Classroom Performance of Students with an Acquired Brain Injury: The Impact of Aide Programs

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ABSTRACT

A number of studies have examined the behavioural and academic difficulties that follow paediatric Acquired Brain Injury (ABI) and made recommendations that students with an ABI be provided with an aide program. However, there is a lack of studies that have been carried out to examine the outcomes of the implementation of aide programs in the paediatric ABI population. The current study investigated the impact of aide programs on eight students (aged nine to fifteen years) with an ABI. In addition, the current study also investigated factors that were found to promote positive outcomes of aide programs. Measures used included: direct observation; interviews with the students, parents, teachers and aides; and neuropsychological tests including the BRIEF, CAFT, TEA-Ch, and WISC-IV Digit Span subtest. The data were analysed descriptively using both qualitative and quantitative techniques. Results demonstrated that the provision of an aide program resulted in a decrease in negative behaviours in the classroom and an increase in students' access to the curriculum. In addition to three frequently discussed factors (including individual assessments of students' cognitive profile, the provision of education and support to teaching staff on the impact of ABI), additional factors important to the outcome of aide programs were raised. These factors included aides having an adequate knowledge of the curriculum, aides being able to provide support through a positive helping style, and awareness of the students' need to fit-in. A model to promote positive outcomes of aide programs for students with an ABI was then proposed based on these six factors. This model suggested that these six factors fall into one of two stages required for the provision of aide programs with positive outcomes. The factors in stage one are those that require consideration during preparation for the implementation of an aide program. The factors in stage two require consideration during service delivery of an aide program (i.e. in the classroom). Consideration of both stages was found to lead to positive outcomes of aide programs, with an absence of either stage found to lead to negative outcomes of aide programs for students with an ABI.

DECLARATION

I, Ruth Tesselaar, declare that the Doctor of Psychology (Clinical Neuropsychology) thesis entitled "Classroom Performance of Students with an Acquired Brain Injury: The Impact of Aide Programs" is no more than 40,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature: Date:

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER ONE: INTRODUCTION

Paediatric acquired brain injury (ABI) from either traumatic or non-traumatic causes are thought to affect over 20,000 children in Australia (Australian Institute of Health and Welfare [AIHW], 2006a). The sequelae following paediatric ABI can include deficits in physical, sensory, and cognitive abilities. The most common of these cognitive deficits include difficulties with attention, speed of information processing, memory, and executive functioning (V. Anderson, Catroppa, Morse, Haritou, & Rosenfeld, 2005; V. Anderson, Smibert, Ekert, & Godber, 1994; Butler et al., 2008; Fay et al., 2009; Levin & Hanten, 2005; Prigatano, Gray, & Gale, 2008; Yeates et al., 2005). Given these cognitive deficits children with an ABI have been found to experience academic difficulties and difficulties with their classroom performance (D'Amato & Rothlisberg, 1996; Silver, 2000; Stavinoha, 2005). Numerous educational strategies have been proposed to assist teaching staff who work with students with an ABI. To support teachers in the implementation of these educational strategies many schools utilise an aide to work directly with the student with an ABI (Sohlberg, Todis, & Glang, 1998; Walker & Wicks, 2005). Ideally, the role of the aide is to help the student with an ABI access the curriculum by providing them with assistance on the cognitive aspects of tasks (Walker & Wicks, 2005).

While the provision of aide programs are generally regarded as being beneficial (Semrud-Clikeman, 2001; Sterling, 1994; Stewart-Scott & Douglas, 1998), there has been a paucity of research specifically examining the impact of aide programs on students with an ABI (Glang, Singer, Cooley, & Tish, 1991; Hall, McClannahan, & Krantz, 1995; Stewart-Scott & Douglas, 1998). Given this gap in the literature, the current study will explore the outcomes of the provision of an aide program for students with an ABI. This research into aide programs will allow examination of the numerous variables which are likely to impact on outcomes for students with an ABI. This information can then be used to assist education departments and rehabilitation providers with policy development and service provision for students with an ABI.

The following chapter will begin with an in-depth discussion on the cognitive sequelae following paediatric ABI. The impact of these cognitive sequelae on the school performance of students with an ABI will then be reviewed. Subsequently, the current literature on educational interventions for students with an ABI will be examined, and recent research on the efficacy of specific interventions will be highlighted. Finally, there will be a thorough examination of the limited literature on the provision of aide programs for students with an ABI.

1.1. Paediatric Acquired Brain Injury

In Australia the term ABI has been defined as an injury to the brain which is acquired after birth and "results in deterioration in cognitive, physical, emotional or independent functioning" (Department of Human Services and Health, 1994, as cited in Fortune & Wen, 1999, p. xii). The term ABI can refer to traumatic injuries such as those sustained by physical trauma to the head (e.g., fall, motor vehicle accident, assault, etc.), or non-traumatic injuries (e.g., stroke, brain tumours, infection, hypoxia, etc.) (AIHW, 2006b; Fortune & Wen, 1999). In keeping with this Australian definition of ABI, this literature review includes information on both traumatic brain injuries (TBI) and non-traumatic brain injuries.

1.1.1. Incidence of paediatric ABI

Despite there being a substantial body of research investigating the incidence and prevalence of paediatric ABI, inconsistencies in the categorisation of ABI make it difficult to obtain accurate figures (Fortune & Wen, 1999). For example, a mild ABI may be classified as a concussion, while a severe ABI may be labelled as a skull fracture (Fortune & Wen, 1999). Given this lack of consistency and other limitations in obtaining accurate figures (see Fortune and Wen (1999) for a detailed discussion), it is not surprising that rates of ABI show a high level of variability. In Australia alone, the incidence rates of ABI have been reported to range from 134 to 1,920 per 100,000 (Fortune & Wen, 1999). Fortune and Wen (1999) also noted that the actual rates of ABI are generally considered to be substantially higher than those estimated.

In light of the above mentioned difficulties, the Australian Bureau of Statistics cautiously estimated that there were 28,000 children with an ABI related disability in Australia in 2003 (AIHW, 2006a). The most common cause of ABI in children and young people was reported to be from traumatic injuries followed by brain tumour, then stroke (AIHW, 2007; Australian Paediatric Cancer Registry, 2009; National Stroke Foundation, Royal Children's Hospital, & Strokidz, 2009). The incidence of TBI has been found to vary according to gender and age, with males being twice as likely as females to sustain a TBI (AIHW, 2007; Fortune & Wen, 1999). In Australia in 1996-1997, the reported incidence rate of TBI in children ranged from 199 to 285 per 100,000 (Fortune & Wen, 1999). The highest incidence rate was found in 15 to

19 year olds (285 per 100,000), followed by those aged up to four years (244 per 100,000), and lowest for five to 14 years olds (199 per 100,000) (Fortune & Wen, 1999).

The second most common cause of paediatric ABI was brain tumours. The Australian Paediatric Cancer registry stated that in 2006 the incidence of discrete central nervous system tumours in children aged zero to 14 years was 3.37 per 100,000 (Australian Paediatric Cancer Registry, 2009). This incidence rate included both benign and malignant tumours and excluded spinal cord tumours and tumours from Acute Lymphoblastic Leukaemia (Australian Paediatric Cancer Registry, 2009). Stroke was the third most common cause of paediatric ABI. While stroke is acknowledged as a major cause of disability in children (Mackey & Gordon, 2007), the incidence rate of stroke is much lower when compared to the incidence of traumatic injuries. A recent information booklet stated that the incidence of paediatric stroke was two per 100,000, (National Stroke Foundation, Royal Children's Hospital, & Strokidz, 2009).

In addition to traumatic events, brain tumour, and stroke, there are other less frequent causes of paediatric ABI. These include hypoxia (such as from near drowning), viral meningitis, encephalitis, and substance abuse (Fortune & Wen, 1999). Unfortunately, there is no published data on the incidence or prevalence of paediatric ABI from these causes.

1.1.2. Paediatric ABI in the education system

Another large gap in the literature on the incidence and prevalence of paediatric ABI is found in the lack of published statistics on students with an ABI within the Australian education system. While the AIHW reported that 97% of children with a disability aged between five years and 14 years were attending school, no breakdown of numbers by disability type was provided (AIHW, 2006b). However, based on this information, as well as data on the ABI prevalence for children under the age of 15 (AIHW, 2006a), we could assume that there are approximately 22,116 children with an ABI currently in the Australian education system.

The only published report that has collected data on the number of students with an ABI in Australian schools is by Sterling (1994). Sterling conducted a survey in four educational regions of Australia (in New South Wales and Queensland) and identified a total of 90 students with an ABI who were known to the educational system. After comparing these numbers with hospital records of admissions for paediatric ABI in the two states, Sterling (1994) noted that children with an ABI were under-recognised within the educational system. This finding is consistent with literature from Canada, the United Kingdom (UK), and the United States of America (USA) which have all reported that students are under-recognised in the education system (Agency for Health Care Policy and Research, 1999; Hawley, Ward, Magnay, & Mychalkiw, 2004; Zinga, Bennett, Good, & Kumpf, 2005).

Two of the main reasons cited for this under-recognition of ABI within educational systems include ABI being a "hidden disability" and mislabelling of students. ABI is frequently described as being a "hidden disability" as people with an ABI often lack physical signs and deficits by which their ABI could be overtly identified (AIHW, 2007). Without any overt physical markers of an ABI, there is often a lack of connection between an ABI that occurred earlier in life and current difficulties with school performance and behaviour (Bennett, Good, Zinga, & Kumpf, 2004; Petit-Zeman, 2002). Indeed, a recent UK study of 67 students with an ABI found that one-third had teachers who were unaware of their ABI (Hawley et al., 2004). This lack of awareness of an ABI may result in students being seen as difficult when they display disruptive classroom behaviours, rather than being provided with the required cognitive supports (Hawley, 2005).

In addition to ABI being a hidden disability, mislabelling of students with an ABI can also contribute to the under-representation of students with an ABI in educational systems. Within the Australian state of Victoria, and in many Canadian provinces and territories, ABI is not a category under which education support services can be applied for (Department of Education and Early Childhood Development, 2009; Zinga et al., 2005). Without an identified category, students with an ABI may be mislabelled (unintentionally or out of necessity) to fit into one of the recognised categories (i.e., Severe Behaviour Disorder) so as to access required education supports (Zinga et al., 2005). Thus, given the difficulty in identifing ABI in schools combined with mislabelling of students with an ABI to access educational supports it becomes very difficult to ascertain accurate numbers of students with an ABI within educational systems.

1.2. Sequelae of Paediatric ABI

The sequelae following a paediatric ABI, from either traumatic or non-traumatic causes, can lead to a wide array of persisting difficulties in numerous areas including sensory, physical, psychosocial, and cognitive changes (V. Anderson, Catroppa, Haritou, Morse, & Rosenfeld, 2005b; Blom et al., 2003; Dickman, MacPhail, & Popp, 2001; Ness et al., 2005).

A dose-response relationship is often reported between severity of injury and physical and cognitive outcomes (V. Anderson, Catroppa, Morse, Haritou, & Rosenfeld, 2000; Fay et al., 2009). The British Society of Rehabilitation Medicine (1998) defines a TBI as being severe when there has been a loss of consciousness (LOC) for more than six hours, and an initial Glasgow Coma Scale (GCS) between three and eight. An injury is seen as moderate when the LOC was longer than fifteen minutes, and the GCS was between nine and twelve. Lastly, an injury is defined as mild when the LOC was for less than fifteen minutes, with an initial GCS of between thirteen and fifteen (British Society of Rehabilitation Medicine; 1998).

While severity of injury categorisation does not apply to non-traumatic brain injuries, a dose-response relationship has similarly been noted between some of the medical treatment options for brain tumours and cognitive outcomes (Palmer, Reddick, & Gajjar, 2007). Medical treatment options for paediatric brain tumour can include a combination of surgical resection of tumours, chemotherapy (e.g., methotrexate), and/or cranial irradiation therapy (CRT) (Mulhern & Butler, 2004). Persistent cognitive deficits are frequently found in children treated with CRT when compared to treatment with chemotherapy (Butler, & Copeland, 2002; Copeland, deMoor, Moore, & Ater, 1999; Mabbott et al., 2005).

1.2.1. Physical, sensory, and psychosocial sequelae

Sensory difficulties following paediatric ABI are commonly reported and can include changes in sight, hearing, touch, smell, and taste (Dickman et al., 2001; Walker & Wicks, 2005). The extent of physical limitations following paediatric ABI has been found to range widely. Physical limitation can include fatigue, minor weakness and clumsiness in a limb, tremor, paralysis, ataxia, aphasia, and seizures (Blom et al., 2003; De Schryver, Kappelle, Jennekens-Schinkel, & Peters, 2000; Dickman et al., 2001; Ness et al., 2005; O'Flaherty et al., 2000; Walker & Wicks, 2005).

Psychosocial outcomes, such as increased behavioural problems, poorer social interactions, and poorer quality of life, are also found to occur following paediatric ABI (Hooper et al., 2004; Limond, Dorris, & McMillan, 2009; Upton & Eiser, 2006). In particular, behavioural problems such as hyperactivity and conduct problems are commonly reported (Hooper et al., 2004; Fay et al., 2009). Longitudinal studies of up to five years post-injury have shown that behavioural problems in children with an ABI may increase over time (Catroppa, Anderson, Morse, Haritou, & Rosenfeld, 2008; Gerber et al., 2008; Yeates & Taylor, 2006). Variables which have been found to impact on the psychosocial outcomes following paediatric ABI include cognitive deficits in the areas of executive functioning and attention, severity of injury, family functioning, and the child's pre-injury level of behavioural problems (Catroppa et al., 2008; Kinsella, Ong, & Murtagh, 1999; Levin & Hanten, 2005; Limond et al., 2009; Nadebaum, Anderson, & Catroppa, 2007; Yeates et al., 2005).

1.2.2. Cognitive sequelae

The cognitive sequelae following paediatric ABI has been extensively researched and documented over many decades. Recent literature suggests that while the cognitive sequelae following paediatric ABI are highly variable, there are also common tendencies in the cognitive outcomes (Butler et al., 2008; Hurvitz, Warschausky, Berg, & Tsai, 2004; Ylvisaker et al., 2001). These common tendencies include deficits in the domains of attention, concentration, speed of information processing, memory, and executive functions (V. Anderson, Catroppa, Morse et al., 2005; V. Anderson et al., 1994; Butler et al., 2008; Fay et al., 2009; Levin & Hanten, 2005; Prigatano et al., 2008; Yeates et al., 2005; Ylvisaker et al., 2005). Given that brain injuries in children generally occur before or during their schooling, the cognitive sequelae are likely to impact on their school performance (V. Anderson, Catroppa, Morse, & Haritou, 1999; Bennett et al., 2004; Block, Nanson, & Lowry, 1999; Catroppa & Anderson, 2002; DePompei, 2005; Palmer et al., 2007)

Discussions of the variables that impact on the cognitive sequelae following paediatric ABI initially began with investigations and debate into the principles of brain plasticity versus an early vulnerability (Hebb 1942; Kennard 1938). The principle of brain plasticity proposed that the developing brain of infants and children has elements of plasticity (Kennard, 1938). This then allows for intact cortical areas to assume the function of damaged cortical areas in the event of an insult to the brain (Kennard, 1938). Based on this principle, it was assumed that young children would demonstrate better recovery following brain injury in comparison with adults. In contrast, the early vulnerability hypothesis proposed that brain development occurs in an important hierarchical sequence (Hebb, 1949). Therefore, it was assumed that any early insult to the brain would disrupt sequential development and result in difficulties with the acquisition of later developing skills (Hebb, 1949). Thus, the early vulnerability hypothesis proposed that the developing brain was more vulnerable to injury than the adult brain (Hebb, 1942).

In accordance with the early vulnerability hypothesis, recent research has found that those aspects of cognitive functions which are currently emerging at the time of injury, or are yet to emerge, are the most vulnerable to impairment following paediatric ABI (V. Anderson, Catroppa, Morse et al., 2005; Taylor & Alden, 1997). Longitudinal studies also report poorer long-term outcomes for children who sustained an ABI at a younger age in comparison to children who were older at the time of injury (V. Anderson et al., 2000; Ganesan et al., 2000; Levine, Kraus, Alexander, Suriyakham, & Huttenlocher, 2005). The reason suggested poorer long-term outcomes in children who were younger at the time if injury is two-fold. Firstly, early injury and disruption of the sequential development of cognitive skills is likely to disrupt later developing skills (V. Anderson, Catroppa, Haritou, Morse, & Rosenfeld, 2005a). Given the lengthy developmental trajectory of cognitive skills, deficits in later developing cognitive areas may only become apparent in the longer term as the child fails to meet age appropriate developmental milestones (Chapman, 2006). Secondly, disruption of cognitive development is likely to lead to difficulties in acquiring skills and knowledge at the same pace as non-injured peers (V. Anderson, Catroppa, Haritou et al., 2005a; Johnson, Thomas-Stonell, Rumney, & Oddson, 2006). Thus, over the longer term there is likely to be an ever increasing gap between children with an ABI and their peers. This concept of deficits emerging over time as children fail to develop at an age appropriate rate has been described as ‘growing into the disability’ (Ylvisaker, & DeBonis, 2000).

