D
- Solid shapes 3 dimensions – 3D
- Cone
- Cube
- Cylinder
- Sphere
- Prism
- Faces
- Edges



CONCEPTS

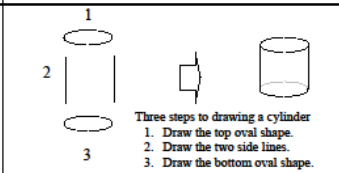
1. Identifying and naming three dimensional objects.
2. Using the terms 'faces', 'edges' and 'corners' to describe three dimensional objects.
3. Identifying two dimensional shapes as faces of three dimensional objects.
4. Drawing three dimensional objects as a set sequence of lines.



Three steps to drawing a cube
1. Draw the front square
2. Draw the back square to overlap.
3. Join top left corner to top left corner, etc.

SENTENCES

1. This is a cube. It has six faces, twelve edges and eight corners.
2. The faces on a cube are all square shape.
3. A cone is a solid shape. It has a circular base and it comes to a point at the top.
4. I take three steps to draw a cylinder.



Three steps to drawing a cylinder
1. Draw the top oval shape.
2. Draw the two side lines.
3. Draw the bottom oval shape.

Figure 9.2.5 Scaffold – 3 D Space (Mathematics)

Topic What do animals need to grow and survive?

Student: Jane **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary	Detailed Vocabulary
Survival needs 1. Water 2. Food 3. Air 4. Right temperature	**Characteristics** Camel Nostrils Eyelids Hump
Habitat	Crocodile Powerful tail Sharp teeth Webbed feet Eyes, nostrils high on head
Examples of habitat	Tortoise Shell Flattened front legs
Climate	
Equipped to survive	
Survival in cold climate	
Survival in the desert	
Camel – how it survives	
Crocodile – how it survives	
Tortoise – how it survives	

CONCEPTS

1. Animals need water, food, air and the right temperature to survive.
2. Animals are equipped in different ways to survive in their habitat.
3. Camels have several adaptations which equip them to live in the desert.
4. By closing its nostrils a camel keeps out dust and sand.
5. By closing its extra set of clear eyelids a camel can still see in a dust storm.

SENTENCES

1. All animals need air, water, food and the right temperature.
2. Animals have special characteristics to help them survive in their habitat.
3. Camels are equipped to survive in a desert habitat.
4. A camel closes its nostrils to keep out dust and sand. It has two pairs of eyelids. One pair is clear.

Figure 9.2.6 Scaffold – What do Animals Need? (Science)

9.3 Case Study for Connor

Connor was a Year 1 student who attended an inclusive primary school in Sydney. At the beginning of the study, Connor was aged six years and five months. He had one older sister who was ten years old. Connor's mother described his sister as having no learning difficulties. At age four years and four months, Connor attended the Communication Disorders Treatment and Research Clinic at the University of Sydney for an initial assessment due to his mother's concern about his language development. At this assessment Connor was reported to have a general language delay. He then attended a preschool intensive therapy program. The recommendations following the intensive preschool program were that Connor have a review language assessment and be assessed by a Paediatrician due to significant attentional and behavioural concerns.

Prior to Connor beginning school, a review language assessment was conducted using the CELF-4. Connor presented with an overall moderate receptive language impairment. His abilities varied across the receptive language subtests. Connor's strength within the receptive language subtests was his receptive semantic knowledge which was at the 50^{th} percentile. This subtest required understanding of word meanings and their associated relationships. This subtest assessed vocabulary knowledge which was important in student understanding of both written and spoken classroom instruction.

Connor had difficulty following directions of the length and complexity that would be expected for his age and academic level. Connor was only able to respond to simple, single level commands. He also had difficulty following instructions containing any positional words. Connor also had difficulty understanding sentences of various syntactical complexity. His responses were often impulsive and the speech pathologist believed it was evident, from his choices, that he was not attending to or understanding the whole sentence. Connor had difficulty answering questions about a short passage that he had just heard. The Speech Pathologist reported that Connor showed a very similar receptive language profile in play situations and in general conversation. He understood single words well, however, he was unable to answer any questions asked. His answers were generally unrelated to the topic or activity and he was often echolalic.

Connor presented with an overall severe expressive language impairment. His abilities varied across the expressive language subtests. Connor was able to formulate sentences which were simple in meaning and structure. However, he had difficulty producing more

complex syntactical structures. He was unable to use any simple conjunctions to form complex sentences.

Connor had great difficulty repeating sentences of varying length and complexity. He had difficulty accessing and retrieving the correct phonological forms of words. Connor had age-appropriate vocabulary, however, he struggled to remain on topic and was unable to sequence information when retelling an event. The speech pathologist concluded that Connor would have great difficulty following class instructions and using language for learning. It was recommended that the use of visual and kinaesthetic teaching supports would help Connor to learn new concepts by assisting his comprehension and memory of new material. It would also be necessary to provide for repetition within the learning.

At age six, Connor was assessed by a paediatrician. His classroom teacher reported that he was obsessive with his favourite topics, resisted being diverted from his own interest areas to classroom topics, was sensitive to noise, was often too tired to keep working, had repetitive finger movements, needed explicit social skilling and found the processing and retention of classroom instruction extremely difficult. Connor received a diagnosis of Asperger's Syndrome.

Prior to the intervention phase of the study, Connor was tested on the PLAI-2. Table 9.3.1 below sets out Connor's pre and post intervention results for the PLAI-2.

Table 9.3.1 Table showing results of PLAI-2 Testing for Connor

Test: PLAI-2 – Preschool Language Assessment Instrument (2nd Edition)				
Participant : Connor				
Level of Language Abstraction	**Raw Score**	**Scaled score relative to age 5.11**	**Percentile Rank relative to age 5.11**	**Age Equivalent relative to age 5.11**
Pre-Intervention Test Results. Chronological Age: 6.5				
1. Matching	16	10	50th	5.6
2. Selective Analysis	10	5	5th	4.3
3. Reordering	8	8	25th	5.3
4. Reasoning	5	4	2nd	3.9
Post-Intervention Test Results. Chronological Age: 7.0				
1. Matching	17	11	≥ 63rd	≥ 6.0
2. Selective Analysis	14	9	37th	5.6
3. Reordering	15	15	95th	> 6.0
4. Reasoning	17	16	98th	> 6.0

The scaled score, percentile rank and age equivalent scores are all relative to a chronological age of 5.11 as explained in the introduction to the case studies.

Prior to the research intervention, Connor had great difficulty with the second level of language abstraction, selective analysis. This level was therefore emphasised in the planning of Connor's scaffolds. In Blank et al.'s hierarchical system, this area of weakness also impacted on his performance at the level of reordering of perception. As set out in Table 9.3.2 below, 82% of Connor's teacher's instructional language was at the selective analysis and reordering levels. Connor, therefore, found classroom learning very stressful.

Table 9.3.2 Table showing analysis of Classroom Teacher's Instructional Language for Connor

Matching	**Selective Analysis**	**Reordering**	**Reasoning**
0%	19.5%	62.5%	18%

Connor's receptive vocabulary score was measured using the PPVT-4 and his expressive vocabulary score was measured using the EVT-2. Tables 9.3.3 to 9.3.6 below set out the scores for these tests and analyse any changes in test scores pre and post the intervention.

Table 9.3.3 Table showing PPVT-4 Receptive Vocabulary Scores for Connor

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
100	6.5	6.5	108	7.0	7.11

Table 9.3.4 Tablw showing analysis of Change in PPVT-4 Scores for Connor

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
8	7	18

In the seven months between pre and post assessment of his receptive vocabulary skills, Connor made a gain of eighteen months calculated using age equivalency scores.

Table 9.3.5 Table showing EVT-2 Expressive Vocabulary Scores for Connor

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
103	6.5	6.7	110	7.0	8.2

Table 9.3.6 Table showing analysis of Change in EVT-2 Scores for Connor

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
7	7	19

In the seven months between pre and post assessment of his expressive vocabulary skills, Connor made a gain of nineteen months, calculated using age equivalency scores. There was no significant difference between Connor's EVT-2 standard scores and his PPVT-4 standard scores. There was therefore no indication of word retrieval difficulties.

Connor's six scaffolded curriculum topics were: *What do Plants Need to Grow and Survive*? (Science), *Ants* (HSIE), *Ants – Information Report* (English), *The Honey Be*e (HSIE), *2 Dimensional Space* (Mathematics), and *Addition and Subtraction* (Mathematics). Connor's scaffolds are shown at the end of this section.

When Connor was given each scaffold, he requested time to draw some of the information himself. His drawings were always based on the scaffold visuals. In the student interview at the conclusion of the study, Connor described the impact of the scaffolds on his understanding of the class work: "The pictures help – they show me what is going on. The pictures help me remember. When I draw them I remember even more".

Connor was interested in plants and insects and was therefore able to easily engage with the science scaffold – *What do Plants Need to Grow and Survive?* He was able to make easy links to his own growing of plants at home.

> "I have lots of plants at my home – I have lots of red berries – they are dangerous, they are poisonous, sometimes my Mum says I have to cut them off with a plant cutter and it's hard. Nothing else, that's all".

The scaffold helped Connor to concentrate upon the particular classroom focus within plant growth and survival. The scaffolds on *The Honey Bee* and *2 Dimensional Space* concentrated on Blank et al.'s first two levels of language abstraction. Connor liked labels on items and the lines which connected the item and the label.

> "Pictures that are like, interesting, help me remember I think. The label is the part you need to describe".

Connor worked well with the Mathematics scaffold, *Addition and Subtraction*. It was concrete and predictable. The particular visual examples of doubling were for Connor a natural extension of his interest in plants and animals.

The first part of the scaffold, *Information Report on Ants*, also concentrated on Blank et al.'s first two levels of language abstraction and this was easy for Connor. The concept of the structure of the Information Report however, required students to manipulate certain items from the vocabulary, such as appearance, habitat and diet, and present these in a specific order. This required Connor to work at Blank et al.'s third level of language abstraction, Reordering, and he was uncomfortable with the manipulating of information in a more abstract way. Connor was confused about why he would be asked to write an Information Report and how it could be organised under five headings. The socially

scripted, self-talk sheet, *How to Write an Information Report*, prepared Connor to effectively use the scaffold, Information Report on Ants.

> "Information Report – those two words are tricky. The hand was a bit tricky. I don't like writing Information Reports".

Table 8.24.1 shows Connor's record of Engaged Learning Time. When he was using a scaffold, Connor's engagement with classroom instruction increased.

In the parent interview, prior to the intervention phase, Connor's mother had three main concerns: Connor's ability to stay on topic, his ability to understand classroom instruction which she rated as three out of ten and his engagement with classroom learning which she rated as one out of ten. In the interview after the intervention phase, Connor's mother reported that staying on topic was no longer as big an issue, his engagement with classroom learning she then rated as three out of ten and his ability to understand classroom instruction as five out of ten.

When asked about the most important part of the Honeybee scaffold, Connor explained,

> "I would take the three pictures and words on the bee – head, thorax and abdomen. The three pictures help me know the important things – the parts of the bee, about the stinger when they take off the lid it's very old and broken and they look like they are vomiting out the honey".

For Connor, the lesson content was clearly set out, sequenced, summarised and remembered using the visuals.

Topic What do plants need to grow and survive?

Student: Connor **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary	Detailed Vocabulary	
living	stem	
germinate	leaves	
sunlight	flower	
soil	needs	
seeds	nutrients	
seed coat	characteristics	
experiment	climate	
cress seeds	adapt	
lima beans	survive	
roots / root system	same / different / the difference between	

CONCEPTS

1. What does a plant need to grow and change (water, sunlight, soil, nutrients)?
2. The root system absorbs water and nutrients (food for the plant) from the soil.
3. Explain what happens to seeds when they germinate.

SENTENCES

1. A seed / plant / flower needs water, sunlight and soil to grow.
2. When a seed germinates it sprouts.
3. The job of the root system is to absorb water and nutrients from the soil for the plant to grow.

what do plants need to grow and survive.doc G. Wilcock, 2010

Figure 9.3.1 Scaffold – What do Plants Need (Science)

Topic Ants (important information) leading to an information report

Student: Connor **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary	Detailed Vocabulary	
classification insect queen ant / male ant / worker ant description three body parts 1. head 2. thorax 3. abdomen six legs two antennae habitat nest / colony	movement smell trail feeding habits • insects • seeds • dead animals breeding habits • queen ant • eggs • larvae	

CONCEPTS

1. Ants are insects. This means they have,
   a. three body parts – head, thorax and abdomen.
   b. six legs.
   c. two antennae.
2. Ants live and work in nests called colonies.
3. There are three types of ant – queen, male and worker ants. Each type of ant has a special job.
4. The queen ant lays eggs which hatch into baby ants called larvae.

Worker ants with eggs

SENTENCES

1. Ants are insects. They have a body that has three parts and they have six legs.
2. Ants live and work in nests called colonies.
3. There are three types of ant in a colony.
4. Every ant in a colony has a job.
5. Most ant nests are underground.
6. Baby ants called larvae hatch from eggs.

Ants building a nest

scaffold ants.doc G. Wilcock, 2010

Figure 9.3.2 Scaffold – Ants (HSIE)

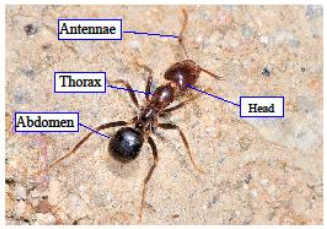
Topic Information Report on Ants

Student: Connor **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary

information report
facts
classification
introduction
appearance
habitat
diet
feeding habits
information report - 5 parts
diagram
label



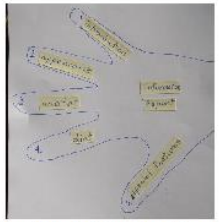
Labelled diagram of the parts of an ant's body

CONCEPTS / SENTENCES

An information report on ants describes 5 fabulous facts about ants.

1. introduction
2. appearance
3. habitat
4. diet
5. special features

1. **Introduction**
   Ants belong to the group called insects.
2. **Appearance**
   Ants have,
   - 3 body parts – the head, thorax and abdomen
   - 6 legs
   - 2 antennae
3. **Habitat**
   Ants live in nests called colonies.
4. **Diet**
   Ants eat insects and dead animals.
5. **Special features**
   Ants follow a smell trail as they walk in line, one behind the other.



Five fabulous facts for Information Reports

Diagram of worker ants with ant eggs

Figure 9.3.3 Scaffold – Ants Information Report (English)

How to write an Information Report

1. What is an Information Report?

Answer: An Information Report is a description of facts about a special topic.

My special topic is Ants. When I write my Information Report, children in my class can read the facts about ants.

2. How do I organise my Information Report?

Answer: An Information Report on an animal is organised under five headings.

(1) Introduction	**My special topic is …..**
(2) Appearance	**What does it look like…?**
(3) Habitat	**Where does it live?**
(4) Diet	**What does it eat?**
(5) Special Features	**Ants follow a smell trail.**

Topic The honeybee

Student: Connor **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary	Detailed Vocabulary
Classification	
Insect	
– Queen bee	
– Drone bee	
– Worker bee	
Description	
Three body parts	
1. head	
2. thorax	
3. abdomen	
Six legs	
Two antennae	
Habitat	
– Colony	
– Bee hive	
	Defence
	Stinger
	Movement
	Two pairs of wings
Feeding habits	
Nectar	
	Pollen
	Pollen baskets
Honey	
Breeding habits	
Swarming	
Larvae (baby bee).	

CONCEPTS

1. Bees are insects. This means they have,
   a. three body parts – head, thorax and abdomen.
   b. six legs.
   c. two antennae.
2. Bees live in a beehive.
3. There are three types of bee – queen, drone and worker bees. Each bee has a special job.
4. The queen bee lays eggs which hatch into larvae.

SENTENCES

1. Bees are insects. They have a body that has three parts and they have six legs,
2. There are three types of bees – queen bee, drone bee and worker bees.
3. Bees live and work in a beehive.
4. Bees collect nectar and pollen from flowers to make honey.

scaffold the honeybee.doc G. Wilcock, 2010

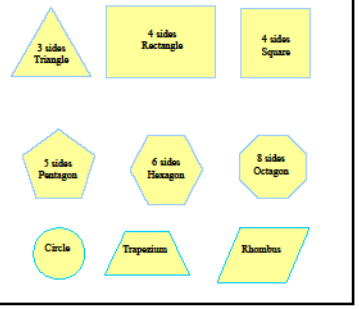
Figure 9.3.4 Scaffold – The Honeybee (HSIE)

Topic Two-dimensional space

Student: Connor **Year:** 1 **Stage:** 1

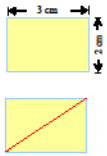
VOCABULARY

General Vocabulary	Detailed Vocabulary
dimension	
corners	
sides	
– straight line	
– curved line	
diagonal line	
parallel lines	
square	
rectangle	
triangle	
circle	
pentagon	
hexagon	
octagon	
rhombus	
trapezium	
	plane shape
	flat surface
	two dimensional
	properties
	symmetry
	symmetrical
	vertical line
	horizontal line
	rotate



CONCEPTS

1. To identify and label two-dimensional shapes according to their features.
2. To justify why the shape is a rectangle.
3. When the shape is rotated its properties remain the same.
4. A fact about a shape is called a property.



The **dimensions** of an object tell us how big the object is. So, the dimensions of this rectangle are 3 cm long and 2 cm wide.

A diagonal is a line drawn from one corner of an object to another corner, like the red line in this rectangle.

SENTENCES

1. This is a triangle because ……. and even if I rotate it, the shape is still a triangle.
2. All these shapes have four corners and four sides.
3. The two rails in a railway track are parallel.
4. A circle has lots of lines of symmetry.

scaffold two dimensional space cody.doc G. Wilcock, 2010

Figure 9.3.5 Scaffold – 2 D Space (Mathematics)

Topic Addition and Subtraction

Student: Connor **Class:** Year 1 **Stage:** 1

VOCABULARY

- 100's chart
- number line
- add
- addition (+)
- plus
- subtract
- subtraction (-)
- minus
- take away
- the difference between
- **count on**
- counting forwards by
- count back
- counting backwards by
- skip counting
- **double**
- two groups of
- **stories about ten**
- number sentence
- +
- -
- =

The 100's Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

The Number Line

CONCEPTS

1. Counting forwards and backwards by ones, twos, fives and tens using skip counting.
2. Recall of addition facts to ten (stories about ten).
3. Using related addition and subtraction number facts to ten.
4. Recording number stories / sentences using numerals and the symbols +, -, =.

Doubles

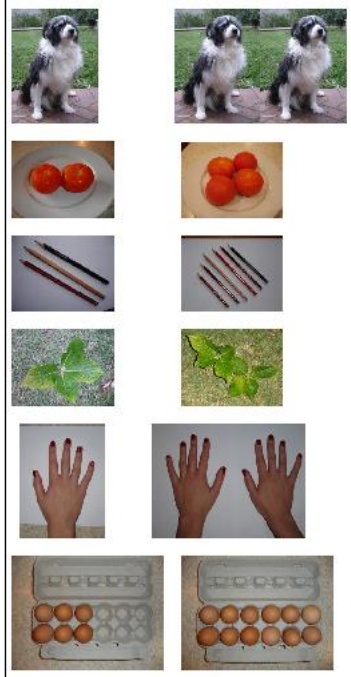


Figure 9.3.6 Scaffold – Addition and Subtraction (Mathematics)

SENTENCES	Number stories about ten.
1. I can count by twos using the even numbers – 2, 4, 6, 8, 10. 2. 2, 4, 6, 8, 10 — this is skip counting in groups of 2 3. I can also count by twos using the odd numbers — 1, 3, 5, 7, 9. 4. I can count by fives or tens. 5. The stories about ten are, 1 + 9, 2 + 8, 3 + 7, 4 + 6, 5 + 5. 6. If 9 + 1 = 10, then 1 + 9 = 10 10 - 1 = 9 10 - 9 = 1 7. 10, 8, 6, 4, 2 — this is skip counting backwards in groups of 2.	1 + 9 = 10 2 + 8 = 10 3 + 7 = 10 9 + 1 = 10 8 + 2 = 10 7 + 3 = 10 10 - 9 = 1 10 - 8 = 2 10 - 7 = 3 10 - 1 = 9 10 - 2 = 8 10 - 3 = 7 4 + 6 = 10 5 + 5 = 10 6 + 4 = 10 10 - 5 = 5 10 - 6 = 4 10 - 4 = 6

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9.4 Case Study for Luis

At the beginning of the study, Luis was a Year 1 student in an inclusive primary school in Sydney. He was aged six years and seven months. At age three, Luis had been diagnosed with delayed language skills, having failed to meet language milestones. Luis received speech therapy prior to beginning school and in Kindergarten and Year 1 he received weekly, half hour speech therapy sessions in the school environment. At the beginning of Kindergarten, the school based Speech Therapist conducted his initial assessment. His report assessed Luis as having a severe receptive language disorder and a severe expressive language disorder. His receptive language score was sixty-eight which was at the 2nd percentile. His expressive language score was fifty-nine corresponding to a percentile rank of 0.3.

At the conclusion of Luis's first term in Kindergarten, he was assessed by a paediatric physician because of both family and school concerns about his behaviour. These concerns included his tendency to tantrum if he was not able to have his own way, inability to verbalise when upset, inability to view things from another's perspective and obsessive interests. Luis was diagnosed as having Autism Spectrum Disorder. Table 9.4.1 below sets out Luis's pre- and post-intervention results for the PLAI-2. Table 9.4.2 sets out the results of the analysis of the teacher's instructional language.

Table 9.4.1 Table showing PLAI-2 Results for Luis

Test: PLAI-2 – Preschool Language Assessment Instrument (2nd Edition)				
Participant : Luis				
Level of Language Abstraction	**Raw Score**	**Scaled score relative to age 5.11**	**Percentile Rank relative to age 5.11**	**Age Equivalent relative to age 5.11**
Pre-Intervention Test Results. Chronological Age: 6.7				
1. Matching	13	7	16th	3.9
2. Selective Analysis	8	4	2nd	3.6
3. Reordering	1	3	1st	2.9
4. Reasoning	4	3	1st	3.3
Post-Intervention Test Results. Chronological Age: 7.2				
1. Matching	14	8	25th	4.3
2. Selective Analysis	14	9	37th	5.6
3. Reordering	5	6	9th	4.3
4. Reasoning	7	6	9th	4.6

Table 9.4.2 Table showing analysis of Classroom Teacher's Instructional Language for Luis

Matching	**Selective Analysis**	**Reordering**	**Reasoning**
5.8%	21.5%	58.5%	14.2%

Tables 9.4.3 to 9.4.6 below set out Luis's scores for the PPVT-4 and the EVT-2 as well as the analysis of any change in these test scores pre- and post-intervention.

Table 9.4.3 Table showing PPVT-4 Scores for Luis

Results before classroom topic testing			**Results after classroom topic testing**		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
84	6.7	5.2	81	7.2	5.3

Table 9.4.4 Table showing analysis of Change in PPVT-4 Scores for Luis

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
-3	7	1

For Luis the increase in age equivalency was less than the increase in his chronological age. Based on the PPVT-4, Luis's level of receptive vocabulary did not increase.

Table 9.4.5 Table showing EVT-2 Scores for Luis

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
90	6.7	5.7	84	7.2	5.7

Table 9.4.6 Table showing analysis of Change in EVT-2 Scores for Luis

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
-6	7	0

Based on the EVT-2, Luis's expressive language did not change. Pre and post the research intervention, Luis'ss expressive vocabulary scores were a little higher than his receptive vocabulary scores. There was, therefore, no indication of word retrieval difficulties.

Luis's six scaffolded curriculum topics were – *Transport* (HSIE); *Magnets* (Science); *Spiders* (HSIE); *Red Back Spiders – Information Report* (English); *Volume and Capacity* (Mathematics); *Addition and Subtraction* (Mathematics). The scaffolds are set out at the end of this section.

At the beginning of the study, Luis scored at the sixteenth percentile for 'matching', which is Blank et al.'s first level of language abstraction. This was a strength for Luis as each of the other three levels were at the first or second percentile. Within the teacher's instructional language, however, only 5.8% was at the matching level while 94.2% was at

a higher level of language abstraction. At the beginning of the study, the teacher reported that Luis's percentage of engaged learning time was generally 0%. At the second level of language abstraction, 'selective analysis', Luis did not understand the label for many of the attributes. For example, in the scaffold *Transport*, when Luis was asked about the shape of the wheels on the bus he said "black and white".

In each of Luis's scaffolds, therefore, there was an emphasis upon the name of each attribute which would enable Luis to both understand and respond to observations or questions at the selective analysis level of language abstraction. For example on the scaffolds about *Spiders* extra time was spent on such labels as abdomen, fangs and spinnerets. In *Transport*, labels such as community, system, water transport and citizen were a focus. In the scaffold on *Magnets* the focus was on the meaning of such selected characteristics as force, metal, attract and repel.

Luis himself always sought to relate items of vocabulary to his own experience. For Luis, this gave the word meaning and it enabled him to file the meaning such that the link between the word and meaning was readily retrieved when needed. For example in the topic *Spiders*, Luis related both spider and web to his own observation of a web at home,

> "I have a web but I don't have a spider. It is coming soon".

Topic Addition and Subtraction

Student: Luis **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary	Detailed Vocabulary
100's chart number line count on count back { even, odd { add, plus { equals, is equal to { take away, minus the difference between { +, -, =	

The 100's Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

CONCEPTS	**The Number Line**
1. Recall of addition facts to ten (friends of ten). 2. Using related addition and subtraction number facts to ten. 3. Recording number sentences using numerals and the symbols +, -, =. 4. Recall of addition facts to twenty.	Participant given a folding number line (1 – 100) to manipulate during the class topic.
SENTENCES 1. The friends of ten are 1 + 9, 2 + 8, 3 + 7, 4 + 6, 5 + 5. 2. If 9 + 1 = 10, then 1 + 9 = 10 10 – 9 = 1 10 – 1 = 9	**Friends of 10** 1 + 9 = 10 2 + 8 = 10 3 + 7 = 10 4 + 6 = 10 5 + 5 = 10

Figure 9.4.1 Scaffold – Addition and Subtraction (Mathematics)

Topic Magnets

Student: Luis **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary

push
pull
magnets
force
metals
stick to
attract
repel
break
bend

Pull

CONCEPTS

1. Forces are things that push or pull on objects.
2. Magnets are special kinds of metals.
3. Magnets create a force when they are brought close to certain materials.
4. What things stick to magnets?

Magnet

SENTENCES

1. Forces push or pull on objects.
2. Magnets are special kinds of metals.
3. Magnets create a force when they are put close to some materials.
4. The metal paper fasteners were sticking to the magnet.

Figure 9.4.2 Scaffold – Magnets (Science)

Topic Information Report on Redback Spiders

Student: Luis **Year:** 1 **Stage:** 1

VOCABULARY

General Vocabulary

Information Report
facts
5 animal facts (for an Information Report)
introduction
appearance
habitat
diet
special features
diagram
label

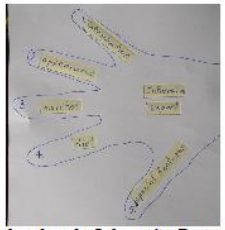
A redback spider

CONCEPTS / SENTENCES

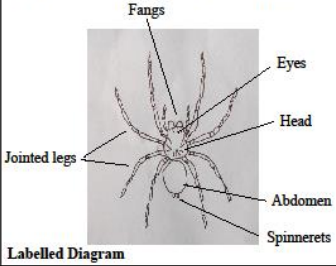
Information reports on spiders describe 5 fabulous facts about spiders.

1. introduction
2. appearance
3. habitat
4. diet
5. special features

1. **Introduction**
   Spiders belong to the group called Arachnids.
2. **Appearance**
   Spiders have,
   - 2 body parts – the head and the abdomen
   - 8 jointed legs
   - 8 eyes
   - 2 fangs
3. **Habitat**
   Spiders usually live in webs, flowers, leaves and trees. Sometimes they live in rubbish piles or under rocks.
4. **Diet**
   Spiders eat insects for example flies, moths and grasshoppers.
5. **Special features**
   A redback spider has a red stripe on its back and can bite people



Five fabulous facts for Information Reports



Labelled Diagram

Figure 9.4.3 Scaffold – Information Report Spiders (English)

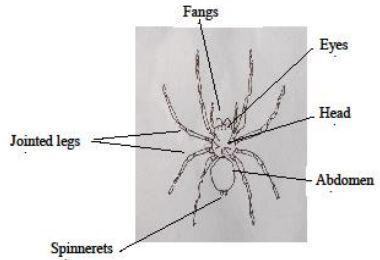
Topic **Spiders**

Student: **Luis** **Year:** **1** **Stage:** **1**

VOCABULARY

General Vocabulary

arachnids
abdomen
jointed legs
skeleton
spinnerets
web
fangs
prey
habitat
spiderlings



CONCEPTS / SENTENCES

1. Spiders belong to the group of animals called Arachnids.
2. Spiders have,
   - Two body parts – the head and the abdomen.
   - Eight jointed legs.
   - Eight eyes.
   - Two fangs.
3. The fangs are used to catch and poison their prey.
4. Spiders have an outside skeleton.
5. Spiders make a web from silk thread.
6. The silk thread comes from their spinnerets.

Spiderlings and eggs

Figure 9.4.4 Scaffold – Spiders (Science)

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Topic **Transport**

Student: **Luis** **Year:** **1** **Stage:** **1**

VOCABULARY

General Vocabulary

- transport
- form of transport
- road / land transport
- water transport
- air transport
- system
- community
- environment
- problem
- citizen
- goods

CONCEPTS

1. In Sydney, our transport system has road, water and air transport.
2. The transport system is used to move people and goods.
3. Sometimes people and goods have to be moved because there is an emergency, for example fire engines or ambulances.

SENTENCES

1. In Sydney, our transport system is made up of …..
2. We need a transport system to move people and goods.
3. People choose to use water transport because……
4. People choose to use air transport because…..

Emergency Transport

Figure 9.4.5 Scaffold – Transport (HSIE)

Topic Volume and Capacity

Student: Luis **Year:** 1 **Stage:** 1

VOCABULARY	
General Vocabulary	
Volume Capacity Contents Container Amount	

CONCEPTS / SENTENCES	
1. When we talk about the space inside a container we call it the capacity of the container.	The contents have volume.
2. When we talk about the space that the contents occupy we call it the volume of the contents.	The container has capacity.

Figure 9.4.6 Scaffold – Volume and Capacity (Mathematics)

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9.5 Case Study for Rhys

Rhys was a Year 2 student who attended an inclusive primary school in Sydney. At the beginning of the study he was aged seven years and six months.

Prior to beginning school, Rhys had had no paediatric assessment and no speech and language assessment. On his first day in Kindergarten, Rhys walked into the room with a large handkerchief covering his head and face. He had repetitive behaviours, difficulty with social interaction with peers and adults and was easily overwhelmed in a noisy environment. In the middle of the Kindergarten year, it was recommended by the school that Rhys have a Speech and Language Assessment, to be followed by a paediatric assessment.

The Speech and Language Assessment was administered using the CELF-4. Rhys presented with a moderately delayed Receptive Language Index standard score of 73 which was at a percentile rank of 4. His Expressive Language Index was a standard score of 85 which was at the 16th percentile and interpreted as mildly delayed. The Speech Pathologist who assessed Rhys, stated that as a result of his receptive language difficulties, Rhys would have to rely on visual input in order to comprehend oral classroom instruction. The Speech Pathologist also stated that understanding this instruction would be very difficult for Rhys because visual input would not always be available and Rhys would not ask for assistance because he was very shy. The Speech Pathologist therefore believed that it would be very likely that his difficulty in comprehending the learning would go unnoticed. Two months after the Speech and Language Assessment, Rhys was assessed by a paediatrician as having Asperger's Syndrome. Rhys is one of two children. His younger sister, Julia, was diagnosed at age two years and three months as having autism. Julia's diagnosis was four years prior to Rhys's diagnosis. Julia was also a participant in this study.

Table 9.5.1 below sets out Rhys's pre and post intervention results for the PLAI-2.

Table 9.5.1 Table showing PLAI-2 Results for Rhys

Test: PLAI-2 – Preschool Language Assessment Instrument (2nd Edition)				
Participant : Rhys				
Level of Language Abstraction	**Raw Score**	**Scaled score relative to age 5.11**	**Percentile Rank relative to age 5.11**	**Age Equivalent relative to age 5.11**
Pre-Intervention Test Results. Chronological Age: 7.6				
1. Matching	17	11	≥ 63rd	6.0
2. Selective Analysis	13	8	25th	5.0
3. Reordering	10	10	50th	5.9
4. Reasoning	13	12	75th	> 6.0
Post-Intervention Test Results. Chronological Age: 8.3				
1. Matching	17	11	≥ 63rd	6.0
2. Selective Analysis	16	11	63rd	6.0
3. Reordering	14	14	91st	> 6.0
4. Reasoning	16	15	95th	> 6.0

Results are relative to a chronological age of 5.11, as explained in the introduction to the case studies. Conversions of raw scores for language levels, matching and selective analysis, are relative to ages 3 – 5 years. Conversions of raw scores for language levels reordering and reasoning are relative to ages 4 – 5 years. Percentile ranks are relative to ages 5.8 to 5.11.

Rhys's one hundred percent score at the matching level of language abstraction, remained the same for pre and post intervention testing. However, he made large gains on Blank et al.'s 2nd, 3rd and 4th levels of language abstraction. The post-intervention test scores showed reordering to be Rhys's poorest level of language abstraction.

Recordings of the teacher's instructional language were not available for Rhys.

Table 9.5.2 Table showing analysis of Classroom Teacher's Instructional Language for Rhys

Matching	**Selective Analysis**	**Reordering**	**Reasoning**
N/A	N/A	N/A	N/A

Tables 9.5.3 to 9.5.6 below set out Rhys's scores for the PPVT-4 and the EVT-2 as well as the analysis of any change in these test scores pre and post the intervention.

Table 9.5.3 Table showing PPVT-4 Receptive Vocabulary Scores for Rhys

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
78	7.6	5.3	84	8.3	6.7

Table 9.5.4 Table showing analysis of Change in PPVT-4 Scores for Rhys

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
6	9	16

Over a nine month period, Rhys made a gain in receptive vocabulary skill of sixteen months. Over the same nine month period, Rhys made a gain of only five months in his expressive language skill. It is probable that this is a reflection of the scaffold emphasis on Rhys's receptive language skill.

Table 9.5.5 Table showing Expressive Vocabulary Scores for Rhys

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
88	7.6	6.3	86	8.3	6.8

Table 9.5.6 Table showing analysis of Change in EVT-2 Scores for Rhys

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
-2	9	5

When Rhys was tested on the PPVT-4 and the EVT-2, prior to the intervention, there was a ten point difference in standard score, with the EVT-2 standard score being higher.

Following the intervention, this gap was reduced to a two point difference in standard score. It is probable that this indicated that Rhys, pre intervention, was experiencing a problem with the breadth of vocabulary knowledge (Williams, 2007). In addition, being asked to speak may have caused Rhys to be more engaged in the EVT-2 testing than the PPVT-4 test, which required him to attend to four pictures and the assessor's spoken word.

Rhys's six scaffolded curriculum topics were – *2D Space* (Mathematics); *Running Shoes* by Frederic Lipp (English); *Cultures – China and the Madeira Islands* (HSIE); *Volume and Capacity* (Mathematics); *Recount – Running Shoes* (English); *Animals in Wetlands Environment* (Science and HSIE). The scaffolds are set out at the end of this section.

At the beginning of the study, of Blank et al.'s four levels of language abstraction, Rhys's understanding of language at the selective analysis level was his lowest. Rhys had great difficulty identifying the key selective aspects or attributes, within any topic or concept. The emphasis within each of Rhys's scaffolds was therefore upon the key attributes. For example, in *Running Shoes*, selective analysis focussed upon the 'who', 'what', 'where' and 'when' details from the story. Based on the key attributes or selective analysis approach within the scaffold, it was then possible to 'lead' Rhys to the 'reordering' or manipulation of these attributes such as in the second concept listed on the scaffold: 'In countries which are close to the Equator, the weather is nearly always hot and sunny'. As Rhys gained confidence with Blank et al.'s first three levels of language abstraction, it was possible to lead Rhys to questions requiring reasoning skills, such as 'Why is this action happening'? In the scaffold titled *Recount – Running Shoes*, Rhys was required to manipulate or reorder the key attributes of the story so the details could be placed within a set 'Recount' format.

In the scaffold titled *2 Dimensional Space* the emphasis was upon the key attributes which were required at the reordering and reasoning level of analysis. The reordering concept was 'When the shape is rotated, its properties remain the same'. An example of a reasoning question was: 'Why is that shape a rectangle?'. The scaffold title '*Cultures of China and the Madeira Islands*' worked through key attributes of both countries prior to the teacher asking questions about comparisons between the two, which required Rhys to hold, manipulate and then record cultural details to meet the teacher's specified criteria.

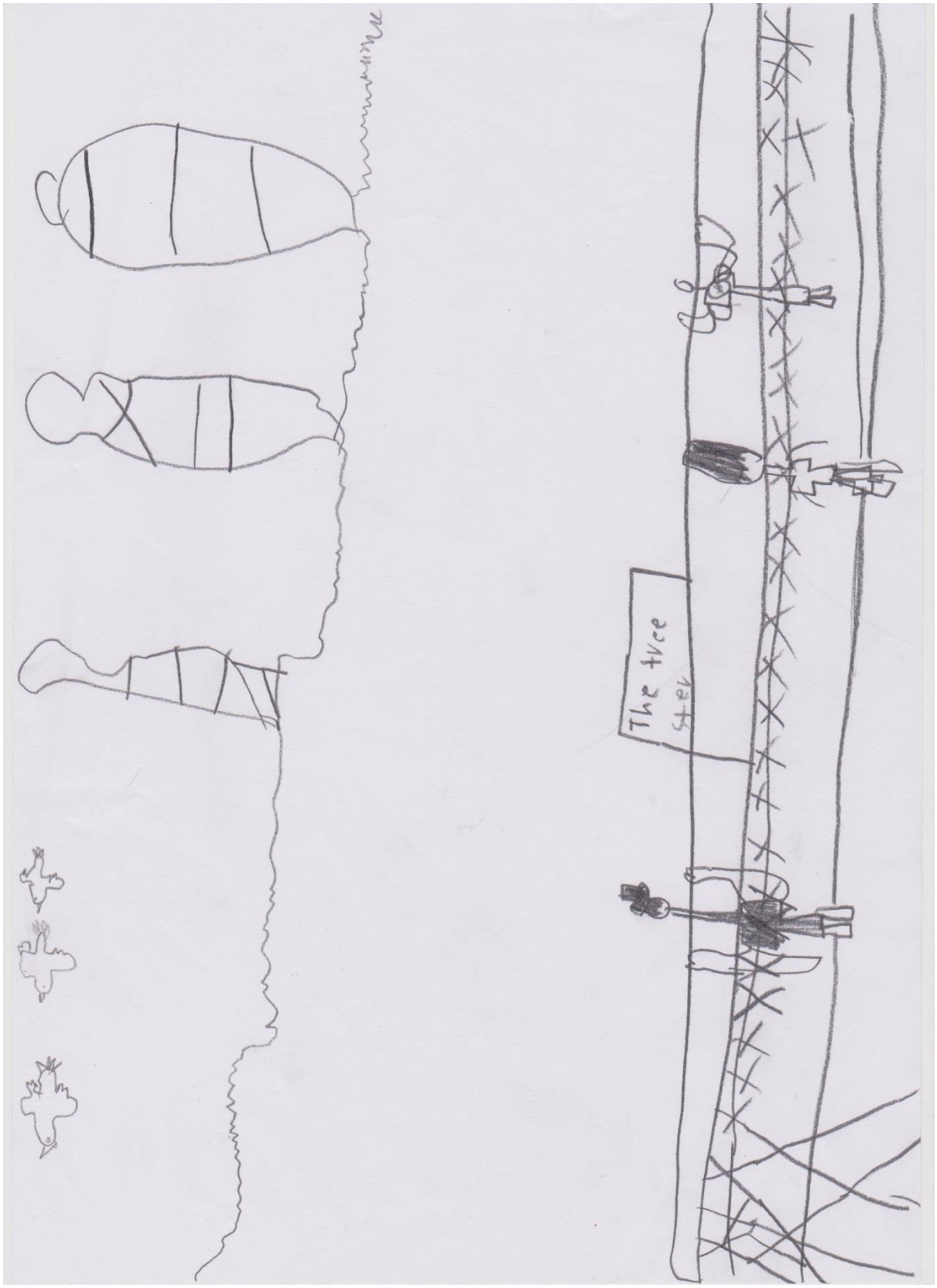
As Rhys became more confident in his use of scaffolds, his engagement with classroom instruction increased. This can be seen from the record of Rhys's engaged learning time. The final three observations record a drop in the percentage score. At this time Rhys's father had been hospitalised, the home routine structures were disrupted and Rhys was very unsettled in the classroom.