In addition to the variable of age at injury, other factors have also been identified as influencing the nature and extent of cognitive sequelae following paediatric ABI. These factors include injury related factors (e.g., severity of injury, focal or diffuse brain injuries, and location of injury), treatment related factors (e.g., duration and type of treatment), and patient related factors (e.g., time since injury, pre-injury levels of functioning, and family dynamics) (Beaulieu, 2002; Mulhern, Merchant, Gajjar, Reddick, & Kun, 2004; Taylor & Alden, 1997; von Hoff et al., 2008).

In the following sections the impact of these factors on the cognitive outcomes following paediatric ABI will be discussed. This review will focus on the cognitive sequelae in the domains of attention, speed of information processing, memory, and executive functioning, as deficits in these areas are often implicated in school performance following paediatric ABI (V. Anderson, Catroppa, Morse et al., 2005; Blosser & DePompei, 2003; Cohen, 1991; DePompei, 2005).

1.2.2.1. Attention

Deficits in attention are commonly seen following paediatric ABI (Penkman, 2004). Attention is a multifaceted construct which can be subdivided into at least four aspects including; sustained attention (the ability to maintain attention over time), selective attention (the ability to filter out irrelevant stimuli while focusing on more salient information), divided attention (the ability to multi-task or to focus on information presented simultaneously), and Switching Attention (the ability to shift attentional focus) (V. Anderson, Catroppa, Morse et al., 2005; Heaton et al., 2001; Yeates et al., 2005). The variables of age at injury, severity of injury, treatment factors, and pre-existing attention problems have all been noted as impacting on the outcome of attention abilities following paediatric ABI (V. Anderson, Catroppa, Morse et al., 2005; Butler & Copeland, 2002; Nadebaum et al., 2007; Yeates et al., 2005).

With regard to the variable of age at injury, research has demonstrated that children who acquire injuries at a younger age are more likely to have poorer outcomes in the domain of attention (V. Anderson, Catroppa, Morse et al., 2005; Max et al., 2004). The aspects of attention which are developing at the time of injury, or are yet to develop, are seen as most vulnerable to injury (Nadebaum et al., 2007). For example, selective attention is thought to develop fully by the age of six years (V. Anderson, Catroppa, Morse et al., 2005), while sustained attention abilities are thought to be constant throughout early childhood with significant development occurring from the age of 11 years (McKay, Halperin, Schwartz, & Sharma, 1994). Given these developmental trajectories it follows that children who have an ABI at or before the age of five years are more likely to have deficits in selective attention in comparison to children who are older at the time of injury (V. Anderson, Catroppa, Morse et al., 2005; Nadebaum et al., 2007). As sustained attention has a later developmental trajectory noticeable deficits in this area are often not observed until children fail to meet age-expected developmental milestone (which is an example of a child ‘growing into their disability’) (V. Anderson, Catroppa, Morse et al., 2005; V. Anderson, Fenwick, Manly, & Robertson, 1998; Catroppa & Anderson, 2003).

Not all findings are explained by the age at injury and the developmental trajectory of attention. Another variable which has also been found to strongly influence outcomes in traumatic head injuries is the severity of the brain injury. A dose-response relationship between injury severity and attention outcomes has been noted, with larger deficits in attention found in children who sustained a more severe TBI (V. Anderson, Catroppa, Morse et al., 2005; V. Anderson et al., 1998; Nadebaum et al., 2007; Yeates et al., 2005). For example, Yeates et al. (2005) followed 82 children who sustained a severe or moderate TBI when they were between the ages of six and twelve years. Despite these injuries occurring after the age at which selective attention is thought to be fully developed, significant deficits in selective attention abilities were found at four years post-injury (Yeates et al., 2005). Children with severe injuries were found to perform more poorly than those with moderate injuries (Yeates et al., 2005).

Similar to the severity of injury, treatment of children with brain tumours with CRT has also been commonly associated with persisting attention problems, in particular sustained attention deficits, regardless of age at injury (Butler & Copeland, 2002; Mabbott et al., 2005; Mulhern & Butler, 2004). A study by Copeland, deMoor, Moore, and Ater (1999), found that children with brain tumours who were treated with a combination of surgery and CRT displayed persistent deficits in attention. In contrast, children treated with surgery and methotrexate (chemotherapy) displayed mean attention performances within the average range for their age (Copeland et al., 1999).

In addition to the above mentioned variables, pre-injury attention problems have also been found to predict attention outcomes post paediatric ABI (V. Anderson, Catroppa, Morse et al., 2005; Yeates et al., 2005). However, higher reports of pre-injury attention problems have only been found to predict a greater number of parent reported post-injury attention problems (V. Anderson, Catroppa, Morse et al., 2005; Yeates et al., 2005). In comparison, the factors of age at injury, severity of injury, and treatment factors have been found to predict formal assessment measures of post-injury attention outcomes.

Thus, it can be concluded that there are numerous variables which are likely to impact on attention outcomes following paediatric ABI. While the above variables have all been discussed separately, interactions between these variables are likely (e.g., a child may be younger than the age of six at the time of injury, sustain a severe injury, and have pre-existing behavioural difficulties). Consequently, individual combinations of factors can result in highly individualised outcomes following a paediatric ABI.

These attention difficulties following paediatric ABI have been suggested to underlie some of the academic and behavioural difficulties observed at school (V. Anderson, Catroppa, Morse et al., 2005). Commonly reported negative behaviours in the classroom following deficits in attention include: difficulties with persisting on tasks, problems completing activities, difficulty maintaining concentration, poor listening, and inattentive behaviour (V. Anderson, Catroppa, Morse et al., 2005; V. Anderson et al., 1998; Block et al, 1999). Thus, when investigating the impact of an educational intervention for students with an ABI, the number of negative behaviours in the classroom due to deficits in attention should be included in the outcome measures.

1.2.2.2. Memory

Memory is commonly discussed as two separate domains; visual memory and verbal memory. While the development of visual memory occurs early in life, verbal memory continues to develop throughout adolescence (Catroppa & Anderson, 2002). It is thought that the developmental gains seen in verbal memory are due to age-related improvements in executive functions (i.e., enhanced organisation and use of strategies in the encoding, storage, and retrieval of information), rather than an increase in memory capacity *per se* (Arroyos-Jurado et al., 2006; Wright & Limond, 2004). In addition to the interaction seen between executive functions and memory performance, attention abilities have also been shown to be strongly related to memory (Cowan, 1995). In particular, selective attention is seen to play a large role in the processes of encoding and retrieving verbal information (Cowan, 1995).

Research into memory difficulties following paediatric ABI has typically focused on the domain of verbal memory (Catroppa & Anderson, 2002; Reeves et al., 2006). This focus on verbal memory abilities may reflect our cultural emphasis on language based learning and memory. In the literature examining visual and verbal memory following paediatric ABI, larger deficits in the verbal memory domain in comparison to visual memory are commonly reported (Arroyos-Jurado, Paulsen, Ehly, & Max, 2006; Block et al., 1999; Mulhern et al., 2004; Reeves et al., 2006). Deficits in verbal memory following paediatric ABI are consistently noted across studies of children with either traumatic or non-traumatic injuries (Arroyos-Jurado et al., 2006; Block et al., 1999; Mulhern et al., 2004). These deficits have been found in the acute stages of injury (Catroppa & Anderson, 2002) and also in the longer term (up to at least eight years post-injury) (Arroyos-Jurado et al., 2006). Interestingly, despite the hypothesised lateralisation of language abilities, deficits in verbal memory have been found in children and young people following unilateral stroke, regardless of which hemisphere the stroke occurred in (Block et al., 1999).

The strongest predictors of verbal memory outcomes following paediatric ABI include severity of injury and the type and strength of treatments (Arroyos-Jurado et al., 2006; Catroppa & Anderson, 2002; Mulhern et al., 2004). For children who have sustained a TBI, there is commonly a dose-response relationship between injury severity and verbal memory outcomes (Catroppa & Anderson, 2002). Findings from a longitudinal study also reported that at six to eight years post paediatric ABI, severity of injury remained the best predictor of verbal memory outcomes (Arroyos-Jurado et al., 2006). For children who have sustained a brain tumour, poorer verbal memory outcomes are most highly correlated with larger doses of CRT (Mulhern et al., 2004). Thus, severity of injury and strength of CRT dose appear to be the best predictors of verbal memory outcomes following paediatric ABI.

The interaction between age at injury and the developmental trajectory of memory is also observed to influence outcomes following paediatric ABI, with the early development of visual memory thought to be the reason behind its apparent resilience to the impact of paediatric ABI (Catroppa & Anderson, 2002). In contrast, the later establishment of the verbal memory system makes it more vulnerable to disruption following an early brain insult, with evidence of the late emergence of verbal memory deficits highlighted throughout the literature (V. Anderson et al., 1999; Block et al., 1999; Catroppa & Anderson, 2002; Mulhern et al., 2004).

Thus, persistent verbal memory deficits are commonly found following a childhood ABI regardless of type of injury (traumatic or non-traumatic) or time since injury (Arroyos-Jurado et al., 2006; Mulhern et al., 2004). A large proportion of school based learning is via verbal communication and thus deficits in verbal memory are likely to have particularly negative implications for students with an ABI (V. Anderson et al., 1999; Catroppa & Anderson, 2002). Consistent with this notion, Kinsella et al. (1995) found that poorer verbal learning performance predicted an increase in the level of educational supports received by children following an ABI. Some of the negative behaviours in the classroom noted to arise from deficits in the memory domain include students being unable to follow task directions, and difficulties with the learning and retaining of new information (Blosser & DePompei, 2003; Dickman et al., 2001; Keyser-Marcus et al., 2002). Given the strong relationship between memory and attention it may be difficult to accurately separate out the underlying cause of specific negative classroom behaviours.

1.2.2.3. Speed of information processing

Deficits in speed of information processing (SOP) are commonly noted following paediatric TBI, stroke, and brain tumour (Block et al., 1999; Nadebaum et al., 2007; Pavlovic et al., 2006; Stargatt, Rosenfeld, Maixner, & Ashley, 2007). The developmental process of SOP is postulated to continue throughout childhood and adolescence until the age of at least 15 years (Hale, 1990). As a result of this ongoing development throughout childhood, a younger age at injury has been found to be a strong predictor of poorer SOP outcomes following paediatric ABI (V. Anderson, Catroppa, Haritou et al., 2005a; Palmer et al., 2009). Specifically, poorer outcomes in the recovery and development of SOP have been observed in children whose ABI occurred or was diagnosed before the age of seven (V. Anderson, Catroppa, Haritou et al., 2005a; Palmer et al., 2009).

Along with age at injury, severity of injury has also been correlated to poorer SOP outcomes in children who sustained a TBI (V. Anderson, Catroppa, Haritou et al., 2005a; Nadebaum et al., 2007; Prigatano et al., 2008). Most commonly, it is only those children who have sustained a severe head injury who have been found to perform below age expected levels on SOP tasks, while the performance of those with mild and moderate injuries tends to remain comparable to controls (V. Anderson, Catroppa, Haritou et al., 2005a; V. Anderson, Catroppa, Morse et al., 2005). However, more recent research has begun to demonstrate decreases in the SOP of children who have sustained mild or moderate injuries (Prigatano et al., 2008). The study by Prigatano et al. (2008) differed from previous studies as, in addition to group means, they also examined individual SOP scores. Consistent with previous research, Prigatano et al. (2008) found that the mean group scores of SOP performance for the mild and moderate ABI groups remained within the average range. However, when they examined scores on an individual basis, they found that 22% of children with mild injuries and 40% of children with moderate injuries demonstrated relative SOP difficulties. This finding by Prigatano et al. (2008) provides clear support to a dose-response relationship between injury severity and SOP performance.

For children with brain tumours greater SOP deficits have been correlated with increased doses of CRT (Stargatt et al., 2007). Indeed SOP is thought to be one of the first deficits to appear following CRT treatment for brain tumours (Palmer et al., 2009). Despite this initial strong reaction following CRT treatment Palmer et al. (2009) also found that over a four year period it was the factor of being diagnosed with a brain tumour before the age of seven and not strength of CRT treatment which predicted poorer SOP outcomes. Given that the majority of studies which investigate the impact of CRT and cognitive functioning have not separated out age at diagnosis as a variable (e.g., Stargatt et al., 2007) limitations with these results are noted.

Similar to the relationship between memory and attention, SOP abilities are seen to have important implications for other cognitive processes including language processing, attention, and memory (Block et al., 1999; Mandalis, Kinsella, Ong, & Anderson, 2007; Rose, Feldman, & Jankowski, 2002). For example, in a recent article on working memory following TBI, Mandalis et al. (2007) noted that a reduction in information processing speed may subsequently impact on an individual's memory span capacity. Mandalis et al. (2007) also acknowledged the difficulty in separating out these two cognitive functions. Given this, SOP has been put forward as one of the core cognitive functions which underlie the process of learning and retention of new information (Mulhern & Butler, 2004; Wright & Limond, 2004).

As a consequence of reduced SOP, students with an ABI may exhibit secondary deficits, such as being unable to keep pace with the presentation of information in a classroom, poor recall of verbally presented information, and difficulties with formulating responses in the allocated time (DePompei, 2005; Mandalis et al., 2007; Palmer et al., 2007). Therefore, SOP deficits following paediatric ABI are likely to manifest as difficulties in areas of academic achievement, as well as in classroom performance.

1.2.2.4. Executive Functions

The term Executive Functions (EF) incorporates numerous higher order cognitive skills including problem solving, planning, goal setting, initiation, organisation, flexibility, self-monitoring, inhibition, self-regulation, and working memory (Levin & Hanten, 2005; Ylvisaker & Feeney, 2002). The development of EF begins from a young age and continues into early adulthood, with differing periods of gradual development and rapid age-related improvements noted for the various aspects of EF (Levin & Hanten, 2005). Working memory is one of the first EF abilities to emerge, and shows a period of large developmental gains between the ages of four and eight years, followed by continued development until 11 years of age (Levin & Hanten, 2005). In comparison, inhibition is proposed to show improvements between the ages of three and seven years, while skills in planning and self-monitoring are evident by age four and continue to demonstrate improvements throughout adolescence (Levin & Hanten, 2005). The process of development of some executive functions has been reported to continue into early adulthood (Ewing-Cobbs, Prasad, Landry, Kramer, & DeLeon, 2004).

Given that EF continue to develop up to the third decade of life these functions are particularly vulnerable to insults during childhood and adolescence (Muscara, Catroppa, & Anderson, 2008; Slomine et al., 2002). However, unlike other cognitive functions, the variable of younger age at injury has not been found to consistently predict poorer overall EF outcomes (Taylor & Alden, 1997). This is likely to be due to the many varied developmental trajectories of EF, resulting in specific EF components being more vulnerable to injury at different ages (Muscara et al., 2008; Taylor & Alden, 1997). For example, Slomine and colleagues (2002) found that on measures of set shifting and idea generation, children aged around seven years old at the time of injury performed more poorly than children aged 13 to 15 years at the time of injury. In contrast, Conklin, Salorio, and Slomine (2008) found that on a working memory task, the children who were older at the time of injury performed more poorly on age scaled scores than younger children.

A variable that has been found to strongly predict EF outcomes following a paediatric TBI is the severity of injury (Babikian & Asarnow, 2009; Nademaum et al., 2007). In a recent study, Nadebaum and colleagues (2007) examined EF outcomes in 54 children with TBI, with their sample grouped according to severity of injury (i.e., mild, moderate, or severe). The authors found that children with severe injuries performed more poorly compared with controls on tasks of cognitive flexibility and on parent ratings of executive functioning. On a goal setting task, the severe group performed significantly more poorly than the controls as well as children with mild or moderate injuries. From their analysis, Nadebaum et al. (2007) concluded that while a number of variables were found to predict EF outcomes following paediatric ABI, severity of injury was the most consistent predictive factor. This finding was supported by a recent meta-analysis conducted by Babikian and Asarnow (2009) who concluded there was a dose-response relationship between severity of injury and EF outcomes following a paediatric ABI.