Prior to the research intervention, Rhys's teacher rated both his ability to understand new class topics and his engagement with the classroom learning as three out of ten. His mother rated his ability to understand new class topics as five out of ten. Rhys rated his own ability on this scale as one out of ten. After the intervention, the class teacher rated Rhys as five out of ten on both understanding of new topics and engagement with learning. This agreed with Rhys's assessment of his own understanding and engagement post intervention.

Explaining the role of the scaffolds within his learning, Rhys stated

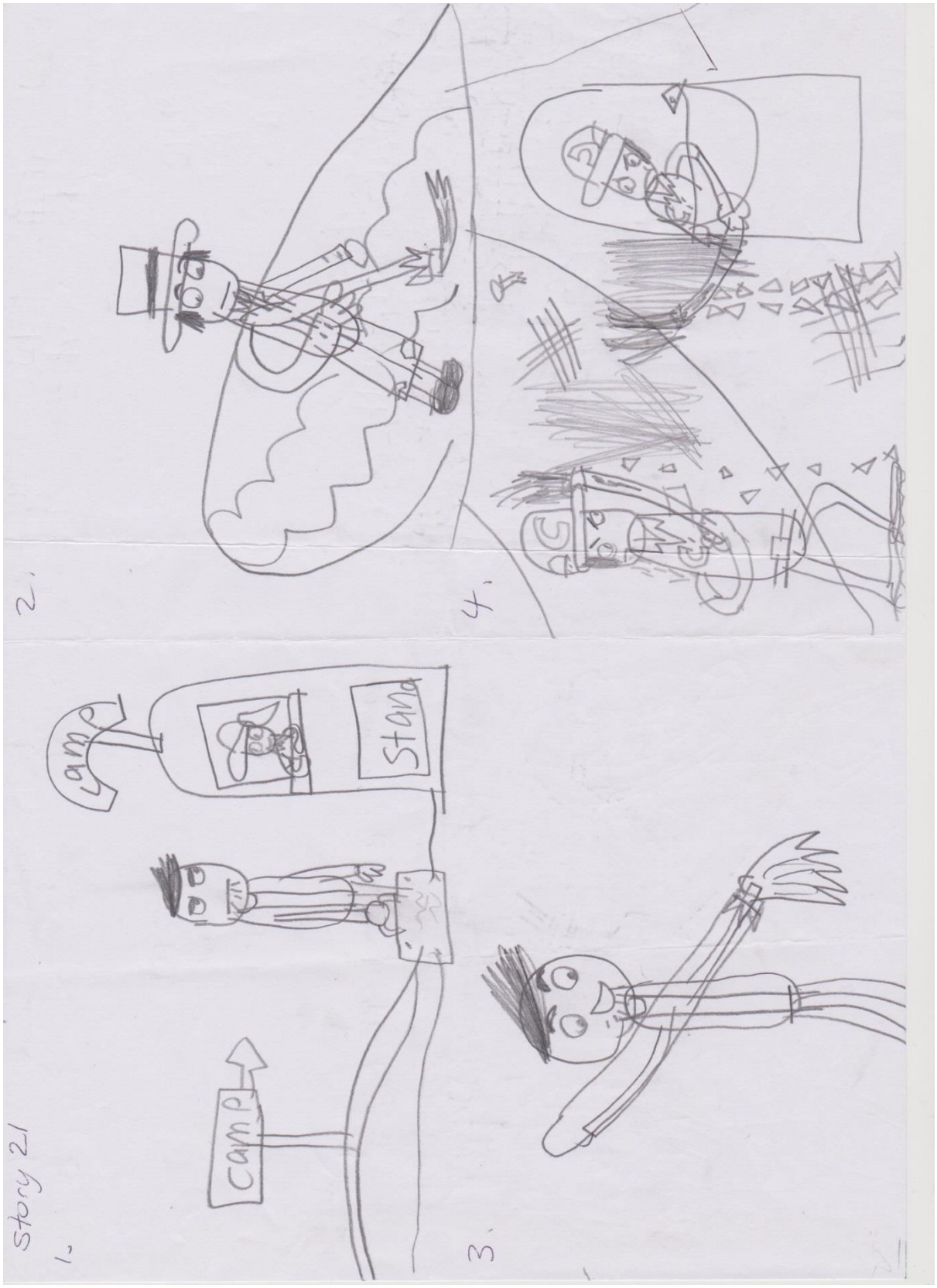
> "Pictures help me remember things because the pictures tell me more. The pictures tell me the answers."

Rhys formed a playground friendship with Connor. The two boys liked to allocate time to draw their own representation of scaffold drawings or pictures. The details in Rhys's drawings increased as he became more familiar with the scaffolds. Drawing 9.5.1 below is an example of a drawing completed when Rhys had just begun to use scaffolds to assist his classroom learning. The drawings in Drawing 9.5.2 Drawing 9.5.3 were completed when Rhys had worked with five of the scaffolds. Drawing 9.5.2 shows the sequence of events in a class story and Drawing 9.5.3 represents what Rhys learned on an excursion to the Nan Tien Bhuddist temple near Sydney. The third drawing is in the style of the scaffolds with all the key features drawn and labelled.

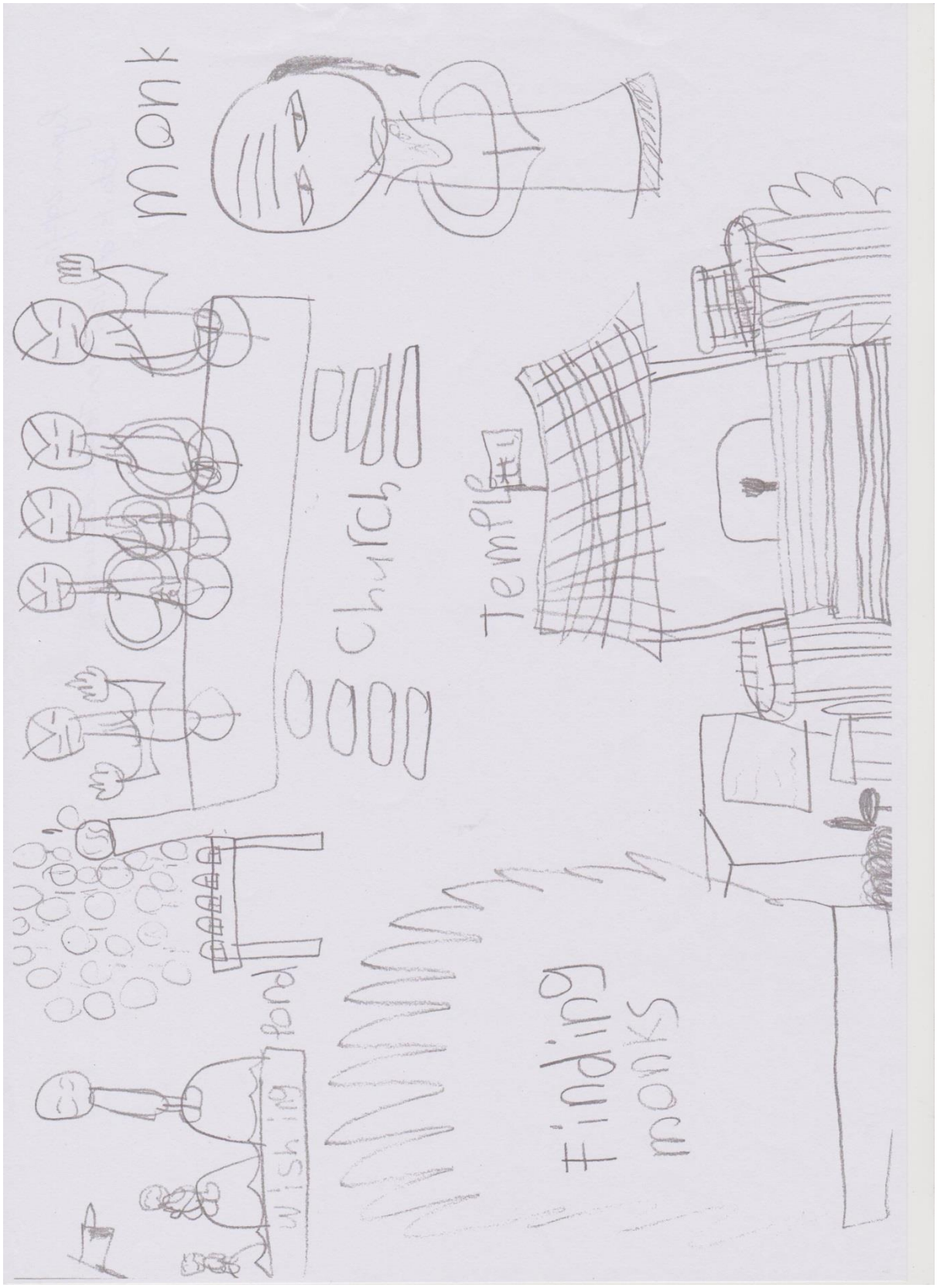


Drawing 9.5.1 Drawing by Rhys showing the Three Sisters

Rhys visited the Three Sisters on a class excursion to the Blue Mountains to the west of Sydney.



Drawing 9.5.2 Drawing by Rhys showing the action sequence within a story he read



Drawing 9.5.3 Drawing by Rhys depicting the Nan Tien Temple south of Sydney

Rhys visited the Nan Tien Bhuddist temple south of Sydney on a class excursion.

Topic Two-dimensional space

Student: Rhys **Year: 2** **Stage: 1**

VOCABULARY

General Vocabulary	**Detailed Vocabulary**	
dimension corners sides straight line curved line diagonal line parallel lines square rectangle triangle circle pentagon hexagon heptagon octagon rhombus trapezium	plane shape flat surface two dimensional features properties symmetry symmetrical mirror tesselate: flip, slide, turn vertical line horizontal line rotate	Envelop containing examples of each of the shapes.

CONCEPTS To identify and label two-dimensional shapes according to their features. To justify why the shape is a rectangle, etc. When the shape is rotated its properties remain the same.	Envelope containing examples of each of the properties listed in the vocabulary.
SENTENCES This is a triangle because ……. and even if I rotate it, the shape is still a triangle. All these shapes have four corners and four sides. The two rails in a railway track are parallel. A circle has lots of lines of symmetry.	

scaffold two dimensional space.doc G. Wilcock, 2010

Figure 9.5.1 Scaffold – 2 D Space (Mathematics)

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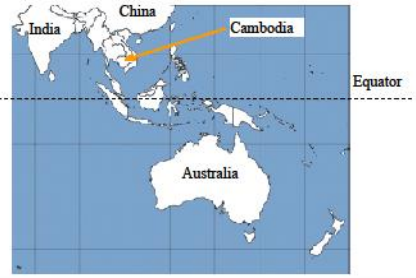
Topic Literacy activity: Running Shoes by Frederic Lipp

Student: Rhys **Year:** 2 **Stage:** 1

VOCABULARY

Cambodia
Monsoon
Bamboo shoots
The number man
Government
Village
Lotus leaf
Coconut tree
Rice field / rice paddy
The cockerel's call



CONCEPTS

1. When I read a book I ask myself
   Who is the main character?
   What is the main action?
   Then I ask myself
   Where is the action happening?
   When is the action happening?
   Why is the action happening?
2. In countries which are close to the Equator, the weather is nearly always hot and sunny.
3. When the rain comes it rains and rains for days and nights. It is called the **monsoon** rains.
4. The government of Cambodia makes the rules for the people who live in Cambodia.
5. Some people live in cities and some people, like Sophy, live in a village.

SENTENCES

1. 154 people lived in the village.
2. The village is called Andong Kralong.
3. Sophy had a secret wish. She wanted to go to school.
4. The one room school is 8 kilometres from Sophy's home.
5. Sophy needed a pair of running shoes so she could run to school.
6. At the end of the story, Sophy wants to help build a school for her village. She wants to be a teacher.

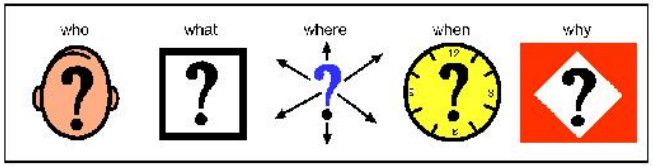


Figure 9.5.2 Scaffold – Running Shoes (English)

Topic **Cultures of China and the Madeira Islands**

Student: **Rhys** **Year:** **2** **Stage:** **1**

Cultural item	China	Madeira
Location	East Asia	Atlantic Ocean off North West coast of Africa.
Capital City	Beijing	Funchal, a seaport.
Language	Mandarin / Cantonese	Portuguese
Currency	Yuan	Euro
Food	Noodles, bean sprouts, bamboo shoots, chicken, beef, pork	Madeira is a mountain range so the farms are in terraces. Crops include vegetables, bananas. Fishing important. People eat a lot of fish – dry cod and sardines.
Cooking	Food often stir fried or steamed. Eaten with small bowls and chopsticks	Dried cod, grilled sardines, caldeirada – a potato based fish stew
Transport	Planes, cars, trains, bicycles	Cars but also oxen pull sleighs up very steep streets
Clothes	Silk is used to make many clothes	Women do a lot of embroidery
Traditional festivals	Chinese New Year and the Dragon Boat Festival	Festivities for Santos Populares (Popular Saints) in June
Famous sites	The Great Wall of China.	The old fortress at the port of Funchal.
Flags		

CONCEPTS

1. Identifies customs, practices, language and traditions of China
2. Identifies customs, practices, language and traditions of the island of Madeira as his own family background.

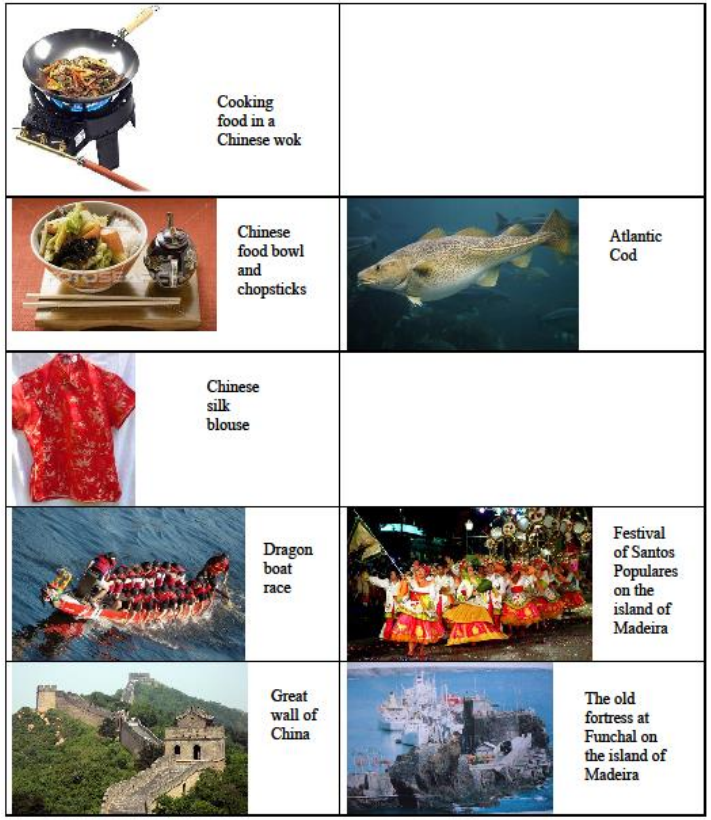
SENTENCES

1. Beijing is the capital of the People's Republic of China
2. Funchal is the main seaport and capital of the Madeira Islands.
3. In China a food is often cooked in a wok. The wok is used for stir frying food such as noodles and bean sprouts.
4. In Madeira the people eat a lot of fish which is caught in the Atlantic Ocean. The fish is dried, grilled or made into a stew.

Map of China

Map of Portugal with the island of Madeira in the Atlantic Ocean

Figure 9.5.3 Scaffold – Cultures (HSIE)



Topic **Volume and Capacity**

Student: Rhys **Year:** 2 **Stage:** 1

VOCABULARY

Volume

Capacity

Contents

Container

Amount

CONCEPTS / SENTENCES

1. Capacity is the word we use when we talk about the space inside a container.
2. Volume is the word we use when we talk about the space that the contents occupy.

A container has capacity.

The contents have volume.

SENTENCES

1. There are many different containers, for example glass jars, drink bottles, cardboard boxes and buckets.
2. Containers can have different shapes and sizes.
3. Capacity is the amount a container can hold.
4. Volume is how much space is occupied by a liquid or a solid.

Each bottle has the same capacity but the bottle on the left contains a smaller volume of liquid.

Figure 9.5.4 Scaffold – Volume and Capacity (Mathematics)

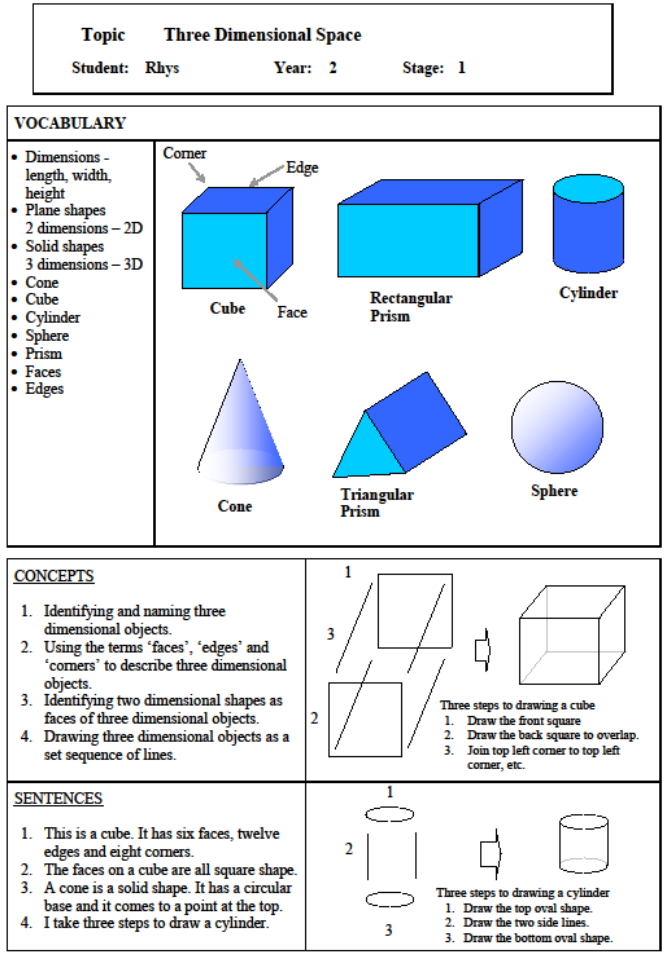


Figure 9.5.5 Scaffold – 3 D Space (Mathematics)

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Topic Animals in the wetland environment: dragonfly, frog, platypus

Student: Rhys **Year:** 2 **Stage:** 1

VOCABULARY

aquatic
environment
life cycle
adaptation
amphibian
mammal
freshwater habitat
incubate
streamlined
predator

Platypus beside a creek

Platypus swimming in a creek

CONCEPTS

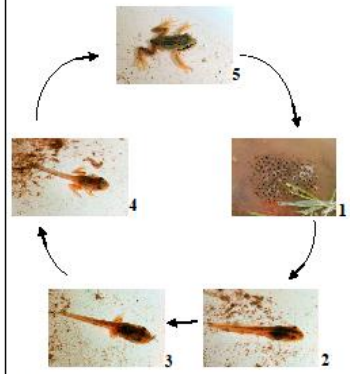
1. There are many tiny creatures hiding in our waterways.
2. Larger birds, mammals like platypus, fish and frogs depend on these smaller creatures for food.
3. A frog will eat dragonflies as part of its food source.
4. Platypuses eat frogs as part of their food source.
5. The wetland environment provides shelter, water, food, a breeding place and protection for many animals.

Dragonfly on a branch

SENTENCES

1. The dragon fly is a flying insect which is adapted to life in a wetland. It catches its food as it flies over the waterways. The female places her eggs in water.
2. Dragonflies need clean water for their habitat, their source of food and their life cycle. Dragonflies are harmless. They help people by feeding on harmful insects such as mosquitoes.
3. Frogs are amphibians which means they Frogs eat insects that live in wetland environments. They lay their eggs in water.
4. Frogs are well adapted to life in a wetland. Their long back legs are excellent for jumping and swimming.
5. The platypus has several adaptations which make it an excellent swimmer. It has a streamlined body and uses its webbed front feet to pull itself through the water. It uses its tail as a rudder to steer itself when it swims.
6. The platypus lays its eggs in a nesting chamber at the end of its burrow. The burrow is dug into the side of a creek bank.

Leaf green tree frog



Life cycle of a frog

1. Frogs eggs
2. Young tadpole
3. Tadpole with two legs
4. Tadpole with four legs
5. Adult frog

Figure 9.5.6 Scaffold – Animals in the Wetland Environment (HSIE)

9.6 Case Study for Stewart

Stewart was a Year 3 student who was aged eight years and six months at the beginning of the study. Stewart was the youngest of four children.

At the end of Year 2, the school recommended that Stewart see a consultant paediatrician because of his short attention span, distractibility and difficulty with social interactions, gross motor and fine motor activities.

He was very interested in movies and was able to recite complete scenes. He was experiencing difficulty acquiring basic reading skills and engaging with any class texts. He did, however, work well with rotating English groups in the morning. Stewart's energy levels dropped after midday and he did not like to work in the afternoon. Stewart was given a diagnosis of high functioning autism.

The paediatrician reported that on the Autism Treatment Evaluation List (ATEC), Stewart's extremely limited diet, scored as being a moderate problem. Minor problems were identified such as feelings of being anxious/fearful, obsessive speech, demands for sameness and fixation on certain objects.

On the Attwood Scale, both the parent and classroom teacher completed similar scales. In both cases social/emotional abilities, communication, cognitive skills, specific interests and movement skills scored positively for a diagnosis of autism. The Childhood Autism Rating Scale (CARS), the SWAN Rating Scale and the Connors Rating Scale were also included in the assessment process. On the High-functioning Autism Spectrum Screening Questionnaire (ASSQ) more than 50% of the items were scored as positive.

Stewart was given a diagnosis of high-functioning autism. At his six monthly review meeting, the paediatrician summarised Stewart's presentation as that of a student with high intelligence, symptoms of anxiety and a need for continual social skill instruction.

Following his paediatric assessment, Stewart was referred by the school for a psychometric assessment in order to ascertain his learning potential and to assist with educational planning. Stewart's general cognitive ability was found to be in the high average range of intellectual functioning, as measured by the full scale score. Both his verbal and nonverbal reasoning abilities were in the average range. In order for Stewart to access learning tasks to his potential, the psychometric report recommended that Stewart be provided with: both visual and verbal cues to assist his processing and retention of new

information; concrete examples rather than having to rely on associations between abstract concepts; visual associations between words and concepts and visual links between new and previously learned material.

The psychometric report also recommended the use of key points, boxes and arrows to show connections within any classroom topic information. It also recommended that tasks be broken down into manageable sections using instructions such as "First we…. then …. finally …", so that the amount of information did not appear overwhelming. The research intervention in the form of the visual scaffold met each of these requirements.

Two months after Stewart's diagnosis, his brother, who was two years older, was also diagnosed with high functioning autism. Stewart's parents believed his two older siblings, though not diagnosed, also exhibited characteristics of autism. Stewart's father described how three of his four siblings and his father exhibited behaviours associated with autism. Two of Stewart's uncles worked from home in order to avoid having to cope with the social difficulties of the work place.

Table 9.6.1 below sets out Stewart's pre and post intervention results for the PLAI-2. Table 9.6.2 sets out the results of the analysis of the teacher's instructional language.

Stewart's four levels of language abstraction were assessed both prior to and following the research intervention.

Table 9.6.1 Table showing results of PLAI-2 Testing for Stewart

Test: PLAI-2 – Preschool Language Assessment Instrument (2nd Edition)				
Participant : Stewart				
Level of Language Abstraction	**Raw Score**	**Scaled score relative to age 5.11**	**Percentile Rank relative to age 5.11**	**Age Equivalent relative to age 5.11**
Pre-Intervention Test Results. Chronological Age: 5.11				
1. Matching	17/17 (100%)	11	≥ 63rd	≥6.0
2. Selective Analysis	13/17 (76%)	8	25th	5.0
3. Reordering	12/15 (80%)	12	75th	> 6.0
4. Reasoning	15/21 (71%)	14	91st	> 6.0
Post-Intervention Test Results. Chronological Age: 6.6				
1. Matching	17/17 (100%)	11	≥ 63rd	≥6.0
2. Selective Analysis	17/17 (100%)	12	≥ 75th	>6.0
3. Reordering	15/15 (100%)	15	≥ 95th	> 6.0
4. Reasoning	21/21 (100%)	20	> 99th	> 6.0

Table 9.6.2 Table showing analysis of Classroom Teacher's Instructional Language for Stewart

Matching	**Selective Analysis**	**Reordering**	**Reasoning**
9.5%	11.7%	44.5%	34.3%

Tables 9.6.3 to 9.6.6 below set out Stewart's receptive vocabulary scores as measured by the PPVT-4; his expressive vocabulary scores as measured by the EVT-2; and the analysis of any change in these test scores pre and post the intervention.

Table 9.6.3 Table showing PPVT-4 Receptive Vocabulary Scores for Stewart

Results before classroom topic testing			**Results after classroom topic testing**		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
111	8.6	9.9	137	9.0	14.5

Table 9.6.4 Table showing analysis of Change in PPVT-4 Scores for Stewart

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Years.Months)
26	6	4.8

Table 9.6.5 Table showing EVT-2 Expressive Vocabulary Scores for Stewart

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	Chronological Age	Age Equivalent	Standard Score	Chronological Age	Age Equivalent
107	8.6	9.6	123	9.0	13.5

Table 9.6.6 Table showing analysis of Change in EVT-2 Scores for Stewart

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Years.Months)
16	6	3.11

Prior to the research intervention, Stewart's weakest areas of language abstraction were reasoning (71%) and selective analysis (76%). Within Stewart's visual scaffolds, therefore the emphasis was on selective analysis of perception as a means of increasing his score on the questions requiring reasoning about the perception.

Following the research intervention, Stewart's receptive language score was fourteen points higher than his expressive language score. This was significant at the .05 level, however it was not interpreted as indicating word retrieval difficulties because Stewart's age equivalent expressive language score was 13.5,well above his chronological age of 9 years.

Stewart's six scaffolded curriculum topics were *Multiplication and Division* (Mathematics); *British Colonisation* (HSIE); *Historical Narrative* (English text type); *Fractions and Decimals* (Mathematics); *Simple Machines* (Science) and *Magnets* (Science). The scaffolds are set out below.

In each of Stewart's scaffolds, there were two areas of emphasis. The first was on the name and meaning of a number of select features or concepts, which come within Blank et al.'s second level of language abstraction, selective analysis. The second area of

emphasis fits within Blank et al.'s third level of language abstraction, reordering. It was the combination of several of the basic features or concepts to form a more complex concept requiring a deeper understanding of the topic.

In each of the scaffolds these selective features, as well as their combination, are evident in the scaffold's visual format. For example, in the mathematics scaffold, *Multiplication and Division*, the mathematical features include multiplication array, product, division and fractions. The combination of these features was set out visually on page two of the scaffold when they combine within more complex features such as factors, multiples and prime and composite numbers. Similarly, on the scaffold, *Fractions and Decimals*, mathematical features such as digit, fraction, numerator, denominator and place value combine within the more complex mathematical feature which enables conversion of a fraction to a decimal and conversion of a decimal to a fraction while following the decimal place value system. These features and their combination are shown in the scaffold's visuals which are on the right hand side of the page.

Topic Multiplication and Division

Student: Stewart **Year:** 3 **Stage:** 2

VOCABULARY

Multiplication
Array
Multiples
Factors
Prime number
Composite number
Product
Squared number
Division
Fractions

Multiplication is repeated addition

This drawing means

a. 2 groups of 3 2 x 3 = 6
b. 3 multiplied by 2 3 x 2 = 6
c. Double 3 3 x 2 = 6

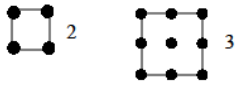
To find the product of two numbers, we multiply.

CONCONCEPTS

1. Multiplication is repeated addition, so 4 x 3 means 3 + 3 + 3 + 3.
2. The order of multiplication does not matter, so 5 x 6 = 6 x 5.
3. Square numbers can be shown by dots in the shape of a square.
4. Describing multiplication patterns and applying the commutative property using arrays.
   . . . . . 3 x 5 = 15
   . . . . . 5 x 3 = 15
   . . . . .
5. Linking multiplication and division facts using groups or arrays.
   . . . . 3 groups of 4 is 12
   . . . . 12 shared among 3 is 4
   . . . .
6. Linking multiplication, divisional and fractional facts connected to the 2x, 3x, 4x, 5x, 10x tables.
7. Recalling multiplication, divisional and fractional facts connected to the 2x, 3x, 4x, 5x, 10x tables.

Squared Numbers
Numbers that can be represented by dots in the shape of a square.

2^2 3^2



When the dots are in rows it's called an array.

To square a number you multiply the number by itself.

$2^2 = 2 \times 2 = 4$

$3^2 = 3 \times 3 = 9$

$4^2 = 4 \times 4 = 16$

$5^2 = 5 \times 5 = 25$

SENTENCES

1. When we square a number, we multiply the number by itself.
2. Division is the opposite of multiplication. I can explain this by using an array
   . . . . 3 groups of 4 is 12
   . . . . 12 shared among 3 is 4
   . . . .
3. Remainder is another word for left over.
4. A fraction has a number on top, a line (called a fraction bar) and a number on the bottom.
5. The number on the bottom tells us how many parts there are altogether.
6. If I know that 3 x 4 = 12
   Then I can say that 4 x 3 = 12
   12 ÷ 3 = 4
   12 ÷ 4 = 3
   I can also say that $\frac{1}{3}$ x 12 = 4
   $\frac{1}{4}$ x 12 = 3

Factors and multiples are like cousins – they are related to each other.

1 x 12 = 12
Factors of 12 — 12 is a multiple of 1 and 12 is multiple of 12

2 x 6 = 12
Factors of 12 — 12 is a multiple of 2 and 12 is a multiple of 6

3 x 4 = 12
Factors of 12 — 12 is a multiple of 3 and 12 is a multiple of 4

Therefore 1, 2, 3, 4, 6 and 12 are factors of 12 and 12 is a multiple of 1, 2, 3, 4, 6 and 12

Prime Numbers

A prime number has only two factors – itself and one

Number	Factors	
3	1 x 3	So 3 is a prime number
5	1 x 5	So 5 is a prime number
7	1 x 7	So 7 is a prime number
8	1 x 8 2 x 4	So 8 is a composite number
11	1 x 11	So 11 is a prime number

A **number** which is **not a prime** number is a **composite** number.

Number 1 is a special case. It is not a **prime** number and it is not a **composite** number.

A **product** is the answer when **two numbers** are **multiplied** together.
7 x 3 = 21
21 is the **product** of **7** and **3**

Figure 9.6.1 Scaffold – Multiplication and Division (Mathematics)

Fraction

- a part of a group

or

- part of a whole number.

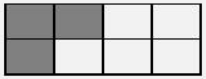
There are five cars. Only one is circled. This means that the circled car is 1 out of a group of 5 or $\frac{1}{5}$ of the total.

$\frac{1}{5}$

Numerator (How many parts we have)

Fraction Bar

Denominator (How many parts altogether)



There are 8 squares in the figure. 3 of the squares are shaded. The fraction of squares that are shaded is $\frac{3}{8}$

$\frac{3}{8}$

Numerator (Number of shaded squares)

Denominator (How many squares altogether)

Topic British Colonisation of Australia

Student: Stewart **Year:** 3 **Stage:** 2

VOCABULARY

1. Colonisation
2. The Great South Land
3. Terra Nullius
4. Transportation
5. The First Fleet
6. Agriculture: difference between England and NSW
7. Journals of earliest NSW colonial history
8. Oral history of the Aboriginal people
9. The Eora people
10. Pemulwuy

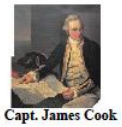
Arthur Phillip

The First Fleet

Map showing journey of the First Fleet

CONCEPTS

1. The context of British colonisation.
2. James Cook's voyage. James Cook's diary impressions of Australia's people and land.
3. Concept of *Terra Nullius* in context of British view of aboriginal people at the time.
4. Journey of the First Fleet to Sydney Cove.
5. The experience of colonisation – 'from the ship' and 'from the shore'. Difficulties experienced by the British colonists.
6. The impact of British occupation on the Eora people of the Sydney region – loss of land, food resources, disease and social disruption.



Capt. James Cook

Watkin Tench's Journal

Pemulwuy

Aboriginal artefacts

scaffold british colonisation.doc G. Wilcock, 2010

Figure 9.6.2 Scaffold – British Colonisation of Australia (HSIE)

Topic Text Type Historical Narrative: British Colonisation

Student: Stewart **Year:** 3 **Stage:** 2

VOCABULARY

- Narrative
- History
- Orientation
- Complication
- Sequence of events
- Resolution
- Coda
- Language of description
- Language to indicate time sequence
- Figurative language

Captain Arthur Phillip

The First Fleet entering Sydney Harbour

On the 26th January, 1788 Arthur Phillip raised the flag and took possession of the new colony. This day is now celebrated as Australia Day.

Aboriginal people watch as British Marines explore parts of Sydney Cove.

CONCEPTS

The purpose of an historical narrative is to tell the reader about events in history.
An historical narrative has 5 parts

1. **Orientation**
   Introduces the main people (**who**), the setting (**where**), the time (**when**) and some idea about **what** is to follow.
2. **Complication**
   Sets out the main things that went wrong.
3. **Sequence** of events
   Describes how people reacted to the complications.
4. **Resolution**
   Describes how complications are resolved.
5. **Coda**
   What has been learned from history?

Five Parts of an Historical Narrative

1. Orientation
2. Complication
3. Sequence of events
4. Resolution
5. Coda

Purpose:
To inform your audience about the British colonisation of NSW.

Orientation

Who	Capt Arthur Phillip and over one thousand people – Officers, sailors, marines and convicts.
What	Bound for NSW to set up a new British Colony.
Where	Sydney Harbour.
When	26th Jan 1788, First Fleet arrived at Sydney Cove.
Why	Overcrowding of English gaols.

Complication

A. Two different views
   - 'from the ship' (British settlers)
   - 'from the shore' (the Eora people)

B. Soil and climate very different to England – difficulty growing food.
   Soil around Sydney Cove – sandy and rocky.
   Little manure to use as fertiliser.
   Result: Colony close to starvation.

C. Impact on Eora people:
   Loss of their land and food resources, disease (smallpox) and social disruption.

Sequence of events

A. 13th May 1787 First Fleet sailed from Portsmouth in England.
   26th January 1788 First Fleet in Sydney Cove – British Flag raised.

B. Within nineteen days of landing, Phillip explored 22Km upstream and discovered rich, dark soil at Rose Hill (later called Parramatta).
   Settlers arrived during a drought.

C. As early as May 1788, the aborigines experienced a shortage of food around Sydney Cove.
   In 1788 the Kadigal clan had fifty aboriginals.
   In 1790 the Kadigal clan had been reduced to three people.
   Smallpox had killed many aboriginals

Figure 9.6.3 Scaffold – Historical Narrative (English)

Resolution

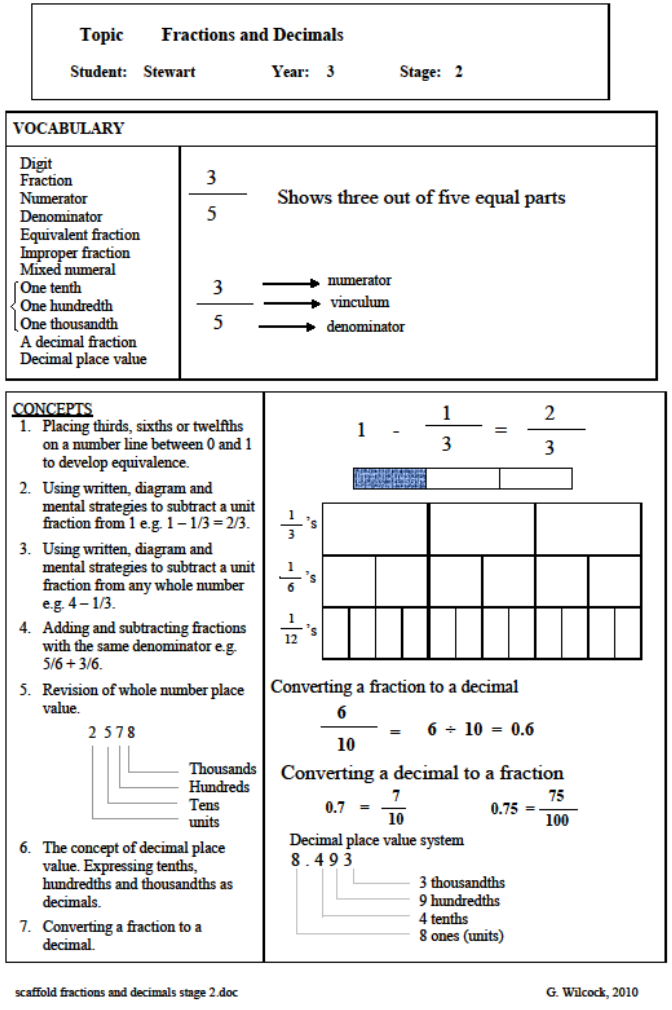
- Arthur Phillip was an excellent leader. He had been in the British navy and had been a farmer.
- Within nineteen days of landing, Phillip went exploring - twenty-two kilometres upstream he discovered rich dark soil at Rose Hill (later called Parramatta)
- Phillip treated the convicts well and he told the soldiers and convicts not to harm the aboriginal people.
- The settlement at Sydney gradually grew and expanded under the leadership of Arthur Phillip, the first Governor

Coda

Aboriginal people are still struggling today to regain control of their land.
In 1992, the Mabo decision gave them the traditional right to crown land.
In 1996, the Wik decision extended traditional ownership to crown land leased to farmers.
The Mabo and the Wik decisions began reconciliation between Aboriginal people and European inhabitants because these decisions officially recognised that Aboriginal people owned the land before 1788.

The early Sydney settlement

Convicts working on the roads were kept in chains



Topic Fractions and Decimals

Student: Stewart **Year:** 3 **Stage:** 2

VOCABULARY

Digit
Fraction
Numerator
Denominator
Equivalent fraction
Improper fraction
Mixed numeral
One tenth
One hundredth
One thousandth
A decimal fraction
Decimal place value

$\frac{3}{5}$ Shows three out of five equal parts

$\frac{3}{5}$ → numerator, vinculum, denominator

CONCEPTS

1. Placing thirds, sixths or twelfths on a number line between 0 and 1 to develop equivalence.
2. Using written, diagram and mental strategies to subtract a unit fraction from 1 e.g. 1 – 1/3 = 2/3.
3. Using written, diagram and mental strategies to subtract a unit fraction from any whole number e.g. 4 – 1/3.
4. Adding and subtracting fractions with the same denominator e.g. 5/6 + 3/6.
5. Revision of whole number place value.