In studies which have examined the combination of both age at injury and severity of injury on EF, a strong interaction between these two variables has been noted (V. Anderson, Catroppa, Haritou et al., 2005a; Nadebaum et al., 2007; Slomine et al., 2002). Those children who sustain severe injuries at a younger age are consistently reported to have the poorest EF outcomes in the paediatric ABI population (V. Anderson, Catroppa, Haritou et al., 2005a; Nadebaum et al., 2007; Slomine et al., 2002). The term “double-hazard” has been used to describe the poor outcomes associated with both low age and severe injuries (V. Anderson, Catroppa, Haritou et al., 2005a).

For children diagnosed with a brain tumour, EF outcomes are often related to the type of treatments provided, with treatment with CRT often associated with increased risk of deficits (Copeland et al., 1999). Copeland et al. (1999) examined the EF outcomes in children diagnosed with a posterior fossa tumour before the age of three years. All of the 21 children in the sample had received surgery to remove the tumour and were tested at more than one year post diagnosis. Seven participants had received whole brain CRT at least six months before their cognitive assessment, while the remaining 14 had not. When EF performance between these two groups were compared Copeland and her colleagues found that the group who had received CRT performed at the below average range while the no-CRT group remained within the average range. While there was no statistical significance between these two results, the authors noted that this was likely to be due to the small sample size.

Following their above results, Copeland et al. (1999) then conducted a growth-curve analysis based on the 15 children in their study who had received at least two cognitive assessments over time since diagnosis. Their growth-curve model suggested that the age scaled EF scores of children who were not treated with CRT would remain within the average range over the longer term, while the age scaled EF scores of those treated with CRT would decline into the impaired range over time. The difference between these two groups on the growth-curve model was statistically significant (Copeland et al., 1999).

These results of a predicted decline in age scaled EF scores over time for children treated with CRT are consistent with a more recent growth-curve analysis by Spiegler, Bouffet, Greenberg, Rutka, and Mabbott (2004). These authors followed 34 children with a posterior fossa tumour who had been treated with CRT. The average age at diagnosis was 6.08 years (*SD* = 2.73 years), and the average follow-up time was approximately five years post-diagnosis (range = 1.33 to 15.25 years). Based on repeat assessments, Spiegler et al. (2004) estimated a one standard deviation decline in age scaled scores every five years post-diagnosis in the EF areas of problem solving and verbal fluency. Given the young age of the children at diagnosis, the observed declines in age scaled EF scores over time are likely to be a function of children failing to keep up with their peers in the continued development of EF rather than an actual decline in abilities.

From the consistent reports of deficits in EF in children with an ABI, it follows that EF deficits are commonly reported in the school performance of these children. An ecological assessment tool of EF, the BRIEF (Behaviour Rating Inventory of Executive Function) is based on teacher and parent reports. The BRIEF provides numerous examples of how EF deficits may manifest as negative behaviours in the classroom. Some examples from the BRIEF include "Resists accepting a different way to solve a problem with schoolwork" and "Does not bring home homework, assignment sheets, materials, and so on" (Gioia, Isquith, Guy, & Kenworthy, 2000). Other frequently noted manifestations of EF deficits for students with an ABI include difficulty beginning tasks, poor monitoring of behaviour, and a disorganised approach to tasks (Bennett et al., 2004; Blosser & DePompei, 2003; Tyler & Grandinette, 2003). Given the impact of EF deficits in the classroom, it will be important to include EF as an outcome measure when examining the impact of educational supports for students with an ABI.

1.3. Return to School Following Paediatric ABI

The percentage of children who return to mainstream school following an ABI is unknown. While some literature suggests that many children return to mainstream school at some stage following injury (Deidrick & Farmer, 2005), no quantitative information is provided. There are many factors which have also been found to influence the school performance of students with an ABI. These factors include the variability in outcome due to cognitive sequelae, severity of injury (Catroppa & Anderson, 1999; Ewing-Cobbs et al., 2006; Fay et al., 2009), dose of treatment received (Barrera, Shaw, Speechley, Maunsell, & Pogany, 2005; Lorenzi et al., 2009; Mitby et al., 2003), age at injury (D'Amato & Rothlisberg, 1996; Ewing-Cobbs, Barnes et al., 2004), pre-existing school difficulties (Arroyos-Jurado et al., 2006; Miller & Donders, 2003; Yeates et al., 2005), and family functioning (Taylor et al., 2002; Yeates et al., 2002).

Success in returning to school is often measured by academic outcomes and classroom performance. Academic outcomes are defined as the results of learning and retaining new information (Walker & Wicks, 2005). Common measures of academic outcomes include single word reading, spelling, and arithmetic abilities (Walker & Wicks, 2005). In comparison, classroom performance is measured through observed behaviours such as paying attention, planning and organisation of tasks, and being able to work independently (Bennett, Good, & Kumpf, 2003).

As discussed above, in addition to IQ, the cognitive skills of attention, memory, SOP, and EF have all been found to underlie the performance of academic outcomes and classroom performance. Thus, as deficits these areas are commonly associated with paediatric ABI, it is not surprising that difficulties in the academic outcomes and classroom performance of students with an ABI are often reported (Arroyos-Jurado & Savage, 2008; Catroppa & Anderson, 2006; De Schryver et al., 2000; Hurvitz et al., 2004; Upton & Eiser, 2006).

1.3.1. Academic outcomes

When the academic performance of students with an ABI is compared with their non-injured peers, deficits are commonly found in outcome measures such as single word reading, spelling, and arithmetic (Catroppa et al., 2008; Ewing-Cobbs, Barnes et al., 2004; Palmer et al., 2007; Upton & Eiser, 2006). The recovery trajectory of these academic abilities indicates initial improvement in the first six months following injury, followed by stabilisation over the next 18 months (Catroppa & Anderson, 1999; Ewing-Cobbs et al., 1998; Taylor et al., 2002). Investigations of academic outcome at five years post-injury have found that academic deficits are likely to persist in the longer term, with evidence of increasing deficits also noted over time in some studies (Ewing-Cobbs, Barnes et al., 2004; Ewing-Cobbs et al., 2006; Hawley, 2003; Palmer et al., 2007; Taylor et al., 2002).

This pattern of persistent and increasing deficits was clearly highlighted in a recent longitudinal study by von Hoff et al. (2008). von Hoff and colleagues (2008) examined the reading performance of 12 children with brain tumours who were treated with both surgery and local irradiation. They found that all 12 children had a reading age which lagged behind their chronological age by one to five years. Of the eight children whose reading performance were then re-examined over time this lag continued to increase over time with students falling further behind age-expected levels (von Hoff et al., 2008). In another longitudinal study, Fay et al. (2009) followed the academic abilities of 109 children with moderate and severe traumatic brain injuries for up to five years post-injury. They found that between 16% and 27% of participants in their study exhibited persistent academic deficits in the areas of reading, writing, and arithmetic. Consistent with von Hoff et al. (2008), Fay et al. (2009) also noted an increasing deterioration in age-normed academic scores over time.

This phenomenon of increasing deficits in academic outcomes is consistent with the proposal that children with an ABI are likely to grow into their disability over time. That is, while some academic deficits may be apparent from the time of school re-entry, others may only appear or increase over the long-term as students with an ABI fail to keep up with the expected rate of skill acquisition (Catroppa & Anderson, 1999; Ewing-Cobbs et al., 1998; von Hoff et al., 2008). Increases in deficits may also appear over time as information established prior to injury becomes less relevant for the student, and assessments begin to measure more sophisticated levels of knowledge (Kinsella et al., 1995).

Unlike the plentiful research on academic outcomes following TBI and brain tumours, there is a distinct lack of research which examines academic outcomes following paediatric stroke. This lack of research perhaps reflects the lower incidence of paediatric stroke when compared with traumatic brain injuries and brain tumours. One study which did briefly examine academic outcomes was by De Schryver et al. (2000). While not specifically measuring performance on academic tasks, they noted that at least 50% of their participants required remedial educational assistance at some point following stroke. Thus, indicating that following a paediatric stroke, these children are also likely to experience some level of academic difficulties.

Despite consistent findings of deficits in the academic abilities of children with paediatric ABI, in comparison to their non-injured peers many authors noted that test scores on academic assessments remained within the average range (Catroppa et al., 2008; Deidrick & Farmer, 2005; Ewing-Cobbs et al., 2006). For example, Ewing-Cobbs et al. (2006) examined the academic outcomes of 23 children with moderate and severe brain injuries for an average of 5.7 years post-injury. Statistically significant group differences were noted when the mean academic scores of students with an ABI were compared with their non-injured peers. Despite this statistically significant difference between groups the average academic scores for children with an ABI remained within the average range. In contrast with their finding of academic scores within the average range, Ewing-Cobbs et al. (2006) noted that nearly 50% of the students with an ABI had either failed a school grade and/or had received special educational interventions.

This discrepancy between academic outcomes and overall performance was also found in a larger longitudinal study by Ewing-Cobbs, Barnes et al. (2004). In their study, Ewing-Cobbs and colleagues (2004) examined the school outcomes of 77 children with a mild to moderate or severe ABI. Along with academic measures of reading, spelling, and arithmetic, Ewing-Cobbs, Barnes et al. (2004) also examined classroom performance through the use of parent ratings on the Child Behaviour Checklist (CBC) academic competence score. The CBC academic competence score includes questions on special education services received, failings of any grade, and the presence of any other school problems. The results of their study demonstrated that while the majority of the academic scores remained within the average range, parent ratings of classroom performance were low. The classroom performance scores for the severe group were reported to be more than one standard deviation below the mean (Ewing-Cobbs, Barnes et al., 2004). The authors concluded that academic outcome scores within the average range did not predict average outcomes in classroom performance.

Given these findings of academic abilities within the average range in combination with poor ratings of classroom performance, the ecological validity of using academic assessments alone to investigate school performance post-paediatric ABI have been brought into question (Perrott, Taylor, & Montes, 1991; Silver, 2000; Ylvisaker &

Feeney, 1998). The reason for this discrepancy may be that these measures of academic ability do not tap the underlying cognitive skills required for competency in school performance (Ewing-Cobbs, Barnes et al., 2004). Given this discrepancy between testing and real-world performance, many authors state that assessments of academic abilities alone will not provide an ecological assessment of the school performance of students with an ABI (Deidrick & Farmer, 2005; Gioia & Isquith, 2004; Perrott et al., 1991; Silver, 2000; Taylor, 2004; Ylvisaker & Feeney, 1998). Thus, examination of the classroom performance of students with an ABI also merits examination.

1.3.2. Classroom performance

Low ratings of classroom performance are consistently reported in children who have sustained a TBI, brain tumour, or stroke (D. Anderson et al., 2001; Armstrong, Blumberg, & Toledano, 1999; Catroppa et al., 2008; Deidrick & Farmer, 2005; Ewing-Cobbs, Barnes et al., 2004; Hogan, Kirkham, & Isaacs, 2000; Lahteenmaki et al., 2007; Upton & Eiser, 2006). This poor classroom performance is often operationalised as a large number of behaviour problems, and/or a decrease in adaptive behaviour within the classroom setting. The most commonly noted negative behaviours in the classroom setting following an ABI include: running out of time to complete work, inability to follow directions, difficulties remembering information from week to week, difficulties in organising self and resources required for each class, speaking out and interrupting the class, asking for repetitions of instructions, and poor interactions with peers (Deidrick & Farmer, 2005; DePompei, 2005; Taylor et al., 2003).

These negative behaviours are often seen as manifestations of the cognitive sequelae following ABI, which include deficits in areas of attention, speed of processing, memory, and executive functioning. Examples of how these cognitive impairments commonly manifest as poor classroom performance are provided in numerous reference guides and education manuals on paediatric ABI (e.g., Bennett et al., 2003; Blosser & DePompei, 2003; Cohen, 1991; Conklin et al., 2008; DePompei, 2005; Dickman et al., 2001; Hawley, 2005; Keyser-Marcus et al., 2002; Kinsella et al., 1997; Levin & Hanten, 2005; Miller & Donders, 2003; Palmer et al., 2007; Reeves et al., 2006; Roncadin, Guger, Archibald, Barnes, & Dennis, 2004; Ylvisaker et al., 2005). Table 1.1 lists a sample of these behavioural manifestations.

While the examples listed in Table 1.1 are succinct examples of how deficits in each cognitive domain may manifest, it is important to note that the performance of each cognitive domain does not occur in isolation, and that strong relationships and/or interactions exist between cognitive domains (Bennett et al., 2003). For example, given that attention plays a large role in memory functions (Cowan, 1995), a deficit in attention abilities may manifest as negative behaviours due to memory deficits. Similarly, deficits in memory may manifest as poor planning and organisation if the student displays difficulties remembering the required materials for each class.

Table 1.1: Examples of how cognitive impairments commonly manifest as negative behaviours in the classroom

Cognitive Impairment	Examples of behaviours in the classroom setting
Memory (verbal new learning)	• Unable to follow directions for task, especially multiple-step directions. • Can't recall what was learnt in last class. • Unable to recall where they placed materials for class. • Poor retention of information over time. • Difficulty with learning new information.
Speed of processing	• Unable to formulate response to question in allocated time. • Displays difficultly with rate of information being presented. • Slower at completing tasks compared with peers.
Attention (sustained, divided, switching)	• Fussing with things on desk instead of completing task at hand. • Looking around room, daydreaming. • Loses track of conversation with peers and/or classroom discussion. • Difficulty copying material from board. • Unable to do two things at once such as listen to the teacher while taking notes. • Distracted by others in classroom.
Executive functioning (e.g., self-regulation, goal-setting, initiating, inhibition, planning and organisation)	• Brings incorrect materials to class. • Difficulty beginning a task and staying on task. • Doesn't monitor own behaviour – doesn't realise when daydreaming, acting out, etc. • Disorganised and as a result unable to complete tasks. • Difficulty in thinking of new ways to solve a problem if initial plan does not work. • Becomes lost in the details of tasks and is unable to carry them out.

Note: Table based on Blosser and DePompei (2003), Cohen (1991), DePompei (2005), Dickman, MacPhail, and Popp (2001), and Keyser-Marcus et al. (2002).

More frequent instances of poor classroom performance following an ABI have often been found to predict higher levels of educational assistance received by students with an ABI (Ewing-Cobbs, Barnes et al., 2004; Kinsella et al., 1995; Taylor et al., 2003). In an Australian study, Kinsella et al. (1995) found that of the 51 students with an ABI included in the sample eight students received either part-time or full-time educational assistance at one year post-injury. Kinsella et al. (1995) found that it was poorer scores on the teacher report form of the Child Behaviour Checklist (which provided measures of school performance, adaptive functioning, and negative behaviours) and not formal academic measures, which predicted this change in educational supports at one year post-injury.

A more recent study by Taylor et al. (2003) also found that it was a higher number of negative behaviours which was positively correlated with the provision of educational assistance. Ylvisaker, Hartwick, Ross, and Nussbaum (1994) postulated that behavioural problems often prove more difficult for schools than academic difficulties. If schools do indeed find behaviour problems difficult to manage, this may explain why a higher number of supports are often found in conjunction with a higher number of negative behaviours. Thus, as negative behaviours are seen to be an area of concern for schools, it will be important to examine what impact any educational intervention has on these behaviours.

1.4. Educational Interventions

For the return to school to be successful for students with an ABI, they are likely to require educational interventions. These interventions have been found to be required during the initial transition back to school as well as in the longer term to assist students with an ABI to access the curriculum and to address their cognitive skill deficits (V. Anderson & Moore, 1995; Deidrick & Farmer, 2005; Ewing-Cobbs, Barnes et al., 2004; Ylvisaker & Feeney, 1998).

As many students return to school within a year post-injury, the return to school is often seen as a continuation of the rehabilitation process, similar to the process of return to work for adults following ABI (Bowen, 2005; Dise-Lewis, Lewis, & Reichardt, 2009; Leigh & Miles, 2006; Petit-Zeman, 2002; Rey-Casserly & Meadows, 2008; Savage, DePompei, Tyler, & Lash, 2005). Congruent with this expectation of rehabilitation at school, students with an ABI will require support in two areas. Firstly, they will require support with the learning of academic content, and secondly with cognitive skill development (Ylvisaker et al., 2005). Within the literature on paediatric ABI, school-based intervention programs are usually multifaceted so as to cover both of the above areas. The three main recommended aspects of intervention programs for students with an ABI are: initial and ongoing assessment of the individual's needs (Ylvisaker et al., 2001), communication with and increased knowledge of teaching staff (Blosser & DePompei, 1991, 2003; Bruce, Chapman, MacDonald, & Newcombe, 2008; D'Amato & Rothlisberg, 1996; Gillett, 2004), and the implementation of compensatory and remediation teaching strategies (McDonald, 1998; Rees, 2006; Sterling, 1994; Ylvisaker et al., 2005). In the following section these three themes will be discussed and reviewed.