2 5 7 8 — Thousands, Hundreds, Tens, units

6. The concept of decimal place value. Expressing tenths, hundredths and thousandths as decimals.
7. Converting a fraction to a decimal.

$1 - \frac{1}{3} = \frac{2}{3}$

$\frac{1}{3}$'s, $\frac{1}{6}$'s, $\frac{1}{12}$'s

Converting a fraction to a decimal

$\frac{6}{10} = 6 \div 10 = 0.6$

Converting a decimal to a fraction

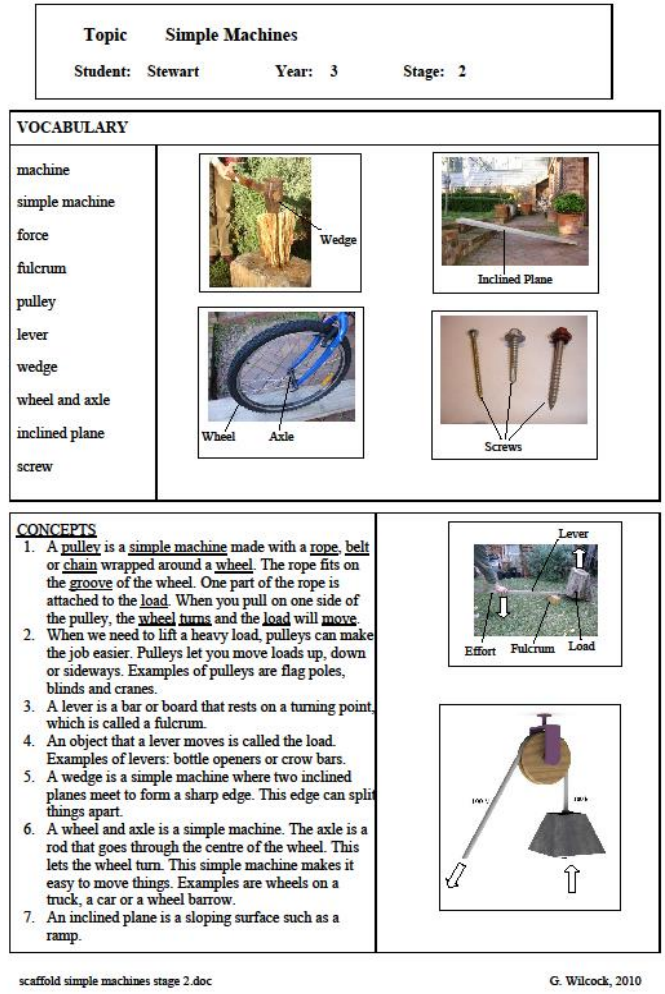
$0.7 = \frac{7}{10}$ $0.75 = \frac{75}{100}$

Decimal place value system

8 . 4 9 3 — 3 thousandths, 9 hundredths, 4 tenths, 8 ones (units)

scaffold fractions and decimals stage 2.doc G. Wilcock, 2010

Figure 9.6.4 Scaffold – Fractions and Decimals (Mathematics)



Topic Simple Machines

Student: Stewart **Year:** 3 **Stage:** 2

VOCABULARY

machine
simple machine
force
fulcrum
pulley
lever
wedge
wheel and axle
inclined plane
screw

Wedge
Inclined Plane
Wheel Axle
Screws

CONCEPTS

1. A pulley is a simple machine made with a rope, belt or chain wrapped around a wheel. The rope fits on the groove of the wheel. One part of the rope is attached to the load. When you pull on one side of the pulley, the wheel turns and the load will move.
2. When we need to lift a heavy load, pulleys can make the job easier. Pulleys let you move loads up, down or sideways. Examples of pulleys are flag poles, blinds and cranes.
3. A lever is a bar or board that rests on a turning point, which is called a fulcrum.
4. An object that a lever moves is called the load. Examples of levers: bottle openers or crow bars.
5. A wedge is a simple machine where two inclined planes meet to form a sharp edge. This edge can split things apart.
6. A wheel and axle is a simple machine. The axle is a rod that goes through the centre of the wheel. This lets the wheel turn. This simple machine makes it easy to move things. Examples are wheels on a truck, a car or a wheel barrow.
7. An inclined plane is a sloping surface such as a ramp.

Lever
Effort Fulcrum Load

scaffold simple machines stage 2.doc G. Wilcock, 2010

Figure 9.6.5 Scaffold – Simple Machines (Science)

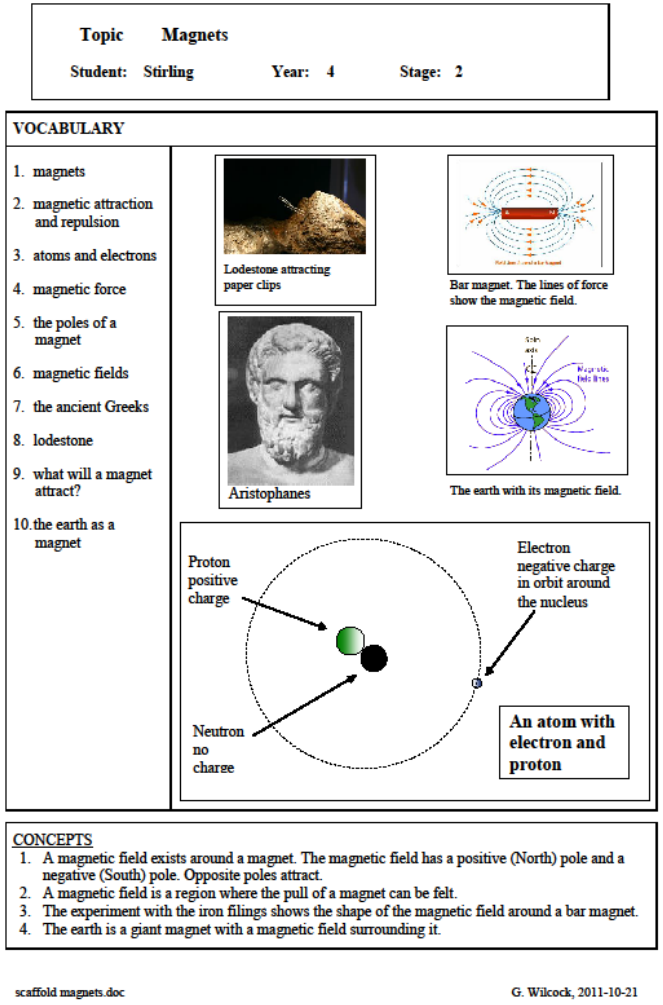


Figure 9.6.6 Scaffold – Magnets (Science)

Intentionally Blank

9.7 Case Study for Danielle

Danielle was a Year 3 student who attended an inclusive primary school in Sydney. At the beginning of the study, Danielle was aged eight years and seven months. She had on older sister who was fourteen years old. Danielle's mother reported that Danielle's sister had no learning difficulties. In the year prior to commencing school, Danielle attended pre-school for two days each week. The director of the pre-school referred Danielle for a paediatric assessment because of a language delay and a preference for solitary play. Danielle was able to speak in sentences but many of her sentences were by rote and lacked meaning. As a pre-school student, Danielle's interest in *Dora the Explorer* was intense, often to the exclusion of other topics or activities. In her pre-school year, Danielle was able to name colours, common shapes and the letters of the alphabet and to count to twenty. She enjoyed being read to and frequently opened books and turned the pages. Pre-school staff reported that although she preferred solitary play, she would join in if other children initiated play with her. Her mother reported that Danielle became very distressed if she heard a vacuum cleaner or hair dryer. The consultant paediatrician did not believe Danielle showed any evidence of cognitive delay but recommended a full assessment of Danielle's expressive and receptive language skills as well as paediatric speech therapy intervention.

Following the paediatric assessment, at age five years and one month, Danielle was assessed by a Speech Pathologist on the CELF-4 Australian. In order to calculate Danielle's Receptive Language Index, the following subtests were administered: *Concepts and Following Directions*, *Word Classes 1 – Receptive* and *Sentence Structure*. Danielle's score on the *Concepts and Following Directions* subtest was at the sixteenth percentile, her score on *Word Classes 1 – Receptive* was at the seventy-fifth percentile while her *Sentence Structure* was at the fifth percentile. Word Classes 1 – Receptive was at an age equivalency of 6.1. Both the Concepts and Following Directions subtest and Sentence Structure subtest were below 5.0 on the age equivalency measure.

In order to calculate Danielle's Expressive Language Index, the following subtests were administered: Word Structure, Recalling Sentences and Formulated Sentences. Danielle's scores on both the Word Structure and Formulated Sentence subtests were at the ninth percentile, while Recalling Sentences was at the first percentile. All three subtests scored below age five on a measure of age equivalency.

Danielle's Receptive Language Index was a standard score of 86 which was at the 18th percentile and in the average range. Her Expressive Language Index was a standard score of 70 which was at the 2nd percentile and in the very low range.

A discrepancy analysis was performed between Danielle's Receptive Language Index standard score of 86 and her Expressive Language Index score of 70. The sixteen point difference between the scores was significant at the .05 level and indicated that Danielle's receptive language skills could be considered a relative strength compared to her expressive language skills.

During testing, Danielle experienced difficulty with several expressive language skills – repeating sentences presented orally without omissions or substitutions, use of specific words in formulating grammatically correct sentences and use of rules of grammar such as plurals and regular/irregular verbs. Danielle experienced greatest difficulty with the recalling sentences subtest. She was unable to repeat sentences directly after the therapist and found it difficult to concentrate on the auditory task.

In Year 1, at age seven, school staff recommended that Danielle have an assessment with a consultant paediatrician. In the school setting, Danielle was often overwhelmed with fear and anxiety, disturbed by loud noises, very upset if she lost a game, had difficulty connecting socially with her peers and found classroom learning difficult. Danielle received a diagnosis of Autism Spectrum Disorder.

Table 9.7.1 below sets out Danielle's pre and post intervention results for the PLAI-2. Table 9.7.2 sets out the results of the analysis of the teacher's instructional language.

Table 9.7.1 Table showing results of PLAI-2 Testing for Danielle

Test: PLAI-2 – Preschool Language Assessment Instrument (2nd Edition)				
Participant : Danielle				
Level of Language Abstraction	**Raw Score**	**Scaled score relative to age 5.11**	**Percentile Rank relative to age 5.11**	**Age Equivalent relative to age 5.11**
Pre-Intervention Test Results. Chronological Age: 8.7				
1. Matching	17	11	≥ 63rd	≥6.0
2. Selective Analysis	17	12	≥ 75th	> 6.0
3. Reordering	9	9	37th	5.6
4. Reasoning	14	13	84th	> 6.0
Post-Intervention Test Results. Chronological Age: 9.2				
1. Matching	17	11	≥ 63rd	> 6.0
2. Selective Analysis	17	12	≥ 75th	> 6.0
3. Reordering	13	13	84th	> 6.0
4. Reasoning	18	17	99th	> 6.0

Table 9.7.2 Table showing analysis of Classroom Teacher's Instructional Language for Danielle

Matching	**Selective Analysis**	**Reordering**	**Reasoning**
4.6%	16.5%	45.3%	33.5%

45.3% of Danielle's teacher's instructional language was at Blank et al.'s 3rd level of language abstraction: *reordering perception.* Prior to the intervention, this was Danielle's weakest area of language abstraction, scoring at an age equivalency of 5 years and 6 months while her chronological age was 8 years and 7 months.

Danielle's receptive vocabulary scores were measured using the PPVT-4 and her expressive vocabulary scores were measured using the EVT-2. Tables 9.7.3 to 9.7.6 below set out the scores for the PPVT-4 and the EVT-2 as well as the analysis of any change in theses scores pre and post the intervention

Table 9.7.3 Table showing PPVT-4 Receptive Vocabulary Scores for Danielle

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
106	8.7	9.3	110	9.1	9.10

Table 9.7.4 Table showing analysis of Change in PPVT-4 Scores for Danielle

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
4	6	7

In the six months between pre and post assessment of Danielle's receptive vocabulary skills, her age equivalent score increased by one month. Both pre and post intervention, Danielle's receptive language scores exceeded her chronological age.

Table 9.7.5 Table showing EVT-2 Expressive Vocabulary Scores for Danielle

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
107	8.7	9.6	107	9.2	10.0

Table 9.7.6 Table showing analysis of Change in EVT-2 Scores for Danielle

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
No change	7	6

For Danielle, the only area of language performance which was below average prior to the intervention was her scoring at Blank et al.'s third level of language abstraction – reordering. It was concluded, therefore, that Danielle would find it difficult to hold and manipulate facts in order to either meet a specified criteria or to combine several facts or concepts to form a larger system of concepts such as the water cycle. This level of language – reordering – was therefore emphasised in the design of the visual scaffolds for Danielle.

The six scaffolded curriculum topics which represented the research intervention for Danielle were: *Wetlands* (HSIE); *The Water Cycle* (Science); *Animals in the Wetland Environment* (HSIE); Exposition – Why We Should not Waste Water (English); *Capacity and Volume* (Mathematics) and *Area* (Mathematics). These scaffolds are set out at the end of this section.

In each of Danielle's scaffolds, the key vocabulary was set out, however, the emphasis was upon the relationship between these items of vocabulary as recorded under the headings concepts and sentences. This relationship sets up more complex concepts such as the system of food and shelter that exists in wetlands; the cycle of cause and effect that is present in the *Exposition – Why We should not Waste Water*; the concepts which combine to form the water cycle or the manipulation of such concepts as 'space', 'contain' and 'enclose' to define volume and capacity and to understand the difference between the two.

When asked, prior to the study, to rate, on a scale of one to ten, Danielle's ability to understand new classroom topics or concepts, there was no agreement between the teacher, parent and student response. The teacher rated Danielle's ability to understand new classroom topics as three out of ten. Danielle's mother rated it as seven out of ten. Danielle rated her own understanding of new topics as one out of ten. She explained that it was sometimes very confusing.

> "Teacher is talking and talking. It is a little bit tiring because you have to cut and cut and glue and paste it in your book. It is hard. I don't know what I'm doing."

The scaffolds were very effective for Danielle. This was reflected in the increase in her percentage of engaged learning time within the classroom. This is set out in Table 8.24.1. As Danielle began work with each scaffold, she checked that she had all the information with her, written down. She was the only participant in the study who requested a copy of the marking schema when she noticed it on the researcher's desk. This gave her a clearly set out table of the ten items of vocabulary and their meanings. She used the marking schema with each scaffold.

When Danielle was offered the choice between the A4 sized scaffold and the pocket sized version, she chose the A4 sheet because,

> "There is more space to see what it is like, you know".

Danielle explained the advantage for her in having all the information written down on the scaffold.

> "The scaffold makes me learn. It is easy to remember. About eighty per cent that I look and remember. When you talk it gets confusing because I can't really remember it."

Topic Wetlands

Student: Danielle **Year:** 3 **Stage:** 2

VOCABULARY

General Vocabulary

- wetlands
- habitat
- marsh
- mangrove
- swamp
- estuary
- amphibians
- wading birds
- reservoir
- eco system

Kensington Pond – Centennial Park

CONCEPTS

1. Wetlands are "wet lands". Water lies on the ground for at least part of the year.
2. Aquatic plants grow in wetlands. For example mosses, cattails, bulrushes, lily pads, pondweed.
3. The soil in wetlands is either full of water or underwater and the plants are adapted to grow in very wet conditions.
4. Habitat means the environment where animals and plants live. The wetlands habitat has a lot of water in it.
5. Plants and wildlife depend on water in wetlands. An ecosystem is a life system where plants and animals depend upon each other.
6. Wetland vegetation is important for the safety of wildlife in the wetlands.
7. Wetlands include marshes, swamps and estuaries.
8. Amphibian is the name for animals that spend part of their time in the water and part on dry land.

Lilies on a pond

Mangroves

SENTENCES

1. Wetlands help prevent floods and droughts by storing water.
2. Wetlands act like a sponge. They soak up extra water and hold onto it for a while. This means there is a longer-lasting more reliable water source.
3. Plants and wildlife depend on water in wetlands. It gives food and water and provides a place of shelter, cooling off, breeding, nesting and rest spots for migrating birds.
4. Wetland vegetation is important for the safety of the wildlife in the wetlands. Many fish, amphibians, invertebrates and insects hide in the wetlands from predators.
5. Swamps are wetlands where shrubs and trees grow. The water is just below the ground level.
6. Marshes have water which is up to 2 metres deep. Marsh plants use sunlight to convert water and nutrients into living matter. Marshes provide food and shelter for a large variety of wildlife.

Bulrushes

Cattails

Macquarie Marshes on Macquarie River

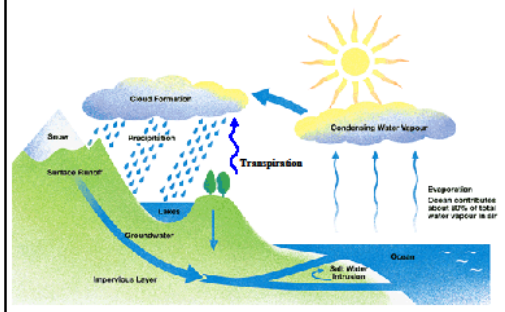
Figure 9.7.1 Scaffold – Wetlands (HSIE)

Topic The Water Cycle

Student: Danielle **Year:** 3 **Stage:** 2

VOCABULARY

- Water cycle
- Atmosphere
- Evaporation
- Condensation
- Precipitation
- Conservation
- Transpiration
- Humidity
- Water vapour
- Solid / liquid / gas



The Water Cycle

(SA Government)

CONCEPTS

1. Water can have three different forms
   - Water vapour
   - Liquid water
   - ice
2. Water takes on one of these three forms in different parts of the water cycle.
3. Water vapour is stored in the air and is measured as humidity.

SENTENCES

1. Water is continually changing its form.
2. Water evaporates into the air from the oceans and the land. Evaporation increases with higher temperatures.
3. Water vapour is stored in the air and is measured as humidity.

The earth has a limited amount of water.

That water keeps going around and around in what we call the "Water Cycle".

This cycle is made up of four main parts:

- evaporation (and transpiration)
- condensation
- precipitation
- collection in oceans and lakes

Figure 9.7.2 Scaffold – The Water Cycle (Science)

Intentionally blank

Topic **Animals in the wetland environment: dragonfly, frog, platypus**

Student: **Danielle** **Year:** **3** **Stage:** **2**

VOCABULARY

aquatic
environment
life cycle
adaptation
amphibian
mammal
freshwater habitat
incubate
streamlined
predator

Platypus beside a creek

Platypus swimming in a creek

CONCEPTS

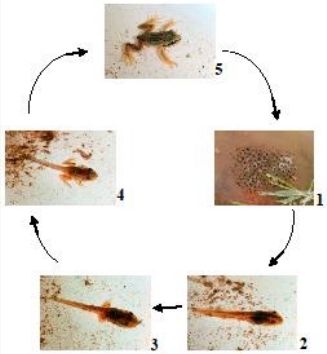
1. There are many tiny creatures hiding in our waterways.
2. Larger birds, mammals like platypus, fish and frogs depend on these smaller creatures for food.
3. A frog will eat dragonflies as part of its food source.
4. Platypuses eat frogs as part of their food source.
5. The wetland environment provides shelter, water, food, a breeding place and protection for many animals.

Dragonfly on a branch

SENTENCES

1. The dragon fly is a flying insect which is adapted to life in a wetland. It catches its food as it flies over the waterways. The female places her eggs in water.
2. Dragonflies need clean water for their habitat, their source of food and their life cycle. Dragonflies are harmless. They help people by feeding on harmful insects such as mosquitoes.
3. Frogs are amphibians which means they Frogs eat insects that live in wetland environments. They lay their eggs in water.
4. Frogs are well adapted to life in a wetland. Their long back legs are excellent for jumping and swimming.
5. The platypus has several adaptations which make it an excellent swimmer. It has a streamlined body and uses its webbed front feet to pull itself through the water. It uses its tail as a rudder to steer itself when it swims.
6. The platypus lays its eggs in a nesting chamber at the end of its burrow. The burrow is dug into the side of a creek bank.