While it is acknowledged that students with an ABI are likely to have cognitive, physical, and psychosocial needs at school (Donders & Warschausky, 2007), the focus of this review will remain on the cognitive needs and associated educational interventions.

1.4.1. Assessment of need

The recommended first step in developing an educational intervention program for students with an ABI is to conduct a thorough assessment of the individual student's educational and functional needs (Mateer & Sohlberg, 2003; Ylvisaker et al., 2005). There are two main reasons given for the need for initial and ongoing assessment of the needs of students with an ABI. Firstly, in the absence of an assessment of the students needs, it is likely that the expectations of teaching staff will be based on the student's pre-injury school performance, which may be incongruent with the student's current abilities (Zinga et al., 2005). Secondly, there are large individual differences observed between each student with an ABI. Thus, a thorough assessment of needs will provide specific information on the individual's areas of strengths and weakness (Ylvisaker et al., 2005). In summary, the aim of the assessments of individual need is to assist in making decisions on which teaching strategies and other interventions are likely to best suit the individual student and their circumstances (Bowen, 2005; Dickman et al., 2001; Savage et al., 2005; Student and Professional Support Services, 2000; Ylvisaker et al., 2005).

While the recommendation of assessment of need for each individual student with an ABI is consistently cited there continues to be extensive discussion on the best way to evaluate these needs. As mentioned in an earlier section, there are limitations with solely using academic achievement tests to assess the school performance of students with an ABI. The conflicting findings often found between academic outcomes and classroom performance can result in the impact of a paediatric ABI on educational needs being either misunderstood and/or underestimated (Deidrick & Farmer, 2005; Perrott et al., 1991; Ylvisaker et al., 2001).

Similar to assessment of academic abilities the relationship between neuropsychological assessment results and real-world functioning does not always completely match (Silver, 2000; Stavinoha, 2005). In her article on the ecological validity of neuropsychological assessment of paediatric ABI, Silver (2000) commented that while it was currently assumed that formal neuropsychological assessment results predict functioning in the natural environment, there was a lack of research on this assumption in the paediatric ABI population.

In a more recent article, Stavinoha (2005) reviewed the literature on the integration between neuropsychological test performance and classroom performance in students with an ABI. Stavinoha (2005) concluded that the predictive abilities of these formal neuropsychological tests were indeed limited. Ewing-Cobbs et al. (1998) and Stavinoha (2005) both put forward that the possible reason for the poor ecological validity of neuropsychological tests was the vast difference between the quiet and structured assessment setting versus the classroom environment. Stavinoha (2005) noted that the classroom environment was likely to place far greater demands on a child's cognitive abilities than the formal testing environment. The suspected poor ecological validity of neuropsychological testing is further supported in a case study by Hawley (2005), where the results of formal cognitive testing of attention and concentration failed to predict the classroom performance in these areas. Notably, however, there remains a distinct lack of research which has compared the results of neuropsychological assessments with direct observations of the classroom performance of students with an ABI, despite recommendations that such research be carried out (Ylvisaker et al., 2005).

Thus, it appears that classroom performance can not be reliably predicted based on a combination of formal tests and measurements alone (Perrott et al., 1991; Ylvisaker et al., 2001). Ewing-Cobbs et al. (1998) suggested that to obtain ecologically valid measurements of school performance, assessments need to utilise multiple data sources (i.e., formal assessments, observations, and reports from others) and settings. Recommendations from Silver (2000), Stavinoha (2005), and

Ylvisaker et al. (2001) echo this conclusion, stating that an accurate assessment of school performance needs to include both quantitative and qualitative measures of performance and should include observations and reports from teaching staff and parents.

The importance of conducting an assessment of need in school-based programs for students with an ABI was recently highlighted in an Australian study. Sharp, Bye, Llewellyn, and Cusick (2006) found that it was the 'level of fit' between the student's ability and school demands which hindered or facilitated a positive return to school for students following an ABI (Sharp et al., 2006). Thus, it is only with an adequate assessment of individual need that this level of fit could be determined.

1.4.2. Communication and knowledge

Communication, or lack thereof, has been found to impact on the educational outcomes of students with an ABI (Glang, Todis et al., 2008; Sharp et al., 2006). Without communication, teaching staff are more likely to be unaware of the student's ABI and have a limited understanding of the underlying reasons behind poor school performance (Bennett et al., 2004; Glang, Todis et al., 2008). For example, in a recent UK study involving 67 students who had sustained an TBI, Hawley, Ward, Magnay, and Mychalkiw (2004) found that almost one third of teachers were unaware that a student in their class had an ABI. In a study on children with brain tumours, poor awareness from teachers of students' needs was reported (Bruce et al., 2008). This poor awareness was reportedly exemplified when the student had no physical deficits associated with their ABI (Bruce et al., 2008). In both the studies by Hawley et al. (2004) and Bruce et al. (2008), it was the parents who informed the school of their child's ABI in the majority of cases, with communication between health services and schools lacking.

When present, open and ongoing communication between home and school has been found to not only raise awareness of a student's ABI, but also promote a shared understanding of the possible underlying reasons for the student's behaviour and of the student's needs (Gillett, 2004). An increase in shared understanding of the student's needs has subsequently been found to produce improvements in the working relationship between schools and families (Dise-Lewis et al., 2009). Ongoing communication has also been found to play a role in ensuring consistency of interventions and strategies across environments (i.e., between home and school, between classes with different teachers) (Sharp et al., 2006).

While open communication assists in ensuring staff are aware of a student's ABI it is equally as important to provide teaching staff with knowledge about paediatric ABI so they can then meet the needs of these students. A recent survey, conducted by Bennett and colleagues (2004) in Canada demonstrated that teaching staff commonly hold misconceptions about the sequelae following paediatric ABI, and of the impact this sequelae may have on students' school performance. While there may be some teaching staff who are aware of the cognitive sequelae associated with paediatric ABI they are often found to lack the knowledge and resources to effectively program for these students (Mohr & Bullock, 2005; Zinga, Bennett, Good, & Kumpf, 2003). In a study examining the use of aides for students with congenital disabilities, Giangreco, Yuan, McKenzie, Cameron, and Fialka (2005) noted that it is this knowledge level of aides that is likely to influence the types of interventions they will use with students. Thus, not surprisingly, this lack of understanding and knowledge has been found to negatively impact on the educational outcomes of students with an ABI (Vaidya, 2002).

In an attempt to promote understanding and knowledge many freely available resources on how to support students with an ABI have been produced for teaching staff. Some examples of these are presented in Table 1.2.

Table 1.2: Examples of freely available resources on supporting students with an ABI.

Author and Year	Title
Bennett, Good, and Kumpf, (2003).	Educating Educators about ABI: Resource Manual
Division of Special Education (2004).	Special Education Evaluation and Services for Students with Traumatic Brain Injury: A Manual for Minnesota Educators.
Florida Department of Education (2005).	Understanding and Teaching Students with Traumatic Brain Injury: What Families and Teachers Need to Know
Ministry of Special Education (2001).	Teaching Students With Acquired Brain Injury. A Resource Guide For Schools.
Queensland Studies Authority (2007).	Acquired Brain Injury.
Student and Professional Support Services (2000).	Children with Acquired Brain Injury: Planning and Support Guide for Schools, Preschools and Childcare Services.

Notes: Full access details, including web addresses, can be found in the references.

Unfortunately, research suggests that teaching staff are unaware of this large body of available resources (Mohr & Bullock, 2005). In addition, Klasassen (1999) suggested that even when staff accessed written resources, they still required secondary consultation about paediatric ABI on a regular basis. This finding was supported more recently by Mohr and Bullock (2005) who conducted a focus group for teaching staff on meeting the needs of students with an ABI. They found that in addition to the provision of written information and one-off training sessions, teaching staff also required ongoing consultation to assist them in the administration of teaching strategies (Mohr & Bullock, 2005).

Many other authors also suggest that without ongoing training and supports to implement teaching strategies, staff would not have the required knowledge to be able to meet the needs of students with an ABI (D'Amato & Rothlisberg, 1996; Glang, Tyler, Pearson, Todis, & Morvant, 2004; Stavinoha, 2005). Consequently, a consistently recommended aspect of educational support programs for students with an ABI is to increase the knowledge of staff through the provision of initial training, coupled with ongoing education and consultation (Blosser & DePompei, 1991, 2003; D'Amato & Rothlisberg, 1996; Glang et al., 2004; Savage & Wolcott, 1988; Sharp et al., 2006; Stavinoha, 2005; Ylvisaker et al., 2001).

Despite these numerous recommendations around communication and knowledge, there is a lack of research that has formally evaluated these aspects of educational programs for students with an ABI. Only one evaluative study was found of an educational intervention program which included the aspects of communication and knowledge. This review was of a four-month-long educational and consultation program, BrainSTARS (Brain Injury: Strategies for Teams and Re-education for Students) which had been specifically designed for parents and teaching staff of students with an ABI (Dise-Lewis et al., 2009). The BrainSTARS program aimed to increase the knowledge of teaching staff about students with an ABI, assist with the development of a parent-school team through strategies including open communication, and consult with the parent-school team to develop educational interventions based on the individual student's needs. The BrainSTARS program included the provision of an information manual on paediatric ABI to the school, and three consultation sessions at school with teaching staff and parents. During these sessions, information on the student's particular cognitive deficits was discussed and an intervention plan made and reviewed over time (Dise-Lewis et al., 2009).

The review of the BrainSTARS program was based on 30 educational teams who undertook the program. Dise-Lewis et al. (2009) found that participant ratings of self-competence in working with students with an ABI significantly improved in comparison to pre-intervention levels. In addition, participants' ratings of the student's performance in the areas that had been targeted by the program had also demonstrated improvement. It was also found that parents and teaching staff highly valued gaining an understanding of each others issues in relation to the student with an ABI. The authors concluded that through improving the knowledge of teaching staff and parents, as through providing them with a shared understanding of issues, this had a positive impact on students functioning in the cognitive areas targeted by the program (Dise-Lewis et al., 2009).

From the recommendations and findings in the literature, it can be seen that the provision or absence of both communication and knowledge are likely to impact on the outcomes for students with an ABI. These aspects of communication and knowledge in educational intervention programs appear to serve two functions. Firstly, they ensure teaching staff are aware of the student's injury and the educational implications of this. Secondly, they ensure teaching staff are provided with knowledge and consultation so they can effectively meet the needs of the student. Given the influence these two aspects of an educational intervention program can have on students with an ABI, they become important to include in any assessment of the outcomes of educational interventions in this population.

1.4.3. Teaching strategies

The pattern of educational difficulties which occur following paediatric ABI usually results in these students requiring assistance with the underlying cognitive components of school-based tasks and activities (i.e., breaking tasks down, problem solving, keeping up with the pace of classroom learning etc.) (Arroyos-Jurado & Savage, 2008; Dickman et al., 2001; Ylvisaker et al., 2005). Given the well known specific areas of cognitive difficulties following paediatric ABI, there are an abundance of specific teaching strategies that have been put forward for staff working with students with an ABI. For example, in the one publication alone, 16 different strategies are provided for the assistance of deficits in attention for students with an ABI (Walker & Wicks, 2005). The copious number of strategies provided within the literature is likely necessitated by the large range of variability in the cognitive and educational capabilities of individuals with paediatric ABI. Given this variation in capabilities the same strategies are not likely to be effective for all students with an ABI (Zinga et al., 2005). This creates the need for a trial and error approach with strategies to ensure a correct fit between the individual needs of the student and supports provided (Arroyos-Jurado & Savage, 2008; Rees & Skidmore, 2008; Zinga et al., 2005).

A brief sample of common teaching strategies for students with an ABI is presented in Table 1.3. While this table is only based on four sources, there are many more articles, books, and resource guides that provide similar lists of teaching strategies for working with students with an ABI (e.g., Bennett et al., 2003; Butler & Copeland, 2002; Deidrick & Farmer, 2005; Dickman et al., 2001; Division of Special Education, 2004; Keyser-Marcus et al., 2002; Lash, Wolcott, & Pearson, 2005; Ministry of Special Education, 2001; Queensland Studies Authority, 2007; Schutz & Schutz, 2000; Sterling, 1994; Student and Professional Support Services, 2000; Utah State Office of Education & Utah State University, 1993; Walker & Wicks, 2005).

Table 1.3: Commonly presented teaching strategies for students with an ABI.

For deficits in attention:
- Provide rest breaks and decrease distractions in the environment. ⌘❖◆
- Break tasks down to fit into attentional capacity of student. ❖◆
- Redirect and increase self-awareness of deficits (re: use of verbal or visual reminders to maintain attention). ❖⌘◆
For deficits in memory
- Teach student to manage incoming information (chunking of information, allow extra processing time). ❖◆⌘
- Teach student to rehearse and summarise new information. ◆❖⌘★
- Elaborate information so student can more easily connect it with previously learnt knowledge. ◆❖⌘
- Use prompts such as diary, lists, homework sheets, and teach students to use these effectively. ◆❖⌘
For deficits in speed of information processing
- Provide extra time. ◆❖
- Present information at a slower rate, keeping it simple and clear. ◆❖★
- Provide a scribe. ❖
For deficits in executive functioning
- Utilise plans such as “Goal, plan, predict, do, review” to teach planning skills. ◆⌘★
- Use daily routines. ◆❖⌘★
- Assist the student in breaking down information into small parts by modelling explicitly. ◆❖⌘
- Provide written structure/steps on how to complete a task. ◆❖⌘

Key: ◆ Dickman et al. (2001); ❖ Bowen (2005); ⌘ Bennett et al. (2003); ★ Ylvisaker et al. (2001).

Teaching strategies for students with an ABI can often be grouped into two main categories, compensatory strategies and remediation strategies (Arroyos-Jurado & Savage, 2008; Catroppa & Anderson, 2006; Parkin, Maas, & Rodger, 1996; Penkman, 2004; Sterling, 1994; Ylvisaker et al., 2005). Compensatory teaching strategies are those which focus on lessening the cognitive load by compensating for the student's known cognitive deficits (Mateer & Sohlberg, 2003). Through this process of reducing the cognitive load, it is thought that students will then be better able to learn information and achieve academic success (McDonald, 1998; Rees, 2006; Sterling, 1994). Examples of compensatory strategies include: providing modified work, reducing external noises, providing rest breaks, giving explicit instructions, providing handouts when presenting verbal information, and providing multiple choice questions (Mateer & Sohlberg, 2003; Walker & Wicks, 2005).

Conversely, remediation strategies aim to provide an opportunity for the development of the cognitive skills underlying academic and behavioural tasks, thus, increasing students' independence with time (McDonald, 1998; Rees, 2006; Sterling, 1994; Ylvisaker et al., 2005). This is achieved by overtly teaching the student specific approaches to learning (Glang, Ylvisaker et al., 2008). Glang, Ylvisaker et al. (2008) provided the example of a student being taught to use self-regulatory self-talk such as "I need to check my work" to improve on academic outcomes (p. 246). Another example of a remediation strategy is teaching the student to utilise a planning and problem solving chart to assist them in breaking down tasks into manageable steps (Glang, Ylvisaker et al., 2008).

While either type of teaching strategy can be used in isolation, McDonald (1998) noted that the provision of compensatory strategies alone would not serve to increase the cognitive capacity of students with an ABI. Thus, McDonald (1998) suggested that remediation strategies are also required as they provide the opportunity for cognitive development and assist students to undertake tasks more independently over time. As a result, it is generally recommended that both categories of teaching strategies are included in any educational intervention program. Taken together, these strategies promote educational achievement by reducing the impact of students' cognitive deficits within the classroom (Bennett et al., 2003; Tyler & Grandinette, 2003). It could be assumed that by using a combination of these teaching strategies, and thus reducing the impact of students' cognitive deficits, they would then also reduce the number of negative behaviours which occur in the classroom.

While these teaching strategies are promoted as effective for students with an ABI, there is a distinct paucity of published research on their efficacy (Catroppa & Anderson, 2006; Semrud-Clikeman, 2001; Sharp et al., 2006; Stewart-Scott & Douglas, 1998; Ylvisaker et al., 2001). While some authors note that the teaching strategies they present have been research-validated, they do so without providing information on the evaluations used and associated outcomes (e.g., see: Bowen (2005), Dawson and Guare (2004), and Dickman et al. (2001)). The need for individuality and variability in the assigning of specific strategies to students with an ABI, as discussed above, has been cited as a large limitation in conducting large scale research validation studies (Arroyos-Jurado & Savage, 2008). Given this obstacle to research, the majority of authors who publish these teaching strategies acknowledge the lack of research and state that the strategies they recommend are based on pragmatic observations and experience (Ylvisaker et al., 2001). Despite the lack of published evaluations, Ylvisaker et al. (2001) suggested that a presence of credibility is obtained as similar strategies are reported across continents in numerous books and journals.

1.4.4. Implications for future research

Despite the lack of research surrounding educational interventions for students with an ABI, there is evidence which demonstrates that these interventions are provided nevertheless. Across five international studies, the number of students with TBI who received special educational interventions ranged from 9% to 73%, with the type of resources provided ranging from special education classes, provision of a tutor, teacher consultation, or resource room support (Donders, 1994; Ewing-Cobbs et al., 1998; Glang, Todis et al., 2008; Miller & Donders, 2003; Taylor et al., 2003). Five studies which examined the percentage of special education support received by students who had sustained either a brain tumour or paediatric stroke reported that the number of students who received supports ranged from 45% to 80% (Armstrong et al., 1999; De Schryver et al., 2000; Ganesan et al., 2000; Hurvitz et al., 2004; Lorenzi et al., 2009). As there is large variability as to what constitutes an educational intervention across studies, this may account for the range of percentages reported.

Given the high numbers of students with an ABI who receive an educational intervention of some type, further research into the outcomes of these interventions is warranted.

1.5. Aides

Aides are often employed to work with students with an ABI to assist in the implementation of educational programs and associated teaching strategies (Sohlberg, Todis, & Glang, 1998; Walker & Wicks, 2005). Aides are seen as having an important role in the management of students' academic needs and classroom behaviours as they are able to provide consistent educational interventions across educational subjects and settings (Sterling, 1994; Todis, Gland, & Fabry et al., 1997; Walker & Wicks, 2005). There are many varied names found for aides within the international and national literature. Some variations include: integration aide (Todis et al., 1997; Walker & Wicks, 2005), teacher's aide or teacher's assistant (Bruce et al., 2008; Rees & Skidmore, 2008; Sharp et al., 2006), instructional assistant (Feeney & Ylvisaker, 2003), resource teacher (Bruce et al., 2008), and para-professional aide (Feeney & Ylvisaker, 2003). Despite these differences in names, the role of aides who work with students with an ABI is commonly defined as assisting students with the cognitive aspects of tasks, and helping students access the curriculum (Walker & Wicks, 2005). Without a clear definition of their role, it is likely that aides will be unclear of the work they are expected to undertake with students. As such, it is often recommended that aides be provided with a clear definition of their role when they begin working with students (Rees & Skidmore, 2008; Walker & Wicks, 2005).

Consistent with the recommendations made for teachers, training and knowledge for aides is required to assist aides to meet the needs of students with an ABI (Rees & Skidmore, 2008; Sohlberg et al., 1998; Sterling, 1994; Todis et al., 1997; Walker & Wicks, 2005). Indeed, it has been suggested that without training and support, aides are likely to only use compensatory strategies and focus only on completing the academic content of students' work (Sohlberg et al., 1998; Todis et al., 1997). In comparison, when aides are provided with training and support it is thought that they are more likely to use remediation strategies which assist with the development of cognitive skills to increase students' independence (Sohlberg et al., 1998; Todis et al., 1997).

Based on the limited literature which discusses the use of aides for students with an ABI, aide programs are generally seen as useful. In an Australian study, Sterling (1994) found that of the parents, teachers, aides, and other support personnel of students with an ABI she interviewed, nearly half stated that aides were required to provide appropriate and effective programs for these students. It appears that aides are likely to be assigned to students who demonstrate negative behaviours or who are seen as disruptive in the classroom (Giangreco, Elderman, Broer, & Doyle., 2001; Todis et al., 1997). Given this, it may be that aides are seen as effective as unlike teachers they have the time to be able to spend the majority of lessons providing direct support and interventions to the students (Todis et al., 1997). Interestingly, while aides are often the people who work directly with students with an ABI there is a paucity of research which directly focuses on what tasks aides specifically perform and what the outcomes of an aide program are. While there have been continual calls for research into the outcome of providing aide programs to children with disabilities so as to inform funding bodies on the best use of resources (Giangreco, Elderman et al., 2001; Hall et al., 1995; Mealings, 2006), there still only remains a small amount of literature which focuses directly on the outcomes of aide programs.

Included within this limited literature are a small number of qualitative studies which have briefly commented on the use of aide programs with students with an ABI. However, these findings tend to be incidental to the primacy focus of the studies. Two such studies are by Todis et al. (1997) and Rees and Skidmore (2008) who examined the school experience for students with an ABI. Both of these studies reported that despite recommendations that the role of an aide be clearly defined, aides were often not clear of their role when working with students with an ABI. As a consequence, aides were uncertain whether their role was to assist students in completing their set work, to increase students' independent functioning skills, or both (Rees and Skidmore, 2008; Todis et al., 1997).

While there is only limited literature that has examined the impact of the education of teaching staff who worked with children with an ABI (i.e., the BrainSTARS program, Dise-Lewis et al., 2009), no literature was found which specifically evaluated the impact of providing education and training to aides who worked with students with an ABI. This lack of evaluation literature also extends to the population of aides who work with students with congenital disabilities, with only one evaluation study found. This study, by Hall, McClannahan, and Krantz (1995), used students' level of independence as an outcome measure to examine the impact of the provision of education and consultation to aides. They found that through the provision of training to aides, children with congenital disabilities demonstrated an increase in their skills and an increase in their level of independence.

The lack of evaluative literature on the provision of education and secondary consultation to aides may reflect other findings that suggest aides only receive minimal, if any, education and guidance to work with students with an ABI (Rees & Skidmore, 2008; Sohlberg et al., 1998). An Australian teacher noted that the issue of poorly trained aides was common in schools, and not specific to those working with students with an ABI (Roberts, 2007). Roberts (2007) also noted that the majority of aides did not have any formal training in working with students with disabilities, and that within Australia there are currently no standards or qualifications required to become an aide. Two recent Australian studies which explored the experience of aides of students with disabilities also found evidence of aides being poorly trained and supported (Bourke, 2008; Howard & Ford, 2007). Both Howard and Ford (2007) and Bourke (2008) noted that aides did not feel well supported and that they gained their knowledge about working with children with disabilities through informal sources such as on-the-job learning, the internet, and through collaborating with other members of the students' team. This apparent dichotomy between recommended and actual levels of training and supports for aides is likely to strongly influence the outcomes for students that can be achieved through the provision of aide programs.

In addition to the knowledge required on how to best provide supports to students with disabilities, the study by Howard and Ford (2007) also raised the issue of aides lacking detailed knowledge of the curriculum. In their study, Howard and Ford (2007) interviewed 14 aides around their roles in supporting students with special needs. They found that aides were concerned that their lack of knowledge on the curriculum was negatively impacting on student outcomes (Howard & Ford, 2007).

The most detailed discussion of the impact of aide programs for students with an ABI has been found in three qualitative studies (Bruce et al., 2008; Mealings, 2006; Sharp et al., 2006). These three studies examined the school experiences for adolescents with an ABI through the use of in-depth interviews with students and parents. Based on these interviews the authors commented on what students and parents saw as positive outcomes at school, and what lead to these positive outcomes. While evaluation of the impact of aide programs was not a specific focus in any of the three studies, outcomes were found interwoven throughout the qualitative results. According to the students and parents in these studies, important outcomes at school included the level of independence of the student (Mealings, 2006; Sharp et al., 2006), and the confidence of the student (Bruce et al., 2008)

Where the studies talked about support received from aides, students were found to highly value supports which promoted their independence, and stated that it was important that the aide program have the overall goal of reducing the need for aide programs (Mealings, 2006; Sharp et al., 2006). Thus, increasing the independence of the student over time was seen as an important outcome of the aide program by both students with an ABI and their parents (Mealings, 2006; Sharp et al., 2006). The aide program was also seen as having the positive outcome of promoting student's self-confidence (Bruce et al., 2008). From his qualitative study of children with a brain tumour, Bruce et al. (2008) noted that students reported having self-confidence in circumstances where their aide understood their needs and limitations, and could adapt work and levels of support accordingly.

In her study, Mealings (2006) also noted that students were not always accepting of the supports offered by an aide. Given this, she also explored what underlying factors were likely to lead to acceptance of supports and positive outcomes. Based on the perspective of students, Mealings (2006) identified that students were more likely to accept support and perceive this support as helpful when they had a good relationship with the aide. She also noted that students were more likely to accept assistance from aides when they perceived the aide to have a "positive helping style". Mealings (2006) concluded that students perceived aides as having a positive helping style when they provided encouragement to the student and assisted them to complete their work independently rather than completing work for them.

Thus, based on the meagre literature on the provision of aide programs for students with an ABI, it appears that in addition to the three main recommended aspects of intervention programs (i.e., assessment of need, communication and knowledge, and use of compensatory and remediation teaching strategies), another two aspects should be added when an aide is utilised. The first aspect is a clear definition of the role of the aide (i.e., are they working on completing set work or development of cognitive skills), and how they work with the student (Rees & Skidmore, 2008; Walker & Wicks, 2005). The second aspect is working to ensure that aides are perceived to have a positive helping style by the student they are working with (Mealings, 2006).

While these above studies provided information on what positive outcomes can be achieved from the provision of aide programs, there still remains gaps within the literature on specific evaluations of aide programs. One limitation of the above studies is that none of them examined the impact of the level of training and supports provided to the aides. As training and support is put forward as impacting outcomes in the school environment for students with an ABI (Walker & Wicks, 2005), this is an important variable to take into consideration. Thus, the overall outcomes of providing aide programs to students with an ABI remains unknown, despite calls for research in this area (Mealings, 2006).

1.6. Summary and Rationale for Current Study

Paediatric ABI has been found to affect many children in Australia. The main causes of paediatric ABI include traumatic brain injury, brain tumour, and stroke. The sequelae of paediatric ABI has been found to include sensory, psychosocial, and cognitive changes. There are numerous variables which have been found to impact on the cognitive sequelae following paediatric ABI, including age at injury, time since injury, severity of injury, extent and type of treatment, premorbid abilities, and family influences. Despite these many variables, central tendencies in the cognitive sequelae exist, with deficits in the areas of speed of processing, executive functioning, attention, and memory commonly seen. For children and young people returning to school following an ABI, it has been noted in the current literature review that these cognitive deficits may manifest as difficulties with academic achievement, and/or, difficulties with classroom performance.

To assist with difficulties within the school environment for students with an ABI, numerous educational interventions have been put forward. These interventions are usually multifaceted and include individual assessment of students' needs, communication and training with teaching staff, and the implementation of specific teaching strategies to assist with cognitive deficits. Often, these interventions are provided together as an educational intervention program. To assist in the implementation of educational programs and associated interventions, schools often acquire the services of an aide to work with the student with an ABI.

The provision of aide programs to students with an ABI has only been briefly mentioned in three exploratory qualitative studies as part of larger research topics. These qualitative studies noted outcomes pertaining to the student themselves such as their levels of independence and confidence. Importantly, qualitative research also highlighted themes relating to the provision of, and acceptance of, educational interventions for students with an ABI.

While these three qualitative studies have provided some initial information on what positive outcomes can be achieved from the provision of aide programs, there still remains a lack of studies that have specifically examined the outcomes following the provision of aide programs to students with and ABI. As schools often utilise their funding to employ aides to implement specific educational interventions for students with an ABI, further research into this area is imperative. Further research into the outcomes of aide programs will provide information to funding bodies on how to best utilise their limited resources and may also assist with funding decisions. Research into this area may also increase our understanding on what should be best practice for when aides are utilised as part of an educational intervention program for students with an ABI.

1.6.1. Aims and hypotheses

To address the gap in the literature, the main purpose of this exploratory study was to investigate the impact of aide programs on the classroom behaviours of students with an ABI and to examine what factors may lead to positive outcomes.

In relation to the cognitive functioning of these students, it was hypothesised that poorer performance on neuropsychological assessment would be negatively correlated with the number of behavioural manifestations of observed negative behaviours in the classroom setting. It was also hypothesised that students would receive a greater number of targeted interventions when an aide was present in the classroom, compared to when no aide was present. In addition it was hypothesised that when an aide was present, a higher number of observed negative behaviours would be discontinued. Lastly, it was hypothesised that teachers and aides who rated their levels of knowledge and support as being high would better meet the needs of these students based on reports of teaching staff and parents.

Furthermore, qualitative data will be explored for additional information on what factors may lead to positive outcomes during the provision of an aide program.

CHAPTER TWO: METHOD

2.1. Participants

The participants were eight students (six male) with an acquired brain injury aged between 9 years 3 months and 15 years 11 months. All participants attended mainstream schools in Victoria, Australia. At the time of this study the participants' educational year levels ranged from Grade 2 to Year 10. The students were recruited via their parents through advertisements distributed by a statewide service for children with an ABI and at a camp run for families with children with an ABI (see Appendix 1). The criteria for involvement in the study included diagnosis of an ABI, current full-time or part-time enrolment at a mainstream school in Victoria, and willingness of the school to be involved. Students with prior learning difficulties were not excluded given the small number of participants who registered their interest.

2.2. Materials

2.2.1. Cognitive test battery

The cognitive test battery consisted of the following tests:

<u>Wechsler Intelligence Scale for Children - Fourth Edition</u>: Digit Span subtest (Wechsler, 2003).

The Digit Span subtest of the Wechsler Intelligence Scale for Children - Fourth Edition (WISC-IV) is one of the two core subtests comprising the WISC-IV working memory index. The Digit Span subtest provides two separate age scaled scores; one for measures of short-term auditory attention (STAA) (Digits Forward), and one for working memory (Digits Backwards) (Lezak, Howieson, & Loring, 2004). In Digits Forward, the participant is required to repeat back to the examiner a string of verbally presented numbers. In Digits Backwards, the participant again repeats a string of numbers, but in the reverse order. In both tests, the string of numbers increases progressively in length every two trials. The Digit Span subtest also provides an overall scaled score, this, however, was not used in the current analysis given the specific focus on working memory. Both Digits Forward and Digits Backwards have strong reliability coefficients of r_{xx}=.83 and r_{xx}=.80 respectively. In the current study, age scaled scores were used in the data analysis.

Rey Auditory Verbal Learning Test (Strauss, Sherman, & Spreen, 2006).

The Rey Auditory Verbal Learning Test (RAVLT) is list learning task. The current study used the standard administration of this test as set out in Strauss et al. (2006). On the first trial participants are read out a list of 15 words, after which they are asked to recall as many of these words as they can. This is repeated for another four trials. On completion of the fifth trial a second (distractor) list of 15 words is read aloud, and participants recall those words. Participants are then asked to recall as many words as they can remember from the initial list.

After a period of 25 minutes, a delay recall trial is administered where the participant is asked to recall the initial list. Then follows a recognition trial; as the examiner reads out a list of 50 words one by one, the participant is required to state whether or not each word was in the initial list.

The RAVLT provides numerous measures of learning and memory including: (a) New Learning: The total number of words recalled across the five trials; (b) Immediate Recall: The number of words recalled on the fifth learning trial; (c) Learning Interference: The number of words recalled from the initial list, following the presentation and recall of the distractor list; (d) Delayed recall: The number of words recalled on the delay recall trials; and (e) Recognition memory: The number of words correctly identified during the recognition trial (Lezak et al., 2004; Strauss et al., 2006).

The internal reliability of the test is high (coefficient alpha of about .90) (Strauss et al., 2006), and the one month test-retest correlations ranged from r =.51 to r =.86 for the various trials (Lezak et al., 2004). For the purpose of data analyses raw scores were compared to age scaled normative data and converted to percentiles.

Test of Everyday Attention for Children (TEA-Ch): Sky Search, Score!, Creature Counting, and Sky Search DT subtests (Manly, Robertson, Anderson, & Nimmo-Smith, 1999).

The TEA-Ch is a widely used measure of attention in children which provides separate scores specific to each attentional domain (i.e., selective/focused attention, attentional control/switching, and sustained attention) (Manly et al., 2001). As specific domains of attention have been found to be more vulnerable than others to the impact of paediatric ABI (V. Anderson et al., 1998), it was important that each of these domains were measured individually. Raw scores of each subtest were converted to age scaled scores for the purpose of analysis in this study.