Leaf green tree frog



Life cycle of a frog

1. Frogs eggs
2. Young tadpole
3. Tadpole with two legs
4. Tadpole with four legs
5. Adult frog

Figure 9.7.3 Scaffold – Animals in Wetlands (HSIE)

Topic **Exposition – Why we should not waste water.**

Student: **Danielle** **Year:** **3** **Stage:** **2**

VOCABULARY

Continent

Resource

Biodiversity

Exposition text

Opinion or point of view

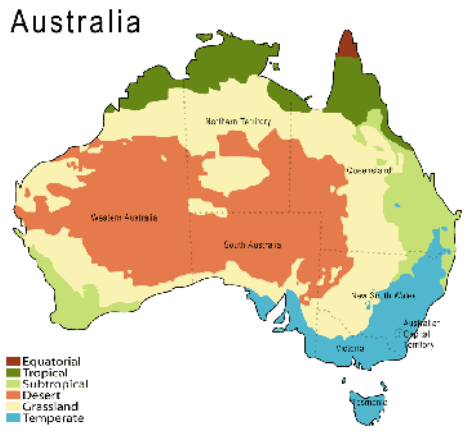
Argument

Parts of an exposition

Evidence

Language of opinion

Language of cause and effect



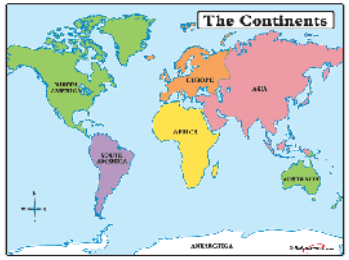
CONCEPTS

1. The purpose of an Exposition text is to present an argument.
2. The argument explains what you believe and why you believe it.
3. I begin my argument with the language of opinion. I say what I believe. For example:

   I believe…

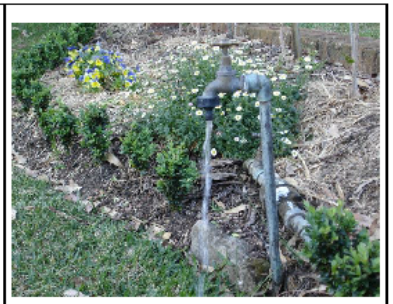
   It is my opinion that…

   In my opinion…
4. Next I explain why I believe it. To do this I use the language of cause and effect. For example: if we waste water, then there will not be enough water for people to use for drinking, cooking and washing.



SENTENCES

1. An explanation text explains an argument.
2. An argument says what I believe and why.
3. Australia has a very low rainfall and lower water runoff than any other continent except Antarctica.
4. In our dry climate, water resources are in great demand.
5. Human beings need clean water for drinking, cooking and washing.



When I write an exposition I need to think about –

1. What I believe [Language of opinion].
   I believe … / It is my opinion that … / Many people believe that … } we should not waste water.
2. Why I believe it [Language of Cause and Effect] +
   Language to indicate sequence – Firstly, ….., Secondly ….

   Firstly, we must not waste water otherwise … / If we waste water then … / No one should waste water because … } human beings will not have enough clean water for drinking and cooking.
   Secondly, animals depend upon water for survival.

The plan for my exposition: Why we should not waste water.

My plan	Topic	
Statement of position	I believe … / It is my opinion that … / Many people believe that …	we should not waste water.
Argument 1.	Firstly, we must not waste water otherwise … / If we waste water then … / No one should waste water because …	human beings will not have enough clean water for drinking and cooking.
Argument 2.	Secondly, plants and animals	depend on water for survival.
Conclusion	In conclusion,	we should not waste water.

Figure 9.7.4 Scaffold – Why we should not waste water (English)

Topic Capacity and Volume

Student: Danielle **Year:** 3 **Stage:** 2

VOCABULARY

General Vocabulary

- Volume
- Capacity
- Measure
- Unit of measurement
- Liquid
- Solid
- Litre
- Millilitre
- Cubic Centimetre
- Contents

A variety of containers

CONCEPTS

1. Capacity is a measure of the space within a container.
2. The word capacity is used only when we are talking about containers.
3. Volume is a measure of the space occupied by a liquid or a solid.
4. Volume tells us a fact about the contents of a container.
5. Volume is used only when we are talking about the contents of a container.

The picture shows three containers. The largest container has the largest capacity. The largest container holds the largest volume of liquid.

SENTENCES

1. There are many different containers, for example glass jars, drink bottles, cardboard boxes and buckets.
2. Containers can have different shapes and sizes.
3. Capacity is the amount a container can hold.
4. Volume is how much space is occupied by a liquid or a solid.

Each bottle has the same capacity but the bottle on the left contains a smaller volume of liquid.

scaffold capacity and volume stage 2.doc G. Wilcock, 2010

Figure 9.7.5 Scaffold – Capacity and Volume (Mathematics)

Topic Area

Student: Danielle **Year:** 3 **Stage:** 2

VOCABULARY

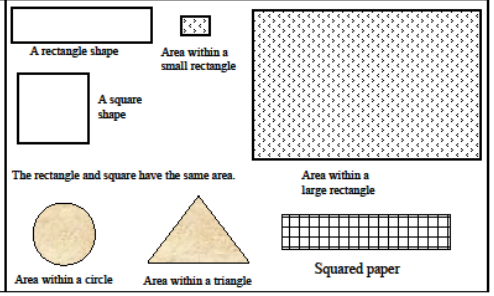
Area

Grid

Squared paper

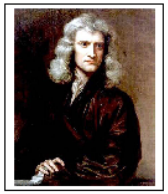
Identical

Tessellate



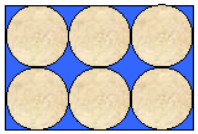
CONCEPTS / SENTENCES

1. Area is a measure of the size of a flat surface within a shape e.g. rectangle, triangle, square.
2. Area is measured in square units.
3. Cm^2 = square centimetre.
4. Units of measurement can be informal (tiles, counters) or formal (the square centimetre).
5. Mathematicians use formal units of measurement so that each mathematician can talk to other mathematicians and compare the area of shapes.
6. We can draw our unit of measurement such as the centimetre square on grid paper.
7. When we have a lot of centimetre squares they can fit together without any gaps. This is called a tessellating pattern.
8. Units of measurement that can tessellate are more suitable for measuring area.
9. Several different shapes can have the same area.



Sir Isaac Newton, 1642 - 1727

Tessellating pattern



Non-tessellating pattern

Figure 9.7.6 Scaffold – Area (Mathematics)

9.8 Case Study for Jack

Jack was aged nine years and six months at the beginning of the study and was attending an inclusive primary school in Sydney. Jack's intervention program was carried out over an eighteen month time period because the researcher was scheduled to spend less time working at Jack's school compared to the other two schools involved in the study. Jack's class had the same teacher for both years.

Jack's parents were Korean, however, he and his older brother were born in Sydney. At age four and a half, a Speech and Language assessment found that Jack's receptive and expressive language skills were severely disordered. Jack had great difficulty understanding language and communicating with others in his pre-school setting. The family spoke English at home however, many of Jack's utterances were reported to be either unintelligible or in a delayed echolalic fashion.

Following this initial Speech and Language assessment, Jack was assessed by the Medical Officer in Child and Adolescent Health at Camperdown Child Adolescent and Family Health Service, as having Autism Spectrum Disorder. Jack's parents reported, at this time, that they had great difficulty encouraging Jack to consume solid food as he 'only liked milk'. When Jack did eat solid food both the range and quantity of food were severely limited.

At Jack's Kindergarten enrolment interview, his parents described his exceptional computing abilities which enabled him to perform computing tasks found to be challenging by a cousin who was in his first year of computing studies at University.

Jack's parents also reported that he required additional non-verbal cues to follow any directions and became very distressed if routines were altered.

At age six, immediately prior to beginning school, Jack had a second Speech and Language Assessment to provide an updated record of his language needs.
A summary of Jack's scores on the Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF-4), are set out in Table 9.8.1 and Table 9.8.2.

Table 9.8.1 Table showing CELF-4 scores for Jack prior to commencing Kindergarten

	Standard Score	Percentile Rank	Interpretation
Core Language	41	< 0.1	Severe difficulties / delay
Receptive Language	45	< 0.1	Severe difficulties / delay
Expressive Language	47	< 0.1	Severe difficulties / delay
Language Structure	42	< 0.1	Severe difficulties / delay

Table 9.8.2 Table showing CELF-4 Subtest scores for Receptive Language for Jack

	Standard Score	Percentile Rank	Interpretation
Concepts and following directions	1	0.1	Severe difficulties
Word classes – Receptive	1	0.1	Severe difficulties
Sentence structure	1	0.1	Severe difficulties

With his receptive language at a percentile rank of less than 0.1, Jack had great difficulty understanding and engaging with classroom learning in Kindergarten, Year 1 and Year 2. From the beginning of his Kindergarten year, a Speech Pathologist attended the school once a week for Jack's Speech and Language session. Throughout Years 2 and 3, Jack often commented on classroom learning as having too many words presented too quickly. When frustrated and uncomfortable with the volume and speed of classroom learning, Jack made noises, rolled on the floor and made statements such as, "I think I'll explode".

Table 9.8.3 below sets out Jack's pre- and post-intervention results for the PLAI-2 test administered when Jack was in Year 3. Table 9.8.4 sets out the results of Jack's teacher's level of instructional language.

Table 9.8.3 Table showing results of PLAI-2 Testing for Jack

Test: PLAI-2 – Preschool Language Assessment Instrument (2nd Edition)				
Participant : Jack				
Level of Language Abstraction	**Raw Score**	**Scaled score relative to age 5.11**	**Percentile Rank relative to age 5.11**	**Age Equivalent relative to age 5.11**
Pre-Intervention Test Results. Chronological Age: 9.6				
1. Matching	17	11	$\geq 63^{rd}$	N/A
2. Selective Analysis	17	12	$\geq 75^{th}$	N/A
3. Reordering	12	12	75^{th}	N/A
4. Reasoning	12	11	63^{rd}	N/A
Post-Intervention Test Results. Chronological Age: 11.0				
1. Matching	17	11	$\geq 63^{rd}$	N/A
2. Selective Analysis	17	12	$\geq 75^{th}$	N/A
3. Reordering	14	14	91^{st}	N/A
4. Reasoning	13	12	75^{th}	N/A

Table 9.8.4 Table showing analysis of Classroom Teacher's Instructional Language for Jack

Matching	**Selective Analysis**	**Reordering**	**Reasoning**
6.8%	21.6%	43.3%	28.3%

At the beginning of Year 4, Jack was referred by his school for a psychometric assessment to ascertain his learning potential and to assist with educational planning. Jack's five main scores achieved on the psychometric assessment are set out in Table 9.8.5 below.

Table 9.8.5 Table showing Psychometric Assessment Scores for Jack in Year 4

Scales	Composite Score	Percentile Rank	Qualitative Description
Verbal Comprehension	87	19	Low average
Perceptual Reasoning	115	84	High average
Working Memory	97	42	Average
Processing Speed	65	1	Extremely low
Full Scale	NA	NA	NA

Processing speed is an indication of the rapidity with which Jack can mentally process simple or routine information. His ability to do this was in the Extremely Low range compared to his peers. Weakness in the speed of processing information may make the task of comprehending new information more time consuming and difficult for Jack. Jack's score on the Processing Speed scale explained his frequent comments about too many words presented too quickly.

On the student questionnaire, completed in Stage 3 after vocabulary testing had been completed, Jack explained the importance of the visual scaffold for his learning.

> "If I don't have words and pictures, I understand some of what the teacher says, not all. It is hard to know what the main words are if I don't have the list and pictures. The pictures show you what the words do and what the words mean. It makes a big difference if you tell me the main words before the lesson. It's the only way Miss – to have the words and pictures because it could be hard".

For Jack, the value of the scaffold was its identification of key information within the learning, the teaming of words and visuals to convey meaning and the opportunity to read the scaffold prior to the class lesson. This was reflected in Jack's increase in engaged learning time (See Table 8.24.1) following the research intervention.

Tables 9.8.6 to 9.8.9 below set out Jack's scores for the PPVT-4 and the EVT-2 as well as the analysis of any change in these test scores pre- and post-intervention.

Table 9.8.6 Table showing PPVT-4 Receptive Vocabulary Scores for Jack

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
80	9.6	6.9	85	11.0	8.8

Table 9.8.7 Table showing analysis of change in PPVT-4 Scores for Jack

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
5	18	23

Table 9.8.8 Table showing EVT-2 Expressive vocabulary scores for Jack

Results before classroom topic testing			Results after classroom topic testing		
Standard Score	**Chronological Age**	**Age Equivalent**	**Standard Score**	**Chronological Age**	**Age Equivalent**
83	9.6	6.6	86	10.11	8.5

Table 9.8.9 Table showing analysis of change in EVT-2 scores for Jack

Change in Standard Score	Increase in Chronological Age (Months)	Increase in Age Equivalence (Months)
3	17	23

The six scaffolded curriculum topics which represented the research intervention for Danielle were: *National Parks* (English); *Capacity and Volume* (Mathematics) *Multiplication and Division* (Mathematics) and *Plants in Action* (HSIE). These scaffolds are set out at the end of this section.

Topic National Parks

Student: Jack **Year:** 3/4 **Stage:** 2

VOCABULARY

- National Park
- Marine Park
- Location of three National Parks
- Protection of National Parks.
- Ecosystem
- Flora
- Fauna
- Native species
- Introduced species
- Climate change

Blue Mountains National Park

CONCEPTS / SENTENCES

1. National Parks are large protected areas of land set aside for native animals and plants and the places where they live. It is a preserved area of land.
2. National Parks protect places of natural beauty.
3. National Parks also protect places which are important to Aboriginal people.
4. In a Marine Park all flora and fauna , including fish, whales, seabirds and marine vegetation are protected.

Snowy Mountains National Park

Great Barrier Reef Marine Park

Royal National Park

scaffold national parks.doc G. Wilcock, 2010

Figure 9.8.1 Scaffold – National Parks (HSIE)

Topic World Heritage Area: The Great Barrier Reef

Student: Jack **Year:** 3/4 **Stage:** 2

VOCABULARY

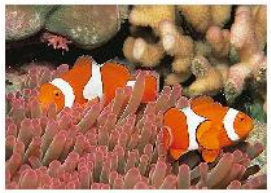
General Vocabulary	Detailed Vocabulary
heritage	anemones
World Heritage List	crustaceans (prawns, crabs, etc).
criteria	echinoderms (starfish, sea urchins)
marine	seagrass
coral	dugong
reef	mammals
Great Barrier Reef	sea urchins
fauna	molluscs
species	turtles (green, loggerhead)
hectare	algae
middens	
archaeological sites	

CONCEPTS

1. Location of the Great Barrier Reef.
2. Reasons for World Heritage listing.
3. Categories for recording of information.
4. Cultural significance is about people.

SENTENCES

1. The Great Barrier Reef is located … .
2. The Great Barrier Reef is listed as a World Heritage area because …… .
3. Examples of plant life on the reef are .. .
4. Examples of animal life on the reef are .. .



scaffold world heritage area great barrier reef.doc G. Wilcock, 2010

Figure 9.8.2 Scaffold – Great Barrier Reef (HSIE)

Topic **Exposition: Why we should look after National Parks**

Student: **Jack** **Year:** **3/4** **Stage:** **2**

VOCABULARY

1. Exposition
2. Point of view or position in an argument
3. An opinion
4. A logical argument
5. Structure of a text type
6. The parts of an exposition
7. Evidence
8. Recommendations
9. Language of opinion
10. Language of cause and effect

Blue Mountains National Park

CONCEPTS/SENTENCES

1. Expositions can be
   - spoken or written
   - formal (meeting with the Principal) or informal (expressing your opinion to friends about which game to play)
2. We use an exposition to explain **what we believe** and **why we believe it.**
3. The **purpose** of an exposition is to **persuade** the other person that your point of view is the correct one.
4. The **Language of Opinion** is used to express a person's thoughts, feelings and **point of view**.
5. The **Language of Cause and Effect connects ideas together** when **one thing causes** the **other** thing to happen.

My plan	**Topic**
Statement of position	We should look after National Parks such as, 1. The Royal N.P. 2. The Snowy Mountains N.P. 3. The Blue Mountains N.P.
Argument 1 is about …..	1. Flora and fauna.
Argument 2 is about …..	2. Ecosystems.
Argument 3 is about …..	3. How people use National Parks.
Conclusion	In conclusion, I believe we should look after National Parks.

scaffold exposition why we should look after national parks G. Wilcock, 2010

Figure 9.8.3 Scaffold – Why we should look after National Parks (English)

Intentionally blank

Topic Capacity and Volume

Student: Jack **Year:** 3/4 **Stage:** 2

VOCABULARY

General Vocabulary

- Volume
- Capacity
- Measure
- Unit of measurement
- Liquid
- Solid
- Litre
- Millilitre
- Cubic Centimetre
- Contents

A variety of containers

CONCEPTS

1. Capacity is a measure of the space inside a container.
2. The word capacity is used only when we are talking about containers.
3. Volume is a measure of the space occupied by a liquid or a solid.
4. Volume tells us a fact about the contents of a container.
5. Volume is used only when we are talking about the contents of a container.

The picture shows three drink bottles. The largest container has the largest capacity. The largest container holds the largest volume of liquid.

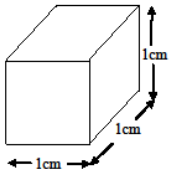
SENTENCES

1. There are many different containers, for example glass jars, drink bottles, cardboard boxes and buckets.
2. Containers can have different shapes and sizes.
3. Capacity is the amount a container can hold.
4. Volume is how much space is occupied by a liquid or a solid.

Each bottle has the same capacity but the bottle on the left contains a smaller volume of liquid.

Measuring Capacity

1. The unit of measurement for the capacity of a small container is the cubic centimetre.
2. A cubic container with sides 1 centimetre in length will have a capacity of 1 cubic centimetre.
3. The abbreviation for cubic centimetre is cm^3.
4. Containers can have the same capacity but different shapes. A container with a capacity of 1 cm^3 does not have to be a cube in shape but could be some other shape e.g. a cylinder or a sphere.
5. You will learn how to calculate the capacity of containers in Year 5.
6. The unit of measurement for the capacity of a large container is the cubic metre, abbreviated as m^3.

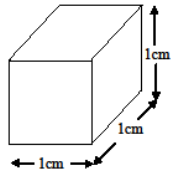


Capacity = 1cm x 1cm x 1cm
= 1 cm^3

Measuring Volume

1. The unit of measurement for the volume of small solids is the cubic centimetre, cm^3 (the same unit as capacity).
2. The unit of measurement for the volume of small quantities of a liquid is the millilitre.
3. A millilitre is a one thousandth part of a litre.
4. For larger volumes the unit of measurement for solids is the metre cubed, m^3 and for liquids is the litre, L.
5. The abbreviation for a litre is L. The abbreviation for a millilitre is mL. (It is important to make sure you use the small m and the capital L).
6. Occasionally other units are used to measure volume e.g. cooking ingredients are commonly measured by how many cups are needed.

The photographs show a volume of 300 mL of water (a liquid) in three different containers - A jug, a glass and a plastic bag. The containers each have a different shape but the volume of water is the same.



The volume of a solid is measured in cubic centimetres. The volume of this solid = 1cm x 1cm x 1cm = 1 cm^3

Figure 9.8.4 Scaffold – Capacity and Volume (Mathematics)

Topic Multiplication and Division

Student: Jack **Year:** 3/4 **Stage:** 2

VOCABULARY

Multiplication
Array
Multiples
Factors
Prime number
Composite number
Product
Squared number
Division
Fractions

Multiplication is repeated addition

This drawing means

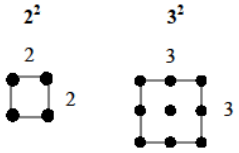
a. 2 groups of 3
   2 x 3 = 6
b. 3 multiplied by 2
   3 x 2 = 6
c. Double 3
   3 x 2 = 6

CONCEPTS

1. Multiplication is repeated addition, so 4 x 3 means 3 + 3 + 3 + 3.
2. The order of multiplication does not matter, so 5 x 6 = 6 x 5.
3. Square numbers can be shown by dots in the shape of a square.
4. Describing multiplication patterns and applying the commutative property using arrays.
   . . . . . 3 x 5 = 15
   . . . . . 5 x 3 = 15
   . . . . .
5. Linking multiplication and division facts using groups or arrays.
   . . . . 3 groups of 4 is 12
   . . . . 12 shared among 3 is 4
   . . . .
6. Linking multiplication, divisional and fractional facts connected to the 2x, 3x, 4x, 5x, 10x tables.
7. Recalling multiplication, divisional and fractional facts connected to the 2x, 3x, 4x, 5x, 10x tables.

Squared Numbers

Numbers that can be represented by dots in the shape of a square.



To square a number you multiply the number by itself.

$2^2 = 2 \times 2 = 4$

$3^2 = 3 \times 3 = 9$

$4^2 = 4 \times 4 = 16$

$5^2 = 5 \times 5 = 25$

SENTENCES

1. When we square a number, we multiply the number by itself.
2. Division is the opposite of multiplication. I can explain this by using an array
   . . . . 3 groups of 4 is 12
   . . . . 12 shared among 3 is 4
   . . . .
3. Remainder is another word for left over.
4. A fraction has a number on top, a line (called a fraction bar) and a number on the bottom.
5. The number on the bottom tells us how many parts there are altogether.
6. If I know that 3 x 4 = 12
   Then I can say that 4 x 3 = 12
   12 ÷ 3 = 4
   12 ÷ 4 = 3
   I can also say that $\frac{1}{3}$ x 12 = 4
   $\frac{1}{4}$ x 12 = 3

Factors and multiples are like cousins – they are related to each other

1 x 12 = 12
Factors of 12 — 12 is a multiple 1 and 12 is multiple of 12

2 x 6 = 12
Factors of 12 — 12 is a multiple of 2 and 12 is a multiple of 6

3 x 4 = 12
Factors of 12 — 12 is a multiple of 3 and 12 is a multiple of 4

Therefore 1, 2, 3, 4, 6 and 12 are factors of 12 and 12 is a multiple of 1, 2, 3, 4,6 and 12

Prime Numbers

A prime number has only two factors – itself and one

Number	Factors	
3	1 x 3	So 3 is a prime number
5	1 x 5	So 5 is a prime number
7	1 x 7	So 7 is a prime number
8	1 x 8 2 x 4	So 8 is a composite number
11	1 x 11	So 11 is a prime number

A **number** which is **not a prime** number is a **composite** number.

Number 1 is a special case. It is not a **prime** number and it is not a **composite** number.

A **product** is the answer when **two numbers** are **multiplied** together.
7 x 3 = 21
21 is the **product** of 7 and 3

Figure 9.8.5 Scaffold – Multiplication and Division (Mathematics)

Fraction
- a part of a group

or
- part of a whole number.

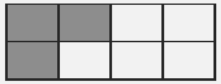
There are five cars. Only one is circled. This means that the circled car is 1 out of a group of 5 or $\frac{1}{5}$ of the total.

Numerator (How many parts we have selected)

$\frac{1}{5}$

Fraction Bar

Denominator (How many parts altogether)



There are 8 squares in the figure. 3 of the squares are shaded. The fraction of squares that are shaded is $\frac{3}{8}$

$\frac{3}{8}$

Numerator (Number of shaded squares)

Denominator (How many squares altogether)

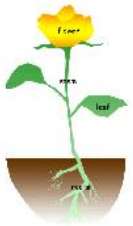
Topic Plants in Action

Student: James **Year:** 3 **Stage:** 3

VOCABULARY

General Vocabulary

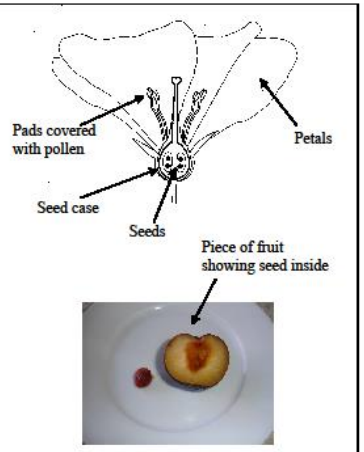
- Root (roots)
- Stem
- Flowers
- Fruit
- Seed
- Germinate
- Life cycle
- Pollination
- Disperse
- Cross-section diagram



CONCEPTS / SENTENCES

A plant has many parts.

1. The parts of a plant are: the roots, the stem, the leaves, the flowers and the fruit.
2. A plant has a life cycle. The stages in the life cycle of a flowering plant.
3. What is inside a seed? Explain the role of the flower and pollination in forming seeds and fruit. Describe how a flower changes into a fruit containing seeds, seeds develop within a fruit, the fruit protects the developing seeds and helps the seeds top be dispersed away from the parent plant.



scaffold plants in action.doc G. Wilcock, 2010

Figure 9.8.6 Scaffold – Plants in Action (HSIE)

10 Discussion

10.1 Restatement of Research Aims

The main aim of this research was to evaluate the effectiveness of the development and implementation of visual scaffolds to support students with autism spectrum disorder in inclusive classrooms. It was hypothesised that use of visual scaffolds would achieve improved learning outcomes for Primary School students with ASD, specifically in:

a) their understanding of the meaning of key vocabulary and

b) their level of engaged learning time in the classroom.

The researcher aimed to utilise those aspects of learning which are often a strength for students with autism so that the effect of the deficits associated with autism would be lessened in the classroom learning environment. Strategies catering to both autism strengths and autism deficits were adapted within this study to provide the blueprint of a visual scaffold. The scaffold was designed to support comprehension of a teacher's oral instructional language by children with ASD whose educational placement was in an inclusive primary school classroom.

Current and inclusive educational practice for students with ASD focuses upon such supports as structured, predictable timetables; visual schedules; out of school speech pathology and occupational therapy; explicit social skilling and classroom aide support. Delivery of the inclusive primary school curriculum almost always begins with teacher oral instruction in a classroom of between twenty and thirty students. This study aimed to develop and implement the visual scaffold as a strategy by which students with ASD could access, comprehend and engage with classroom learning.

In this chapter, the effectiveness of the visual scaffold, as the research intervention, was evaluated by answering the five research questions set out in Section 2.3. Consideration was given to the factors that may have contributed to these effects. The second part of the chapter considers the implications of the results for the literature on autism theory; professional implications and recommendations arising from the research findings; limitations of the study; evidence of the worth of the study; the need for further study and suggestions for future research.

10.2 Research Questions

The first of the research questions asked whether there was a disparity between the teacher's level of language abstraction and the student's ability to comprehend language, based on Blank et al.'s (1978; 2003) four levels of language abstraction. This study audio recorded a total of thirty one and a half hours of teacher instructional language. Recordings involved seven teachers across Early Stage 1 (Kindergarten), Stage 1 (Years 1 and 2) and Stage 2 (Years 3 and 4) in inclusive primary school settings in Sydney. In the case of every research participant, the majority of the teacher's instructional language was at the reordering level. When tested after the research intervention, five out of the eight participants scored lowest for the reordering level of language abstraction. These participants experienced greatest difficulty with the level of language abstraction used most frequently by the teacher. In the case of the two youngest participants, their reordering score, pre- to post-intervention, increased least of the four levels of language. Two of the three oldest participants, Stage 2 students, did not show any evidence of the 'reordering effect' which was evident in the younger participants who found reordering the most difficult of the language levels. In the case of the participants at Early Stage 1 and Stage 1, there was a wide disparity between the teacher's level of language abstraction and the student's ability to comprehend language. At the Stage 2 level there was less evidence of this disparity.

The second research question asked whether use of the visual scaffold resulted in the student having greater understanding of classroom topic vocabulary. This question was investigated by conducting vocabulary testing before and after the intervention for each of the classroom topics studied by each participant.

Section 8.17 shows that the mean of the vocabulary test scores of all participants before the intervention (Phase A) was 1.3 out of 10. The mean of the vocabulary test scores of all participants after the intervention (Phase B) was 8.6. Thus the mean increase resulting from the intervention was 5.5 points from a total of 10 points. These results support the research hypothesis that use of the scaffold has a positive effect on student's understanding of classroom topic vocabulary.

Section 8.18 discussed non-overlapping data. From a total of 480 data points representing the results of 480 vocabulary tests, in only one instance was a pre-intervention score the same as the post-intervention score. There were no instances where post-intervention

scores were less than pre-intervention scores. These results indicate a positive gain in vocabulary test scores as a result of the intervention and therefore support the research hypothesis.

Section 8.19 discussed the percentage of zero data (PZD), where a participant scored zero points out of ten and the percentage of full score data (PFSD) where a participant scored the maximum of ten points. The aggregated result was that on average the participants scored zero in vocabulary testing in 44% of the tests before the intervention. In none of the pre-intervention tests did any participant score 100%. After the intervention, the full score data shows that, on average, the participants scored a maximum of ten points in 56% of the vocabulary tests. In none of the post-intervention vocabulary tests was a zero score recorded. The results for PZD and PSFD support the research hypothesis.

Section 8.20 discussed the statistical analysis of the results of vocabulary testing. For seven out of the eight participants the test scores were significant to the 0.001 level. In the case of participant Luis, his test results were significant to the 0.01 level. This indicates that for those participants with vocabulary test results significant to the 0.001 level, the probability that the results were achieved by chance was 1 in one 1000. In the case of Luis, the probability of his result having occurred by chance was 1 in 100. These are low probabilities and hence the results are considered to support the research hypothesis.

The visual scaffold enabled children to learn curriculum topic vocabulary in a clear, visual, explicit format which reduced the difficulty that students with ASD often experience with the pace and volume of classroom learning. Several participants explained how the pace of classroom learning made them feel very anxious. Jack said he thought he would 'explode'. Connor often said, "I am thinking fast today". This was Connor's way of saying that he was not comfortable with the speed at which he was being asked to assimilate and process information. Danielle said, "I don't know what it all means."

The third research question asked whether the use of the visual scaffold increased the participant's receptive and expressive vocabulary scores as measured by two standardised tests, the Peabody Picture Vocabulary Test, 4th Edition (PPVT-4) (Dunn & Dunn, 2007) and the Expressive Vocabulary Test, 2nd Edition (EVT-2) (Williams, 2007).

Each participant's receptive vocabulary was assessed before and after the intervention. For five of the participants, the increase in age equivalence was greater than the increase

in their chronological age. The results suggest that for those participants, use of the scaffold supported improved vocabulary knowledge both within the classroom and also in the broader vocabulary knowledge as assessed by the PPVT-4. Two of the Stage 2 participants achieved the largest gain in PPVT-4 scores relative to chronological age.

Expressive vocabulary was also assessed before and after the intervention and these same Stage 2 participants achieved the largest gain in EVT-2 scores. For six of the participants, the increase in EVT-2 age equivalence score was either equal to or less than the increase in their chronological age.

The fourth research question asked whether the use of visual scaffolds increases the student's level of response across Blank et al.'s (1978, 2003) four levels of language abstraction.

Table 8.23.2 recorded each participant's percentile rank, relative to age 5.11, for each of Blank et al.'s four levels of language abstraction both pre- and post- the intervention. Each participant increased his/her level of language performance across all four levels of language abstraction.

Student mastery of the four levels of language abstraction is sequential. 'Matching involves the lowest level of abstraction, and reasoning involves the highest level' (Blank et al. 2003, p1). Competency at level 1, *Matching*, is required for the student to perform well at the second level, *Selective Analysis*. The same sequential learning pattern applies to levels 3 and 4.

The main emphasis within any one scaffold was on the level of language abstraction which was the first level of weakness for that participant shown by the PLAI-2 assessment. Prior to the intervention, for example, Connor had great difficulty with *Selective Analysis*. He was unable to identify selective aspects of a situation, conversing instead about his own favourite subjects. The link between the class topic and Connor's conversation was often not obvious.

Prior to classroom lessons, Connor had explicit, individualised instruction at the *Selective Analysis* level, on scaffolds such as 2D Space - Figure 9.3.5, Ants - Figure 9.3.2 and Honeybees- Figure 9.3.4. When Connor was able to focus upon selective attributes within a situation, he was then able to begin to manipulate those attributes, based on linguistic constraints, as required at the reordering level of language abstraction. The result was that Connor's *Selective Analysis* score on the PLAI-2 moved from the 5th percentile to the 37th

percentile rank relative to age 5.11. As Connor's *Selective Analysis* of perception improved, his classroom engaged learning time also increased.

The fifth research question was: Does the use of visual scaffolds increase a student's level of engagement with classroom learning?

Prior to the research intervention, the mean of the engaged learning time across seven of the participants was 39.7%, while the mean after the intervention was 69.2%. This was consistent with the hypothesis that use of a visual scaffold assists students with ASD to achieve greater engagement with classroom learning. The teacher's instructional language covered Blank et al.'s (1978, 2003) four levels of language abstraction. As each participant improved his/her performance across these four levels, the research results recorded a corresponding increase in classroom engaged learning time.

10.3 Implications of the Results in relation to the Literature on Autism

Results from this research have several implications. The first area is the nature of autistic perception. Mottron et al. (2006, p.39) stated that "perception plays a different and superior role in autistic cognition" which included locally oriented visual and auditory perception. For example, Julia, the Kindergarten research participant, had great difficulty with the word 'tub' in the story of Mrs Wishy Washy. She was initially unable to think beyond her local classroom perception of 'tub' which, for Julia, was an orange coloured, A4 sized receptacle for pencils and paper. From Julia's local perception, it was not possible to wash a cow, a pig or a duck in her orange tub. Julia therefore did not initially process story details beyond the issue of the tub nor was she engaged with classroom learning.

The current research also found that several Stage 1 and Stage 2 participants did not process the word 'volume' according to the context in which the classroom teacher used the word. Instead, they believed it referred to the level of sound production rather than a geometrical concept. The participants maintained their inappropriate definition of the word 'volume' for several classroom lessons dealing with volume as a mathematics topic. Researcher observations were similar to those of Happé (1997) and Joliffe and Baron-Cohen (1999). The research participants did not appear to integrate the topic context when interpreting vocabulary meaning. Joliffe and Baron-Cohen (1999) referred to this as impaired local coherence. Hill and Frith (2003, p.284) considered that this tendency

would work “at the expense of contextual meaning and in favour of piecemeal processing”. Vermeulen (2011) went further when he re-conceptualised ‘weak central coherence’ as ‘context blindness’.

From this researcher’s perspective, lack of contextual meaning did indeed lead to piecemeal processing and poor levels of engaged learning time. This was evident in Table 8.1.1 to Table 8.8.1 showing the results of vocabulary testing pre- and post- the intervention and in Table 8.24.1 showing engaged learning time pre- and post- the intervention. These results emphasise the relevance of Vermeulen’s (2011) theory of context blindness to this research . Contextual sensitivity plays a crucial part in information processing for students with ASD.

A second area having implications for autism literature is cognitive flexibility. Executive functioning skills are important in the management of everyday life and critical to educational success in an inclusive primary school classroom. Landa and Goldberg (2005) considered that within autism research, executive dysfunction has been most evident in planning and set shifting (flexibility). A number of research studies point to poor cognitive flexibility as a key aspect of executive dysfunction in autism (Goldstein, Johnson & Minshew, 2001, Ozonoff, Pennington & Rogers, 1991; Prior & Hoffman, 1990). Vermuelen (2011) argued that contextual sensitivity enabled a person to understand inherently ambiguous stimuli and was therefore crucial to flexibility in thoughts and behaviour. Cognitive flexibility is a central feature of Blank et al.’s third level of language abstraction, *Reordering of Perception.* At the reodering level, students are required to hold items in working memory while considering additional information. Much of this ‘additional information’ is contextual detail which is the key feature of Vermeulen’s theory of context blindness. Many students with ASD find this reordering task extremely difficult (Bennetto, Pennington & Rogers, 1995). In the course of this study, several participants experienced great difficulty with tasks at this level. When tested prior to the intervention, five participants recorded their lowest scores on questions at the reordering of perception level. After the intervention, three of the youngest participants, Julia, Jane and Luis, continued to have their lowest score at the reordering level. In post-intervention testing, the two youngest participants, Julia and Jane, found reordering much more difficult than reasoning. This is a reversal of the sequential order of Blank et al.’s final two levels of language abstraction.

10.4 Professional Implications and Recommendations Arising from the Research Findings

The results of this research support the expansion of visual scaffolds beyond their use in visual schedules and social stories to the explicit support of comprehension of curriculum content. It is recommended that visual scaffolds be used across all year levels and across all curriculum areas. Administratively, it is recommended that the key vocabulary and visuals be added to the scaffold blueprint during the classroom teacher's planning time prior to the start of each school term.

In the study, it was found that student management of the scaffold, in the classroom, increased the student's role as an active participant in the learning process. Questionnaire responses indicated that the participants felt less stress in the classroom when they had a visual scaffold to support them as they gathered information about the class topic and then shared their ideas with the teacher and peers. The process of sharing is an important part of the NSW guidelines on education as set out in the NSW Foundation Statements. All participants were initially offered two sizes of scaffold, an A4 and a pocket sized copy. All participants were definite in their preference for the A4 size. They explained that the bigger size meant they could read the words easily. This was important because they needed words and pictures together to ensure understanding of vocabulary and concepts.

Research by Howlin (2000) emphasised the central importance of receptive language development for children with ASD. Howlin (2000, p.71) reported that regression analysis indicated that the childhood PPVT score was "the most powerful predictor of linguistic and social functioning in adulthood". It is recommended, therefore, that the norm referenced PPVT be used in primary schools as a measure of the breadth and accuracy of a student's vocabulary knowledge.

At the classroom level, in order to focus upon student comprehension of teacher's oral instructional language, it is necessary to have a framework against which to analyse each exchange between teacher and child. Blank et al.'s PLAI-2 assessment was very important in understanding where the student's comprehension of vocabulary was positioned in relation to the four levels of language abstraction. PLAI-2 assessment results were also central to the planning of the scaffolds for each individual participant. It

is therefore recommended that the classroom teacher assess each student with ASD on the PLAI-2, twice each year to assist with scaffold planning.

This study highlighted the value for ASD research and practice, of understanding the conceptual framework developed by Blank et al. It has value for improving the interaction between teacher and child in terms of learning engagement and comprehension of curriculum material. It is therefore recommended that it be included in teacher training courses, particularly for primary school and special needs teachers. Use of the PLAI-2 assessment tool serves to highlight teacher awareness of a child's level of language abstraction.

10.5 Suggestions for Future Research

Mastery of the four levels of language abstraction was gradual for most of the participants. Development of feelings of independence associated with use of the visual scaffold was also gradual, as was the increase in engaged learning time. The ramifications of these effects would be seen most clearly in longitudinal studies based on a large sample of participants.

Specific suggestions for future research include individual studies, across a large number of participants of varying ages to further explore:

- the use of visual scaffolds to support comprehension of classroom topic vocabulary for students with ASD
- the relationship between ASD, visual scaffold use and test scores on the PLAI-2
- the relationship between scaffold use and engaged learning time
- the disparity between student, teacher and parent perception of participant comprehension of classroom learning
- the outcome suggested by the study that, for younger students, the third level of language abstraction, reordering, was the most difficult of the four levels. This would be contrary to the hierarchy of difficulty of Blank et al.'s four levels
- whether young children with ASD are different in their sequence of level of language abstraction compared with children whose language development is within the norm

- use of the scaffold by students with language disabilities such as processing or memory difficulties
- use of the scaffold by students with learning disabilities
- use of the scaffold by students with a hearing impairment
- use of the scaffold by secondary students and their development of their own scaffolds.

10.6 Limitations of the Study

This study was limited by the small number of participants. The number of participants was limited due to the researcher being associated with and working within only three primary schools. However, inclusion of larger numbers is recommended for future studies.

Another limitation of the present study was that the researcher was involved in both the implementation of the research model and its evaluation. It was not possible, with the present research, to have the evaluation carried out by an external evaluator due to a lack of financial resources. However, the research was made more robust by having a Speech Pathologist conduct approximately fifty percent of the PPVT-4, EVT-2 and PLAI-2 assessments with the current researcher conducting the remaining assessments. In addition, all the instruments used in the research have high reliability and validity.