Sky Search provides a measure of selective attention (i.e., the ability to filter out irrelevant information) (V. Anderson et al., 1998). Participants are presented with a large sheet of paper which has 128 pairs of spaceships on it. Working as quickly as they can, participants are required to find and circle pairs of identical spaceships (there are 20 such pairs) which are randomly placed throughout the 108 distracter pairs. To account for motor speed, a second trial is given in which the participant is presented with only the identical pairs and no distracters. The Sky Search attention score is based on the time taken to complete the initial task, minus the motor speed component. It has an adequate test-retest reliability coefficient (r_{xx} =.75) (Manly et al., 1999).

Score! measures sustained attention. Participants are required to count the number of beeps they hear played on a tape (from nine to 15 beeps). The task is designed to be monotonous, with long gaps between beeps. There are ten trials, with one point scored as correct for those trials where the participant correctly counted the total number of beeps. As this test has ceiling effects, instead of a test-retest reliability coefficient, the authors provided a percentage agreement of the scores which were within one standard deviation of the original score on re-test. This percentage agreement was found to be adequate (percentage agreement = 76.2%) (Manly et al., 1999).

Creature Counting provides a measure of attentional control/switching through two scores. One score is for the total number of correct trials (accuracy score), and the other is a timing score. Participants count the number of “creatures” in the “burrows” by counting forwards or backwards, dependent upon the presentation of an up or down arrow. When presented with a down arrow participants are required to inhibit there usual response of counting upwards, and switch to counting downwards; and *vice versa* when presented with an up arrow. The number of switches per trial ranges from two to six switches across the seven trials. While the test-retest reliability coefficient was low for the timing score (r_{xx}=.57), the test-retest reliability coefficient for the accuracy score was adequate (r_{xx} =.71) (Manly et al., 1999).

The *Sky Search DT* subtest is the simultaneous completion of two previously completed subtests, *Sky Search* and *Score!.* The Sky Search DT subtest provides a measure of divided attention. Participants are asked to circle the pairs of identical space ships (*Sky Search)* while simultaneously counting the number of beeps played on the tape (*Score!)*. The task is ended when the participant indicates they have found all the pairs of spaceships. The score obtained is a decrement score, which takes into account how well the participant performed on the initial *Sky Search* task, and thus provides information on the participant's ability in dividing their attention between tasks. The test-retest coefficient for this subtest was high (r_{xx} =.0.81) (Manly et al., 1999).

<u>Controlled Animal Fluency Test (CAFT)</u> (Tucker, Ewing, & Ross, 1996).

The CAFT is designed to measure executive function tasks including planning, organisation, and idea generation (Tucker, Ewing, & Oguzkaya, 2009; Tucker et al., 1996). It consists of three 60-second trials in which the participant is required to generate lists of animals under a specific condition. For the first trial, participants name as many animals as they can without restrictions (Animals Automatic) which provides a measure of Idea Generation. For the second trial, participants name as many animals as possible from smallest to largest size (Animals by Size), which measures planning and organisation. In the final trial participants name as many animals as possible in alphabetical order (Animals by Alphabet) which provides a second measure of planning and organisation. Each trial is scored by giving one-point to each animal named that correctly adhered to the specific condition of that trial. For example, in Animals by Size, if a participant said "Cat, Horse, Dog, Cow, Bear", they would only score four points as "Horse" was not in the correct size order. In Animals by Alphabet, no points are given for skipped letters, or if an incorrect letter was used e.g., if "Cat" was given for the letter "K".

In addition to the scores obtained from the three trials, a further score is also available, Size Relative Difficulty. This score is obtained by comparing raw scores from the Animals Automatic condition with the Animals by Size condition, and provides detail on the degree of difficulty associated with completing the more complex task of Animals by Size. See Appendix 2 for complete administration and scoring instructions of the CAFT. All scores were compared with age scaled normative data to obtain percentiles (Tucker et al., 2009).

The Behaviour Rating Inventory of Executive Function (Gioia et al., 2000).

The Behaviour Rating Inventory of Executive Function (BRIEF) is a self-administered questionnaire which assesses a range of observed behaviours commonly associated with executive dysfunction in children and adolescents (Gioia, Isquith, Retzlaff, & Espy, 2002). There is a separate parent form and teacher form which each have 86 forced-choice response questions. For every question the informant indicates how frequently the child has difficulties with a particular behaviour (never, sometimes, or always). The form takes about 15 minutes to complete.

Scoring of the responses is grouped into executive function subcomponents of inhibit, shift, emotional control, initiate, working memory, plan/organise, organisation of materials, and monitoring. The first three scales combine to form the Behaviour Regulation Index (BRI). The remaining five scales comprise the Metacognition Index (MI) (Gioia et al., 2000). The MI index is interpreted in the BRIEF manual as being "the ability to cognitively self-manage tasks and reflects the participant's ability to monitor his or her own performance" (Gioia et al., 2000, p.21). The BRI and MI together comprise the Global Executive Composite, which is provided as a summary measure of executive functioning.

Scores on the BRIEF are reported as age scaled *T*-scores, with a mean of 50 and a standard deviation of 10. Higher scores on all BRIEF scales indicate poorer levels of executive functioning, which is in contrast to the other measures of cognitive functioning used in the current study.

The BRIEF is proposed to be more sensitive to executive function deficits in children and adolescents with an ABI than other formal assessment tasks of executive function, as it provides an ecologically valid measure of executive dysfunction (Vriezen & Pigott, 2002). The BRIEF was standardised and validated for use with children between the ages of five to 18 years. Internal consistency of the BRIEF is high, with indices of .80 and above for the parent scales, and .90 and above for the teacher scales (Gioia & Isquith, 2004). Good test-retest reliability for all scale and index scores are also reported, ranging between r = .76 to .88 for the parent scales, and r =.83 to .92 for the teacher scales (Gioia & Isquith, 2004).

2.2.2. Semi-structured interviews

Semi-structured interviews were used to collect demographic information about the student, as well as to obtain information on the student's needs at schools. The interviews were also used to collect qualitative and quantitative measures of the outcomes of providing aide programs to these students. These semi-structured interviews were conducted with the students, one of their parents/care givers, a classroom teacher, and their aide. Copies of the questions used in the semi-structured interviews described below are provided in Appendix 3.

Student Interviews

Students were asked questions regarding their relationship with their aides and teachers. They were also interviewed around their level of involvement they had in planning for this aide support, as well as their perceived outcomes of having an aide support them in the classroom.

Parent Interviews

The first section of the parent semi-structured interviews was used to acquire demographic information around their child (e.g., age, gender), information on past and current schooling (e.g., learning issues prior to injury, current grade, etc.), as well as information on their child's ABI (e.g., date of injury, type of injury, therapy services received, etc.). In the second section of the parent interview, seven-point Likert scales were provided for parents to rate how well they felt their child's needs were being met by the aide program.

Teacher and Aide Interviews

The teacher and aide semi-structured interviews were used to inquire about their levels of knowledge, training, support, and confidence they had in regards to working with students with an ABI. Teachers and aides rated their levels of knowledge and need for further support when working with students with an ABI on seven-point Likert scales. On the knowledge scale, a score of one indicated they perceived themselves to have a poor level of knowledge. On the support scale, a score of one indicated that they felt they did not require extra supports and they felt well supported.

In addition to the above information, teachers and aides were asked for their perception of the students main needs. They then rated on a seven-point Likert scale how well they felt the aide program, and the school in general, were meeting these needs.

The teacher interview was used to acquire structural information on the aide program (e.g., where funding was obtained from, how many hours of support were provided, etc.). Teachers were also asked to provide information about any educational modifications which were currently provided to the student.

2.2.3. Observational measures

Given the large variability in outcomes within the paediatric ABI population, support has been given to utilising qualitative observational methods as this allows for greater consideration of individual variables which may impact on outcomes (Feeney & Ylvisaker, 2008). In the current study, observations focused on the manifestation of cognitive deficits in the areas of memory, speed of processing, attention, and executive function, as deficits in these areas are highly likely to impact on classroom performance (V. Anderson, Catroppa, Morse et al., 2005; Blosser & DePompei, 2003; Cohen, 1991; DePompei, 2005; Keyser-Marcus et al., 2002). Examples of how these cognitive difficulties commonly manifest as negative behaviours in the classroom for students with an ABI were based on information from Blosser and DePompei (2003), Cohen (1991), DePompei (2005), Dickman et al. (2001), and Keyser-Marcus et al. (2002). These examples were collated into an observational reference table (see Appendix 4) to help ensure the observed behavioural manifestations were recorded against the same cognitive area across observation sessions. In addition, an observational chart was used to measure the frequency and intensity of these behaviours (see Appendix 5). The observational chart was also used to record if the student was provided with support when they displayed these behavioural manifestations, and if so what type of support this was, and if the behaviour stopped following provision of support.

2.3. Procedure

2.3.1. Initial and revised research designs

The initial research design was to compare the classroom performance of three independent groups of students with an ABI. Group one would contain those students who had no aide support, Group two would have some aide support (e.g., between 10 and 15 hours per week), and Group three would have a large amount of aide support (e.g., more than 15 hours per week). Each participant would be observed twice in the classroom; once with their aide (if applicable), and once without their aide. Formal neuropsychological assessments would be utilised so as to compare each participant's cognitive profile with their classroom performance. As there are many extraneous variables which are known to impact on interventions for children and young people with an ABI, the collection of additional qualitative information was included within the research design. Indeed, recommendations have been made from previous research to utilise a combination of formal assessments and observation techniques when measuring school performance of students with an ABI (Ewing-Cobbs et al., 1998; Kinsella et al., 1995). Many previous studies have also made use of qualitative research methods when conducting research on students with an ABI (e.g.,: Mealings, 2006; Rees & Skidmore, 2008; Sharp et al., 2006; Stewart-Scott & Douglas, 1998; Todis et al., 1997).

However, given the small number of participants recruited (eight), the distances required to travelled to complete assessments and observations for these eight participants (over 3,800 kilometres), and the time frame involved, a revised research design was required. Aside from the small sample size, all eight participants received at least some aide support, meaning that a between group comparison study design could no longer be used. A new research design was implemented which used a repeated measures approach. This revised design compared the classroom performance of each student when the aide was present, with their classroom performance when the aide was not present.

2.3.2. Procedure

After approval to conduct the study was granted by the Victoria University Human Research Ethics Committee (see Appendix 6), an invitational flyer to participate in this study was disseminated at a camp for families with children with an ABI, and also via a statewide paediatric ABI consulting service in Victoria. Families who were interested in the study made initial telephone contact with the researcher who then sent them a detailed information sheet outlining the study (see Appendix 7). They were also sent informed consent forms to be completed by the parent, and also the student where the parent felt they were mature enough to understand. Once families had completed and returned the signed consent forms, a date and time for the cognitive assessment and interviews was made. The relevant school was then contacted and provided with the same information sheet. Informed consent was obtained from teachers and aides for the observation sessions and semi-structured interviews. Following this, two observation dates were made with the school. The observations sessions were held before the cognitive assessment.

Despite attempts to conduct the two observation sessions for each student within the same subject, at the same time of day, and for the aide to be present at only one of these sessions, this was not always possible within the constraints of each school. For example, for one student an aide was present in both of their observation sessions, while for another their aide was not present in either of the observation sessions. For other students the lesson content during the two observation sessions differed greatly (e.g., watching a movie versus a textiles class). For students whose school was a drive of two hours or more away from the examiner the two observation sessions were conducted on the same day (n = 5).

For each observation session the researcher was introduced by the teacher as a student teacher who was observing the entire class so as not to single out the student with an ABI. In the majority of cases (n=6), the student had not met the researcher beforehand, and on request of their parents, was unaware that they were the subject of observation. Within the classroom the researcher located herself in a position where she could discretely observe and hear the student with an ABI. A five-point scale and an observational chart were used to record the intensity of the student's behavioural manifestation of cognitive deficits (negative behaviours) in each five-minute segment of the class; a score of one indicated no instances of negative behaviours, and a score of five indicated negative behaviours which occurred repeatedly or continuously within the five-minute segment. To ensure consistency, if a negative behaviour could be attributed to one or more cognitive areas, it was scored in line with the examples provided in the observational reference table. For example, if a student did not answer a question when asked it may have been the manifestation of memory deficits or SOP deficits, however, this was scored as a negative behaviour due to SOP deficits as per the examples in the reference table. For those students who received a fully modified program for the entire class, this provision of support was noted once for each five-minute segment of the class. Notes were taken on what supports were offered to the student following the behaviour, and by whom (i.e., the aide or the teacher). It was then noted if the behaviour continued (or not) following this provision of support.

Following the observation sessions, separate semi-structure interviews were conducted with the teacher and aide. The majority of these occurred on the same day as the observation session. If the teacher or aide was unavailable at these times a telephone interview was employed. If the teacher was unable to answer all questions relating to the aide program (i.e., hours of aide funding etc.), the school's Special Needs Coordinator was contacted by telephone for this information. Teachers and aides completed the BRIEF Teacher Form in their own time and returned the form to the researcher by mail.

Cognitive assessment and semi-structured interviews with the students were performed at their homes as soon after the observation sessions as possible. The order of task administration was the same for each participant; the Rey Auditory Verbal Learning Test, the Test of Everyday Attention for Children, the Controlled Animal Fluency Test, and then the Digit Span subtest of the WISC-IV. A parent or care giver (usually the mother or female care giver) completed the BRIEF Parent Form questionnaire while the student was being assessed. Lastly, semi-structured interviews with the parents were then conducted.

2.4. Preparation of Data for Analysis

As stated above, classroom observational data was collected on the behavioural manifestations of cognitive deficits in the four cognitive domains of speed of processing, memory, attention, and executive functioning. Within each five-minute segment of the class, the observed behaviours were rated on a five-point scale. A score of one indicated that no behaviours were observed, while a score of five indicated the behaviours occurred frequently.

Following completion of the observation sessions for all eight students, it was noted that the majority of scores used were a one, three, or five. Thus, to simplify the scale for analysis, ratings were changed to a three-point scale (0, 1, 2). Table 2.1 details the score conversion process.

Table 2.1: Score conversion table

Original Score	Converted Score
1 - Behaviours never occurred	0 - Behaviours never occurred
2 - Behaviours occurred once	1 - Behaviours occurred once or twice
3 - Behaviours occurred at least twice	1 - Behaviours occurred once or twice
4 - Behaviours occurred at least three times	2-Behaviours occurred three or more times
5 - Behaviours occurred three or more times.	2-Behaviours occurred three or more times

As all classes did not run for the same duration, scores were then adjusted further so that comparisons around the frequency of behaviours across students could be made. The first step was to sum the converted scores for the students' behaviours to obtain a total for each of the cognitive domains. Next, each total was divided by the number of five-minute segments for which that student had been observed, so as to provide their average behaviour score per segment. Lastly, this mean score was then multiplied by eight (the median class time was 40 minutes, creating eight five-minute segments). These final scores for each domain were recorded as the number of observed behaviours for each student. To obtain the overall number of observed behaviours for students per class, the final scores from each of the four cognitive domains were summed.

Unless otherwise indicated, the analysis conducted compared the number of behaviours which occurred when the aide was present, to the number of behaviours which occurred when the aide was not present.

2.5. Data Analysis

2.5.1. Quantitative data

The data were analysed using the Statistical Package for the Social Sciences – Windows Version 15.0. Descriptive data were obtained regarding the skewness and kurtosis of variables, and the Shapiro-Wilk statistic was used to assess normality. For the small number of variables that were not normally distributed, and did not meet the assumptions of normality required for the use of parametric statistics, non-parametric statistical analyses were performed. For normally distributed data, correlation analyses were conducted using Pearson's *r*, and paired sample *t*-tests were used. For those variables which did not meet the assumptions of normality, Spearman's *rho* and the Wilcoxon Signed Ranks tests were used.

In the interest of extracting useful information from the small data set, one-tailed correlations and *t*-tests were used when the expected direction of the findings had been previously stated. This has been found to be an acceptable practice in exploratory investigations (Gravetter & Wallnau, 2007). Caution in the increased probability of accepting the null hypothesis was noted given the use of *t*-tests with the small sample size. Interpretations of significance were based on standard definitions of statistical significance ($p<.05$). When comparing neuropsychological test scores with the number of observed behaviours, age scaled scores and percentile scores were used (as discussed in section 2.2.1).