10.7 Evidence of the Value of the Research Study

Increasing numbers of students are receiving diagnoses of ASD and many of these students attend inclusive primary schools. The difficulty experienced by students with ASD in coping with the demands of a verbally based instructional process is a problem for educators because any student who is unable to comprehend the meaning of classroom topic vocabulary will not have access to the curriculum. As a preliminary study in a previously unexplored area of research, this current research was very worthwhile. When the quantitative data was combined with the qualitative statements from the teacher, parent and participant questionnaires, results suggested that the visual scaffold was successful in supporting comprehension of oral instructional language across all primary school year groups and all classroom topics. In addition, anecdotal reports from the study, suggest that benefits from using a scaffold may not be limited to students with ASD. One student, who had a processing difficulty but shared a desk with participant Stewart, began

to make use of the scaffold. Participant Stewart turned the scaffold face down and instructed his classmate that he should keep the information in his head. The student with processing difficulties did not understand the directive but continued to use the scaffold. The research data suggest that this study is worth replicating with a larger number of participants.

For students with ASD, inclusion is not about location (Jordan, 2003) but about the attitudes and understandings of each school staff member. These attitudes and understandings will determine how the curriculum learning is presented to the student. Good leadership, a positive school climate and an individualised approach which listens to the student voice are key to learning success for these students (Roberts, APAC, Adelaide, 2013). There is a need to research how children with ASD are accessing and mastering the learning within their inclusive classrooms. Failure to do this is to assume that an inclusive educational placement is, in itself, an outcome measure of success (Jordan, 2003).

10.8 Conclusion

As education providers, inclusive primary schools are required by the Disability Discrimination Act (1992, Section 2) to develop curricula that can be accessed by all students. The Education Standards (Commonwealth of Australia, 2005) further clarify this requirement. Standard 6.2 states that the education provider must

a) consult the student, or an associate of the student, about the impact of the disability upon the student's ability to access the curriculum and

b) decide whether an adjustment is necessary to enable that student to have access to learning.

This study developed a teacher, parent and student questionnaire which facilitated the consultative process. Findings from the literature review and pre-study standardised testing, combined with the pre-intervention topic vocabulary testing, led to the conclusion that there was a need for an adjustment to the teaching strategy for primary school students with ASD. The study then developed, implemented and tested the effectiveness of the visual scaffold as an intervention.

When the eight research participants were tested throughout the study on topic vocabulary, the results provided strong evidence to support the conclusion that the use of scaffolds was effective in improving access to the curriculum for students with ASD.

Feedback from the participants as to the effectiveness of the scaffold was very positive. The benefit of using written words and visuals was explained by Stewart, a Year 3 student,

> "When I have the words and pictures, I know what it means.
> I can read the scaffold. I can't read the teacher."

Appendices

Flinders University and Southern Adelaide Health Service

SOCIAL AND BEHAVIOURAL RESEARCH ETHICS COMMITTEE

Room B1, Union Building, Flinders University,
GPO Box 2100, ADELAIDE SA 5001
Phone: (08) 8201 3116
Email: human.researchethics@flinders.edu.au

FINAL APPROVAL NOTICE

Principal Researcher:	Ms Mary Wilcock
Email:	wilc0011@flinders.edu.au
Address:	9 Yarra Burra Street, Gymea Bay NSW 2227
Project Title:	Strategies for achievement in inclusive classrooms using cognitive visual scaffolds to support students with autism spectrum disorder

Project No.:	4679	Final Approval Date:	2 December 2009	Approval Expiry Date:	30 May 2011

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

Please ensure that any outstanding permission letters (item D8) that may have been previously requested by the Committee are forwarded as soon as possible. Additionally, for projects where approval has also been sought from another Human Research Ethics Committee (item G1), please be reminded that a copy of the ethics approval notice will need to be sent to the Committee on receipt.

In accordance with the undertaking you provided in your application for ethics approval for the project, please inform the Social and Behavioural Research Ethics Committee, giving reasons, if the research project is discontinued before the expected date of completion.

You are also required to report anything which might warrant review of ethical approval of the protocol. Such matters include:

- serious or unexpected adverse effects on participants;
- proposed changes in the protocol (modifications); and
- unforeseen events that might affect continued ethical acceptability of the project.

In order to comply with monitoring requirements of the *National Statement on Ethical Conduct in Human Research (March 2007)* an annual progress and/or final report must be submitted. A copy of the pro forma is available from http://www.flinders.edu.au/research/info-for-researchers/ethics/committees/social-behavioural.cfm. Your first report is due on **2 December 2010** or on completion of the project, whichever is the earliest. *Please retain this notice for reference when completing annual progress or final reports.* If an extension of time is required, please email a request for an extension of time, to a date you specify, to human.researchethics@flinders.edu.au before the expiry date.

Andrea Jacobs
Acting Secretary
Social and Behavioural Research Ethics Committee
7 December 2009

c.c A/Prof Verity Bottroff, verity.bottroff@flinders.edu.au
Dr Paul Jewell, paul.jewell@flinders.edu.au
Dr Brian Matthews, brian.matthews@flinders.edu.au

Appendix 1 Ethics approval from Flinders University Social and Behavioural Research Ethics Committee

Catholic Education Office Sydney
www.ceosyd.catholic.edu.au

7 April 2014

Ref: Research Application 869

Ms Mary Wilcock
9 Yarra Burra Street
GYMEA BAY NSW 2227

Dear Mary,

RE: RESEARCH APPLICATION REF: 869 – LETTER OF APPROVAL

Thank you for the submission of your application to conduct research in Archdiocesan Catholic Schools under the jurisdiction of the Catholic Education Office (CEO) Sydney. Approval is given by CEO Sydney to conduct this study. **This approval is granted subject to full compliance with NSW Child Protection and Commonwealth Privacy Act legislation.** It is the prerogative of any Principal or staff member whom you might approach to decline your invitation to be involved in this study or to withdraw from involvement at any time. Any study involving the participation of students will require written, informed consent by parents/guardians.

Permission is given for you to approach the Principals of the schools nominated, listed below, requesting participants for your study: ***"Development and implementation of visual scaffolds to support students with autism spectrum disorder in inclusive classrooms".***

Our Lady of Fatima Catholic Primary School, Kingsgrove	*Ms Anne Colreavy*
St Francis Xavier's Catholic Primary School, Arncliffe	*Mr Kevin Bryson*
Our Lady of Lourdes Catholic Primary School, Earlwood	*Mr David Casey*

COMMONWEALTH PRIVACY ACT

The privacy of the school and that of any school personnel or students involved in your study must, of course, be preserved at all times and comply with requirements under the Commonwealth Privacy Amendment (Private Sector) Act 2000. In complying with this legislation, the CEO Sydney has decided that individual research participants should not be identified in the report.

FURTHER REQUIREMENTS

It is a condition of approval that when your research has been completed you will forward a **summary report of the findings and/or recommendations** to this office as soon as results are to hand.

38 Renwick Street, PO Box 217, Leichhardt NSW 2040 • Phone (02) 9569 6111 • Fax (02) 9550 0052
Eastern Region 33 Banks Avenue, Daceyville NSW 2032 • Phone (02) 8344 3000 • Fax (02) 8344 3097
Inner Western Region 3 Keating Street, Lidcombe NSW 2141 (Locked Bag 83, 1825) • Phone (02) 9643 3600 • Fax (02) 9643 3609
Southern Region 300 The River Road, Revesby Heights NSW 2212 • Phone (02) 9772 7000 • Fax (02) 9772 7009

Appendix 2 Catholic Education Office Sydney, Letter of Approval

Flinders
UNIVERSITY
ADELAIDE • AUSTRALIA

Head: Department of Disability Studies
School of Medicine
Faculty of Health Sciences
GPO Box 2100
Adelaide SA 5001
Tel: +61 8201 3426
Fax: +61 8201 3646
Email: Verity.bottroff@flinders.edu.au
Website:
http://som.flinders.edu.au/FUSA/disabstud

The Principal,
Our Lady of Fatima Primary School
KINGSGROVE NSW

Dear Ms Colreavy,

This letter is to certify that Mary Gabrielle Wilcock is a Masters student in the School of Disability Studies at Flinders University.

Mary is undertaking research into teaching methods aimed at improving academic achievement for mainstreamed Primary School students with Autism Spectrum Disorder (ASD).

The research is focused on an intervention for student classroom learning which will require Mary to develop learning scaffolds to support student achievement. Implementation of the research study will require the agreement and support of yourself and classroom teachers.

The integrity of the research will rely on quantifiable results. It will be necessary therefore for students to have their level of language competency tested before and after the classroom intervention.

The tests to be used are standard, commercially available tests of language competency. The tests are such as would be used by a Special Needs teacher or a Speech Pathologist and have international academic recognition. Each test will take in the order of twenty minutes per student to administer.

Mary intends to deliver information sessions to explain the proposal in more detail to yourself, to school staff and to the parents of the students involved. As is required by ethical standards, involvement of students will be on the basis of strict anonymity. None of the participants will be identifiable in the final thesis. In addition, individual student participation will be entirely voluntary and require parental consent.

This research proposal has been approved by the Flinders University Social and Behavioural Research Ethics Committee. The Secretary of this Committee can be contacted on 08 8201 3116, fax 08 8201 2035 or email to andrea.jacobs@flinders.edu.au.

Any enquiries you may have concerning this project should be directed to me at the address above or by telephone on 08 8201 3426 or email to verity.bottroff@flinders.edu.au.

Thankyou for your attention and assistance.

Yours sincerely,

Associate Professor,
Verity Bottroff
/ / 2009

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Appendix 3 Letter from supervisor introducing the researcher to school Principals

Flinders UNIVERSITY
ADELAIDE • AUSTRALIA

Head: Department of Disability Studies
School of Medicine
Faculty of Health Sciences
GPO Box 2100
Adelaide SA 5001
Tel: +61 8201 3426
Fax: +61 8201 3646
Email: Verity.bottroff@flinders.edu.au
Website:
http://som.flinders.edu.au/FUSA/disabstud

Dear Parent/Caregiver,

This letter is to certify that Mrs Mary Gabrielle Wilcock, Special Needs Teacher at Our Lady of Fatima, Primary School, Kingsgrove is a Masters student in the School of Disability Studies at Flinders University.

Mrs Wilcock is undertaking research into teaching methods aimed at improving academic achievement for mainstreamed primary school students with Autism Spectrum Disorder. Mrs Wilcock will develop specialised learning scaffolds containing detailed information about the classroom topic under study. This will be in addition to the information given in lessons by the classroom teacher.

As the integrity of the research will rely on quantifiable results, it will be necessary for participating students to have their level of language competency tested before and after the use of learning scaffolds in the classroom.

The tests to be used are standard, commercially available tests of language competency as used by Special Needs teachers or Speech Pathologists. Each test will take approximately fifteen minutes per student to administer. Results of each child's performance within the study will be available to their parents. In addition, each parent will be asked to complete a social skills rating scale and a communication checklist for their child. Each of these will take approximately fifteen minutes to complete and will be given to each parent by Mrs Wilcock.

Mrs Wilcock will give information sessions to explain the project in more detail to school staff and to the parents of the students involved.

As is required by ethical standards, involvement of students will be on the basis of strict anonymity. None of the participants will be identifiable in the final thesis. In addition, individual student participation will be entirely voluntary. Would you please contact Mrs Wilcock if you wish to provide permission for your child to be involved in this research.

Any enquiries you may have concerning this project should be directed to me at the address above or by telephone on 08 8201 3426 or email to verity.bottroff@flinders.edu.au.

Thankyou for your attention and assistance.

Yours sincerely,

Associate Professor,
Verity Bottroff
/ / 2009

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project Number 4679). For more information regarding ethical approval of the project the Secretary of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au..

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Appendix 4 Letter to parent certifying researcher

Flinders UNIVERSITY
ADELAIDE • AUSTRALIA

Head: Department of Disability Studies
School of Medicine
Faculty of Health Sciences
GPO Box 2100
Adelaide SA 5001
Tel: +61 8201 3426
Fax: +61 8201 3646
Email: Verity.bottrell@flinders.edu.au
Website:
http://som.flinders.edu.au/FUSA/disabstud

CONSENT FORM FOR PARTICIPATION IN RESEARCH PROJECT

I, ...

being the parent of .....

hereby consent for him/her to participate in a research project on learning scaffolds to support students with Autism spectrum disorder.

1. I have read the information provided.
2. Details of the procedures and any risks have been explained to my satisfaction.
3. I agree to my son's/daughter's information and participation being audio and video recorded.
4. I am aware that I should retain a copy of the Letter of Introduction and Consent Form for future reference.
5. I understand that:
    a. My son/daughter is free to withdraw from the project at any time without disadvantage.
    b. While the information gained in this study will be published as explained, he/she will not be identified and individual information will remain confidential.
    c. Whether my child participates or not, or withdraws after participating, will have no effect on his/her progress in his/her course of study, or results gained.

Parent's signature ..... Date .....

Researcher's signature ..... Date .....

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Appendix 5 Parent consent form

Questions for parent interviews

Interview with [name of parents]
Student Name:
Year:
Location:
Date: / / 2011

Parent
1. Compared to other students, does your son / daughter have particular learning needs? Yes ☐ No ☐
2. If you answered yes to question 1, what are your son / daughter's particular learning needs?
3. When you are talking about or explaining a new idea to your son / daughter, is it necessary for you to make adjustments to your language so that your son / daughter understands you?
4. What adjustments do you need to make? a) Do you repeat the explanation more quickly? Yes ☐ No ☐ b) Do you explain the vocabulary? Yes ☐ No ☐ c) Do you increase the volume of your voice? Yes ☐ No ☐ d) Do you use shorter sentences? Yes ☐ No ☐
5. a) On a scale of 1 to 10, compared to other students, how would you rate your son / daughter's ability to understand new classroom topics or concepts? 1 2 3 4 5 6 7 8 9 10 b) What is it that leads you to select this rating?
6. a) On a scale of 1 – 10, how would you rate your son / daughter's engagement with classroom learning? 1 2 3 4 5 6 7 8 9 10 1. What is it that your son / daughter does that leads you to select this rating?
7. a) On a scale of 1 – 10 how would you rate your son / daughter's enjoyment of classroom activities? 1 2 3 4 5 6 7 8 9 10 b) What is it that your son / daughter does that leads you to select this rating?

Questions for parent interviews

Interview with [name of parents]
Student Name:
Year:
Location:
Date: / / 2011

8. a) On a scale of 1 – 10 how would you rate your son / daughter's engagement with other students? 1 2 3 4 5 6 7 8 9 10 b) What is it that your son / daughter does that leads you to select this rating?
9. a) On a scale of 1 – 10 how would you rate your son / daughter's enjoyment of morning tea and lunch sessions? 1 2 3 4 5 6 7 8 9 10 b) What is it that your son / daughter does/says that leads you to select this rating?
10. What does your son / daughter enjoy most about school?
11. What does your son / daughter not enjoy about school?
12. What would help your son / daughter enjoy school more?

Appendix 6 Parent questionnaire

Questions for teacher interviews

Teacher name:
Student name: **Grade:** **Location:**
Pre/Post Intervention: **Date: / / 2011**

1. Compared to other students, does [student name] have particular learning needs?

   Yes ☐ No ☐

2. If you answered yes to question 1, what are [student name]'s particular learning needs?

3. When you are talking about or explaining a new idea to [student name], is it necessary for you to make adjustments to your language so that [student name] understands you?

4. What adjustments do you need to make?
   a) Do you repeat the explanation more quickly? Yes ☐ No ☐
   b) Do you explain the vocabulary? Yes ☐ No ☐
   c) Do you increase the volume of your voice? Yes ☐ No ☐
   d) Do you use shorter sentences? Yes ☐ No ☐

5. a) On a scale of 1 to 10, compared to other students, how would you rate [student name]'s ability to understand new classroom topics or concepts?
   1 2 3 4 5 6 7 8 9 10
   b) What is it that leads you to select this rating?

6. a) On a scale of 1 – 10, how would you rate [student name]'s engagement with classroom learning?
   1 2 3 4 5 6 7 8 9 10
   1. What is it that [student name] does that leads you to select this rating?

7. a) On a scale of 1 – 10 how would you rate [student name]'s enjoyment of classroom activities?
   1 2 3 4 5 6 7 8 9 10
   b) What is it that [student name] does that leads you to select this rating?

8. a) On a scale of 1 – 10 how would you rate [student name]'s engagement with other students?
   1 2 3 4 5 6 7 8 9 10
   b) What is it that [student name] does that leads you to select this rating?

Questions for teacher interviews

Teacher name:
Student name: **Grade:** **Location:**
Pre/Post Intervention: **Date: / / 2011**

9. a) On a scale of 1 – 10 how would you rate [student name]'s enjoyment of morning tea and lunch sessions?
   1 2 3 4 5 6 7 8 9 10
   b) What is it that [student name] does/says that leads you to select this rating?

10. What does [student name] most enjoy about school?

11. What does [student name] not enjoy about school?

12. What would help [student name] enjoy school more?

Appendix 7 Teacher questionnaire

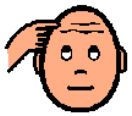
Informal pre and post researcher/student interview

Student Name: …….
Location: **Grade:**
Pre / Post Intervention: **Date:** …../…../…..

1. **When the teacher was telling the class about**

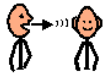
(most recent classroom topic)
……..,

did you understand what she was telling you?



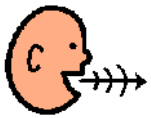
2. **The teacher told the class about** (latest classroom topic).

Can you tell me the most important thing you learnt about the (latest classroom topic)**?**



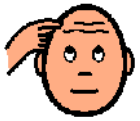
Are there any other important things you learnt about the (latest classroom topic)**?**

3. **When the teacher told the class about (latest classroom topic) she used the words (choose three words).**



What do the (three words) mean?

4. **What would make it easier for you to understand what you are learning in the classroom?**



5. **Sometimes the teacher tells you about a new topic, for example (latest classroom topic). When she tells you new things, how well do you understand what she is telling you ? Show me on your scale that goes from 1 to 10.**

1 2 3 4 5 6 7 8 9 10

6. **When the teacher gives you work, do you understand what you have to do?**

When you are working in the classroom do you know what the teacher wants you to do?

1 2 3 4 5 6 7 8 9 10

7. **Is school fun when you are learning in the classroom?**

8. a) Do you play with other students at morning tea and lunch?

b. If you do, what games do you play?

9. a. Is school fun for you at lunchtime when all the children are playing in the playground?

b. "What makes it fun?"

c. "Why isn't it fun?"

10. What do you enjoy <u>most</u> about school?

11. What do you do at school that you do not like?
[What makes you very sad at school?]

12. What can I do so you will like school even more?

Appendix 8 Participant interview questions (six pages)

Classroom observation schedule
The table below was designed to measure engaged learning time for the participant within a classroom learning lesson.

Participant Name …… Date …/…/……
Classroom Teacher …..…… Observer ……

Time	**Oriented** to teacher	Engaged in **Discourse** with teacher	**Asking** a question	**Answering** a question		**Time**	**Oriented** to teacher	Engaged in **Discourse** with teacher	**Asking** a question	**Answering** a question
10						10				
20						20				
30						30				
40						40				
50						50				
1 min						6 min				
10						10				
20						20				
30						30				
40						40				
50						50				
2 min						7 min				
10						10				
20						20				
30						30				
40						40				
50						50				
3 min						8 min				
10						10				
20						20				
30						30				
40						40				
50						50				
4 min						9 min				
10						10				
20						20				
30						30				
40						40				
50						50				
5 min						10 min				

Time sampling of behaviour
At the end of each 10 second interval, record participant behaviour by placing a tick [✓] in the relevant box.

Oriented Tick if participant is oriented to the teacher.
Discourse Tick if participant is involved in appropriate discourse with the teacher.
Asking Tick if participant asked a question.
Answering Tick if participant answered a question.

Appendix 9 Blueprint of schedule used to measure Engaged Learning Time

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