2.5.2. Qualitative data

During interviews, respondents' answers were recorded verbatim. All the data were typed out, with responses arranged by respondent category and question (i.e., all of the aides responses to question one were grouped together). According to Auerbach and Silverstein (2003), data from interviews can be interpreted and analysed for patterns and themes. As some of the semi-structured interview questions were driven by theories based on previous research (i.e., that teacher/aide levels of training, knowledge, and support are likely to influence outcomes for students with an ABI), pre-determined categories were imposed on certain questions during data analysis (see Table 2.2). Within each of these pre-determined categories, the responses were arranged by group (i.e., teachers, aides, and parents), and then analysed for patterns.

Table 2.2: Pre-determined categories for data analysis

Pre-determined category used	Questions category imposed on
Knowledge of ABI	Aide q.2, Teacher q.8
Support for aides/teachers	Aide q.3, Aide q.5, Teacher q.9, Teacher q.11
Student's needs met?	Aide q.8, Teacher q.16, Parent q.6

As there was no predetermined theory for the remainder of the interview questions, these data were read and analysed for main themes. This analysis examined themes across the four groups. Based on the initial themes which emerged, data were then organised into categories. Data were re-examined to look for subcategories, with this process being repeated until no more sub-categories could be created. Thus, all categories were mutually exclusive. Once this process of categorisation was completed, possible relationships between categories were noted.

CHAPTER THREE: RESULTS

In the following results section, both qualitative and quantitative data will be presented alongside each other where appropriate. Pseudonyms were used in the qualitative analysis to protect the identity of the students.

3.1. Demographic characteristics of the participants

There were nine participants in total who, together with their parents, consented to be involved in this study. However, one participant was excluded because their school declined to be involved in the research project. This left a total of eight participants with an ABI in this study. Three participants had acquired their brain injury from stroke, one from brain tumour, three from involvement in a motor vehicle accident, and one from physical abuse. For the participants who sustained a traumatic brain injury, information on the Glasgow Coma Scale and the duration of post-traumatic amnesia was not known by their parents. The duration of hospital stay for all participants ranged from 0 to 19.5 weeks (*M* = 6.39, *SD* = 7.10).

The mean age of the participants was 13.2 years (*SD* = 2.5 years). At the time of this study, all participants were at least two and a half years post-injury (M = 7.65 years, *SD* = 4.40, see Table 3.1). Four participants were pre-school age at the time of their injury. The year level at the time of injury for the remaining four participants ranged from Prep (first year of school in Australia) to Year 7. Four participants were attending school at the time of injury and they missed between 10 to 30 weeks of full-time school, before beginning a gradual return to full-time school. At the time of this study the participants' educational year levels ranged from Grade 2 to Year 10, with half in secondary school (Years 7 and above).

Table 3.1: Demographic and educational characteristics of participants.

	n	*M*	*SD*	Range
Current age (years)	8	13.20	2.50	9.30 - 15.90
Age at injury (years)	8	5.45	4.37	0.30 - 12.70
Time since injury (years)	8	7.75	4.30	2.70 - 15.00
Length hospital stay (weeks)	8	6.39	7.10	0.00 - 19.50
Hours of aide support (p/week)	7	17.03	9.42	5.00 - 32.50

Notes: Hours of aide support was unknown for one participant

All of the participants currently attended school on a full-time basis, with two having a reduced study load (i.e., they did not attend all classes). One participant attended mainstream school two-and-a-half days per week, and attended a special education school the other two-and-a-half days (observation sessions took place in his mainstream school). One participant had repeated a year of schooling prior to sustaining their ABI. Another three participants repeated a year of schooling following their ABI.

Given the limitations of school and family availability, the full procedure as set out in the method section was only completed with five participants. For the remaining three participants, at least one aspect of data collection was not completed (e.g., the teacher, aide, parent, or participant was not available for interview, the participant was unable to complete full cognitive assessment, etc.). Table 3.2 shows the number of data sets collected for each procedure.

Table 3.2: Number of data sets collected for each procedure.

	Obs	Teacher Interview	Aide Interview	Parent Interview	Student Interview	Digit Span	CAFT	RAVLT	TEA-Ch
n	8	6	7	7	7	6	6	5	7

Notes: Obs: Classroom observations; Digit: Digit Span subtest from the Wechsler Intelligence Scale for Children IV; CAFT: Controlled Animal Fluency Test; RAVLT: Rey Auditory Verbal Learning Test; TEA-Ch: Test of Everyday Attention for Children.

3.2. Correlation between neuropsychological measures and observed negative behaviours

Correlational analyses were used to compare the performance of students on formal neuropsychological assessment measures (formal measures) with the number of negative behaviours taken from the two classroom observation sessions. The results of the formal measures were compared to the total number of negative behaviours in each separate cognitive domain, as well as to the total number of observed negative behaviours across the four cognitive domains.

3.2.1. Measures of attention

Table 3.3 shows that observed behaviours in the attention domain had a significant negative correlation with Short Term Auditory Attention (STAA) and a significant negative correlation with Switching Attention. These two formal measures of attention were also found to have significant negative correlations with the total number of observed behaviours. Of note the measure of sustained attention had a significant negative correlation with behaviours if the memory domain.

Table 3.3: Correlations between formal measures of attention performance and number of observed behaviours (one-tailed).

Domains		Memory	SOP	Attention	Executive Function	Total Behaviours
	n	*r (p)*	*r (p)*	*r (p)*	*r (p)*	*r (p)*
STAA	6	-.41 (.21)	-.22 (.34)	-.72 (.05)	-.03 (.47)	-.73 (.05)
Selective Attention	7	-.50 (.13)	.27 (.28)	-.38 (.20)	.20 (.33)	-.24 (.30)
Sustained Attention	7	-.82 (.01)	-.32 (.24)	.14 (.38)	.01 (.49)	-.39 (.20)
Switching Attention	7	-.17 (.36)	.48 (.14)	-.85 (.01)	-.62 (.07)	-.76 (.02)
Divided Attention	6	-.01 (.49)	-.05 (.46)	.46 (.18)	-.53 (.14)	-.11 (.42)

Notes: SOP: Speed of information processing; STAA: Short-term auditory attention; Total Behaviours: Total number of behaviours observed across all four cognitive domains.

None of the other measures of attention were significantly correlated with either behaviours in the attention domain or the total number of observed behaviours. However, the majority of correlations between formal measures of attention and observed behaviours were mostly in the negative direction. This most likely indicates possible limitations due to lack of statistical power.

3.2.2. Measures of memory

Table 3.4 shows that poor performance on formal measures of memory was not significantly correlated with the number of observed behaviours in the memory domain.

Table 3.4: Correlations between formal measures of memory performance and number of observed behaviours (one-tailed).

Domains		Memory	SOP	Attention	Executive Function	Total Behaviours
	n	*r (p)*	*r (p)*	*r (p)*	*r (p)*	*r (p)*
New Learning	5	-.36 (.27)	-.10 (.44)	-.15 (.41)	-.65 (.12)	-.87 (.03)
Immediate Recall	5	-.26 (.33)	-.02 (.48)	-.01 (.49)	-.79 (.05)	-.79 (.06)
Learning Interference	5	-.45 (.22)	-.15 (.40)	-.11 (.43)	-.48 (.20)	-.78 (.06)
Delayed Recall	5	-.33 (.30)	-.09 (.44)	-.15 (.41)	-.71 (.09)	-.89 (.02)
Recognition Memory	5	-.52 (.18)	-.21 (.37)	.11 (.43)	-.58 (.15)	-.77 (.06)

Notes: SOP: Speed of information processing; STAA: Short-term auditory attention; RD: Relative Difficulty; Total Behaviours: Total number of behaviours observed across all four cognitive domains.

As only five participants completed the formal measures of memory, the non-significant correlations may be due to the low *n* and hence lower statistical power. The trend to correlations in the negative direction suggests that this may have been the case. The results in Table 3.4 also show that two formal measures of memory, New Learning and Delayed Recall, had significant negative correlations with the total number of behaviours observed across all four of the cognitive domains. A significant negative correlation was also found between Immediate Recall and the number of observed behaviours in the EF domain.

3.2.3. Measures of speed of information processing

Table 3.5 displays the correlations between formal measures of speed of information processing (SOP) and then number of observed behaviours in each cognitive domain. These correlations demonstrated that neither of the two formal measures of SOP were significantly related to observed behaviours in the SOP domain. However, a significant negative correlation was noted between speed of information processing and observed memory behaviours.

Table 3.5: Correlations between formal measures of SOP performance and number of observed behaviours (one-tailed).

Domains		Memory	SOP	Attention	Executive Function	Total Behaviours
	n	*r (p)*	*r (p)*	*r (p)*	*r (p)*	*r (p)*
Selective Attention Speed	7	-.57 (.09)	.24 (.30)	-.39 (.20)	.12 (.40)	-.34 (.23)
Switching Attention Speed	7	-.87 (.00)	-.33 (.24)	.03 (.48)	-.14 (.39)	-.56 (.09)

Notes: SOP: Speed of information processing; Total Behaviours: Total number of behaviours observed across all four cognitive domains.

3.2.4. Measures of executive functioning

Table 3.6 shows the results of correlation analyses between formal measures of EF and the number of observed behaviours in each cognitive domain. These results show a significant negative correlation between Planning and Organisation and the total number of observed behaviours. A significant negative correlation was also observed between Idea Generation, a timed EF task, and the total number of observed behaviours in the memory domain. Significant negative correlations were also noted between formal measures of EF and observed behaviours in the attention domain.

Table 3.6: Correlations between formal measures of EF performance and number of observed behaviours (one-tailed).

Domains		Memory	SOP	Attention	Executive Function	Total Behaviours
	n	*r / rho (p)*	*r / rho (p)*	*r / rho (p)*	*r / rho (p)*	*r / rho (p)*
Working memory	6	-.02 (.49)	.06 (.46)	-.76 (.04)	-.27 (.30)	-.60 (.10)
Idea Generation	6	-.87 (.01)	-.36 (.24)	.02 (.48)	-.14 (.39)	-.57 (.12)
Planning & Organisation	6	-.47 (.17)	-.18 (.37)	-.37 (.24)	-.71 (.06)	-.89 (.01)
Size Relative Difficulty	6	.26 (.31)	.60 (.10)	-.94 (.00)	-.60 (.10)	-.54 (.13)

Notes: SOP: Speed of information processing; Total Behaviours: Total number of behaviours observed across all four cognitive domains.

Table 3.7: Correlations between the BRIEF Teacher and Parents forms and number of observed behaviours (one-tailed).

Domains		Memory	SOP	Attention	Executive Function	Total Behaviours
	n	*r (p)*	*r (p)*	*r (p)*	*r (p)*	*r (p)*
Teacher Metacognition	7	.13 (.39)	-.42 (.18)	.71 (.04)	.72 (.03)	.66 (.05)
Teacher Behaviour Regulation	7	.33 (.23)	-.05 (.46)	.63 (.06)	.77 (.02)	.75 (.03)
Teacher Global EF	7	.16 (.36)	-.25 (.29)	.68 (.05)	.76 (.02)	.69 (.04)
Aide Metacognition	7	.08 (.43)	-.53 (.11)	.71 (.04)	.58 (.08)	.57 (.09)
Aide Behaviour Regulation	7	.31 (.25)	-.42 (.17)	.79 (.02)	.44 (.16)	.64 (.06)
Aide Global EF	7	.14 (.39)	-.50 (.13)	.74 (.03)	.54 (.11)	.59 (.08)
Parent Metacognition	7	-.07 (.44)	-.40 (.19)	.20 (.34)	.39 (.19)	.15 (.38)
Parent Behaviour Regulation	7	.44 (.16)	-.31 (.25)	.15 (.38)	.42 (.17)	.38 (.20)
Parent Global EF	7	.11 (.41)	-.45 (.16)	.26 (.29)	.34 (.23)	.22 (.32)

Notes: SOP: Speed of information processing; Total Behaviours: Total number of behaviours observed across all four cognitive domains.

Correlational analyses were also conducted between EF abilities as measured by the BRIEF and the number of observed behaviours in each cognitive domain. As noted in the methods section, scores from the BRIEF were inverse when compared with the other formal cognitive assessment measures, with higher scores indicating poorer levels of EF. An analysis of variance showed that there was no significant effect of group membership (parent, aide, or teacher) on scores of the BRIEF Metacognition,

$F(2, 20) = 1.04$, $p = .37$, Behaviour Regulation, $F(2, 20) = 1.67$, $p = .22$, or Global EF, $F(2, 20) = 1.13$, $p = .34$.

Table 3.7 shows that significant positive correlations were found between all Teacher reports of EF and the number of observed behaviours relating to EF deficits, as well as the total number of observed behaviours. The results show that neither Aide nor Parent reports of EF were significantly related to the number of observed EF, or total, behaviours. However, some of these correlations were found to be close to statistical significance.

Significant positive correlations were found between the majority of the Teacher and Aide BRIEF measures and observed behaviours in the attention domain.

3.3. Behaviours and Interventions

3.3.1. Observed behaviours and associated interventions

Figure 3.1 indicates that the total number of observed behaviours over the four cognitive domains was slightly higher when the aide was present ($M = 10.73$, $SD = 5.31$) compared with when there was no aide ($M = 8.73$, $SD = 3.62$). This difference was not statistically significant, $t(5) = 0.80$, $p = 0.46$, two-tailed. Teachers provided less interventions for observed behaviours when an aide was present ($M = 0.52$, $SD = 0.86$), compared with when no aide was present ($M = 2.22$, $SD = 3.17$). This difference was only approaching statistical significance $t(5) = -1.16$, $p = 0.15$, one-tailed.

Figure 3.1 also demonstrates that students received an average of six extra targeted interventions when an aide was present in the classroom ($M = 8.09$, $SD = 6.61$), compared with when no aide was present ($M = 2.22$, $SD = 3.17$). A paired-sample analysis of means demonstrated that difference was only approaching statistical significance, $t(5) = -1.64$, $p = 0.08$, one-tailed. Based on the number of observed behaviours and interventions, students received an intervention in response to 75% of their observed behaviours when an aide was present, compared to 25% when no aide was present.

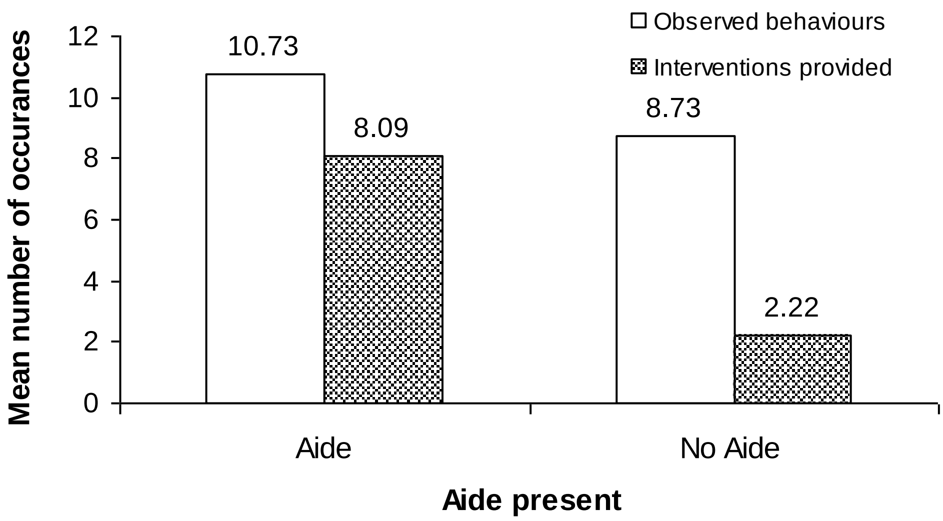

Figure 3.1: Mean number of occurrences of observed behaviours and interventions provided across all four cognitive domains (*n*=6).

Table 3.8 shows the results of paired samples *t*-tests used to compare the number of interventions provided for observed behaviours in each cognitive domain when the aide was present or not. The results show that when the aide was present, significantly more targeted interventions were provided for observed behaviours in the SOP and attention domains, compared with when the aide was not present.

Table 3.8: Paired samples *t*-test and Wilcoxon signed ranks test results for difference between the number of targeted interventions provided (one-tailed) (*n*=6).

	No Aide Present	Aide Present		
Domain	*M (SD)*	*M (SD)*	*t* (*p*)	*T* (*p*)
Memory	.96 (1.79)	1.79 (2.30)	-.57 (.30)	-
SOP	0 (0)	.55 (.60)	-	-1.63 (.05)
Attention	0 (0)	1.98 (2.35)	-	-1.60 (.05)
EF	1.26 (1.70)	3.79 (2.37)	-1.88 (.06)	-

Notes: SOP: Speed of Information Processing; EF: Executive Functioning.

Observational data was collected on the number of compensatory and remediation teaching strategies provided to all eight students over the two observational periods. There was a statistical significant difference between the total number of remediation strategies provided (M = 1.50, SD = 2.51) when compared to the total number of compensatory strategies provided (M = 7.88, SD = 4.19), $t(7)$= 3.66, p = 0.01, two-tailed. The mean number of compensatory and remediation teaching strategies provided to each student by the teacher and aide is presented in **Error! Reference source not found.**.

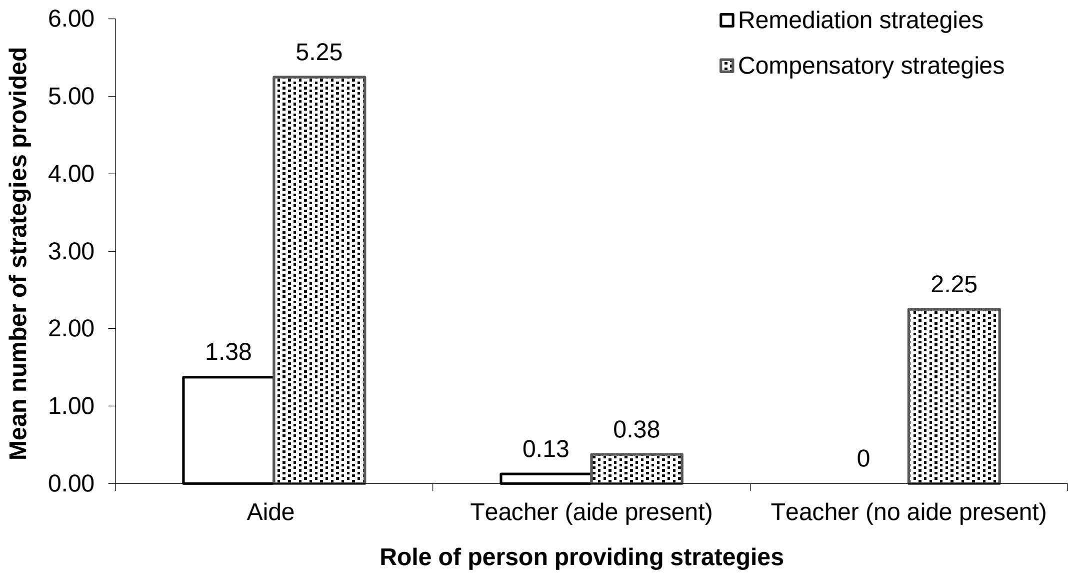

Figure 3.2: Mean numbers of teaching strategies provided by the teacher and aide (*n*=8).

3.3.2. Impact of aide presence on the continuation of observed behaviours

There was a significant difference in the number of behaviours which were observed to continue for more than one five-minute segment of the observation period when an aide was present (M = 2.87, SD = 1.28), compared with when the aide was not present (M = 5.20, SD = 2.57), $t(5)$= -2.39, p =.03, one-tailed. Figure 3.3 illustrates the total number of observed behaviours, and the number of behaviours which continued for more than one five-minute segment of the observation period.

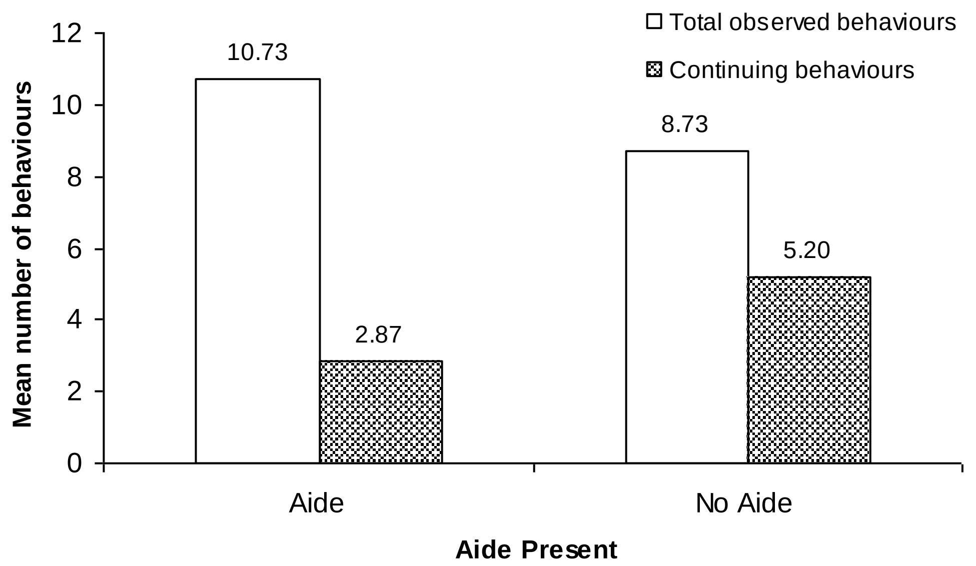

Figure 3.3: Mean number of observed behaviours which initially occurred and mean number of behaviours which continued for more than one five-minute segment of the observation period when an aide was present and not (*n*=6).

Based on the above figure it can be seen that when the aide was present in the classroom, an average of 73% of the initial behaviours had ceased by the end of the five-minute observation segment in which they had begun. When the aide was not present, this average dropped to around 40%.

3.4. Knowledge and Support of Teaching Staff

3.4.1. Knowledge of Teaching Staff

Figure 3.4 shows that 71% of aides rated themselves as having at least an adequate level of knowledge about students with an ABI. Of the 29% of aides who rated themselves as having less than adequate knowledge, one rated themselves as having no knowledge at all. In comparison, 33% of teachers rated themselves as having an adequate level of knowledge. The majority of teachers (67%) rated themselves having a less than adequate level of knowledge about students with an ABI. There was no significant difference between teachers (M = 3.00, SD = 1.10) and aides (M = 3.86, SD = 1.86) ratings of knowledge on paediatric ABI, $t(11)= .99$, $p = .35$ (two tailed).

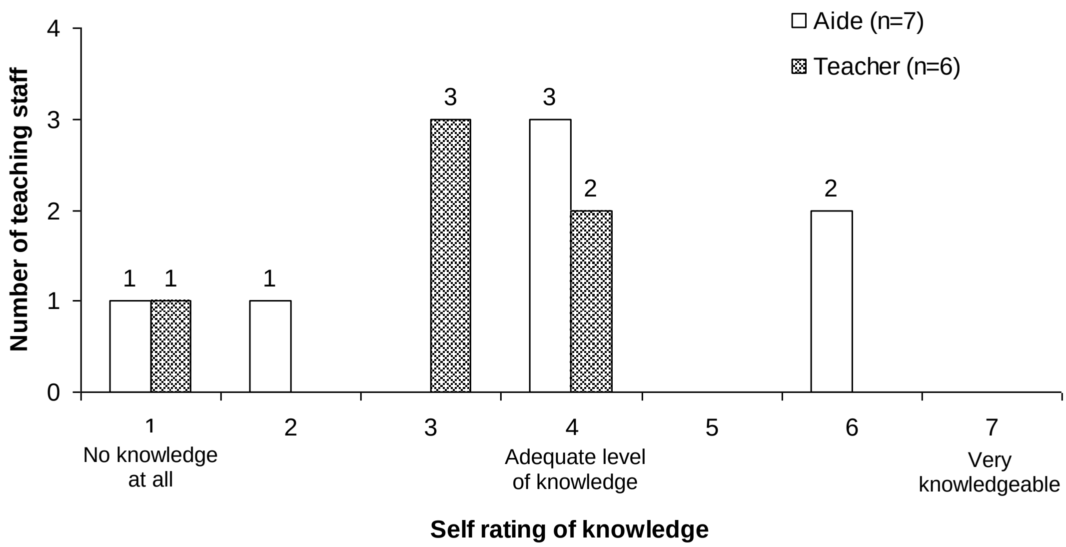

Figure 3.4: Count of teacher and aide self ratings of level of knowledge around students with an ABI.

In addition to this quantitative data, qualitative data on knowledge was also collected from teachers and aides. From analysis of the qualitative data collected from teaching staff, a lack of formal education and training of staff was identified as impacting on their levels of knowledge. As one aide stated: *"I was going in blind when I began working with him."* This sentiment was echoed by other aides, many of whom noted that prior to working with the student with an ABI they were only provided with limited information on brain injury. Both teachers and aides noted that much of their knowledge on working with students with an ABI had been acquired through working with the student:

"(My level of knowledge is) through what I pick up when working with him, and through information gained through reading on internet." – Aide

"We are learning as we go." – Teacher

Despite some aides and teachers having worked with the student for numerous years, there was no significant correlation between the amount of time worked with the student and self-ratings levels of knowledge for either aides (r=.09, n=7, p=.85, two tailed), or teachers (r=.21, n=6, p=.70, two tailed).

Another theme noted from discussions with parents and aides was of the inconsistent performance and needs of the students. As one teacher noted:

"[The student's] abilities fluctuate from day to day, making it hard to get a grasp of her abilities".

Similarly, an aide noted:

"Every day is different. What I learnt today doesn't apply tomorrow. It [the student's performance] depends on his medication, his weekends etc."

For teaching staff, the inconsistent performance of these students appeared to highlight their limited repertoire of knowledge and teaching strategies.

Qualitative data also provided information on where aides and teachers acquired their knowledge. The majority of knowledge appears to have been obtained through informal avenues, such as parents passing on information they had received from the hospital, internet searches, or through learning from the student's therapy team. Only one aide and one teacher (from separate schools) indicated that they had been formally provided with information on working with students with an ABI. The aide reported a specific information and training session on the student. The teacher stated they had been provided with information from a specialist ABI education consultant.

One parent noted that a limitation in aides attending professional development sessions was the lack of funding for the aide to attend these sessions.

3.4.2. Support for Teaching Staff

Figure 3.5 displays teachers and aides' perceptions on the level of support they received to work with the students with an ABI. The majority of aides (85%) rated the level of support received being at least adequate. One aide (14%) rated the level of support received as being less than adequate. All teachers rated their level of support received to work with the student with an ABI as being more than adequate. Using an independent samples *t*-test, there was a significant difference found between teachers' perceived levels of support (M = 6.33, SD = .82) and aides' perceived levels of support (M = 4.43, SD = 1.13), $t(11) = 3.42$, p = .01, two-tailed.

There was a statistically significant correlation between aides' perceived levels of support and their self-reported levels of knowledge (r =.82, n=7, p=.02, two-tailed). The correlation between teachers perceived levels of support and their self-reported levels of knowledge was not found to be statistically significant (r = -.22, n=6, p = .67, two-tailed).

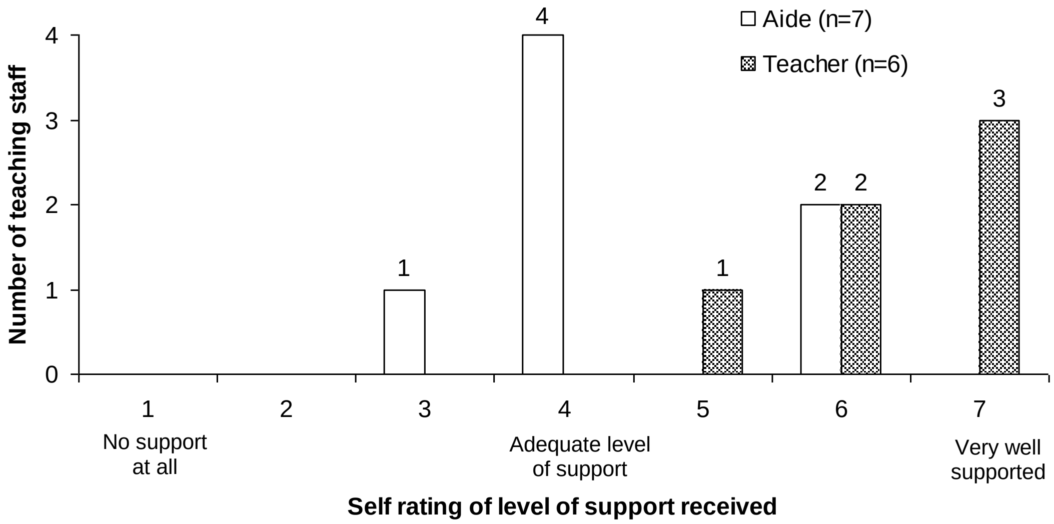

Figure 3.5: Count of teacher and aide self ratings of support received to work with the student with an ABI.

Qualitative responses from teaching staff revealed that aides and teachers saw themselves as having different sources of supports. Four of the seven aides interviewed noted their supports were from sources external to the school. These external supports included a student's mother, a student's therapy team (which comprised of an occupational therapist and physiotherapist), neuropsychologists, and specialist ABI education consultants. Difficulty in contacting these external supports as required was noted by the aides. Four of the six teachers interviewed noted their supports were internal to the school, with three teachers listing the aide as their main source of support. As one teacher noted: *"[The aide] is my only support, but she is very good".* Four aides and two teachers also noted that the Special Education Coordinator at their school was a source of support for them. Analysis of the qualitative data revealed that teaching staff rated their levels of supports more highly if the supports provided were perceived as accessible.

Independent samples *t*-test revealed no significant difference between teachers (M = 2.17, SD = 1.60) and aides (M = 3.71, SD = 2.87) when asked to rate their need for extra supports to work with the student with an ABI, $t(11) = 1.17$, $p = .27$ (two-tailed). This score was based on a Likert scale, with a score of one indicating no extra supports were required at all, and a seven indicating that extra supports would be very beneficial. Figure 3.6 illustrates the average ratings of the current supports received by teachers and aides, along with the ratings of their need for extra supports.

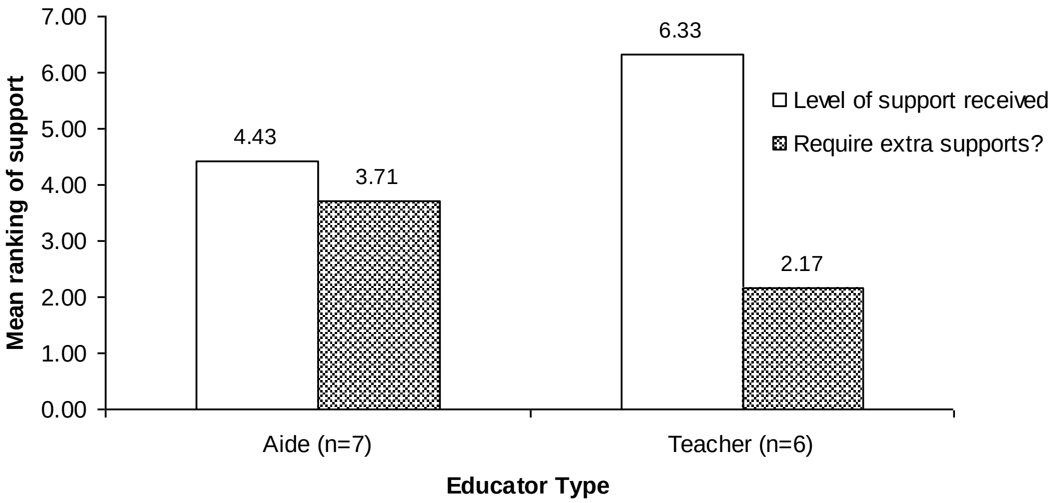

Figure 3.6: Mean ratings of teachers and aide's in regards to the current level of support provided to them, and if they require extra supports.

While the average ratings for aide on the need for extra supports was 3.71, a large split within the responses in this group was noted; fifty-seven percent of aides rated their need for further support to be low (rating of three of below), with the remaining 43% indicating that extra supports would be very beneficial (rating of six or above). Of the aides who indicated that extra supports would be beneficial they stated that they would like information on specific classroom strategies for students with an ABI, training, emotional support, and supports which were accessible (especially for crisis situations).

3.5. The Impact of Aide Programs

3.5.1. Quantitative data on the impact of the aide program

Figure 3.7 shows that 86% of parents rated the aide program as more than adequately meeting the needs of the student. The remaining 14% rated the aide program as not meeting the needs of the students at all. Of the teachers and aides, 100% rated the aide program as at least adequately meeting each students' needs. A one-way ANOVA showed that there was no statistically significant difference between these three groups when rating how well the aide program met the students' needs, F (3, 17)= 1.14, p = .34.

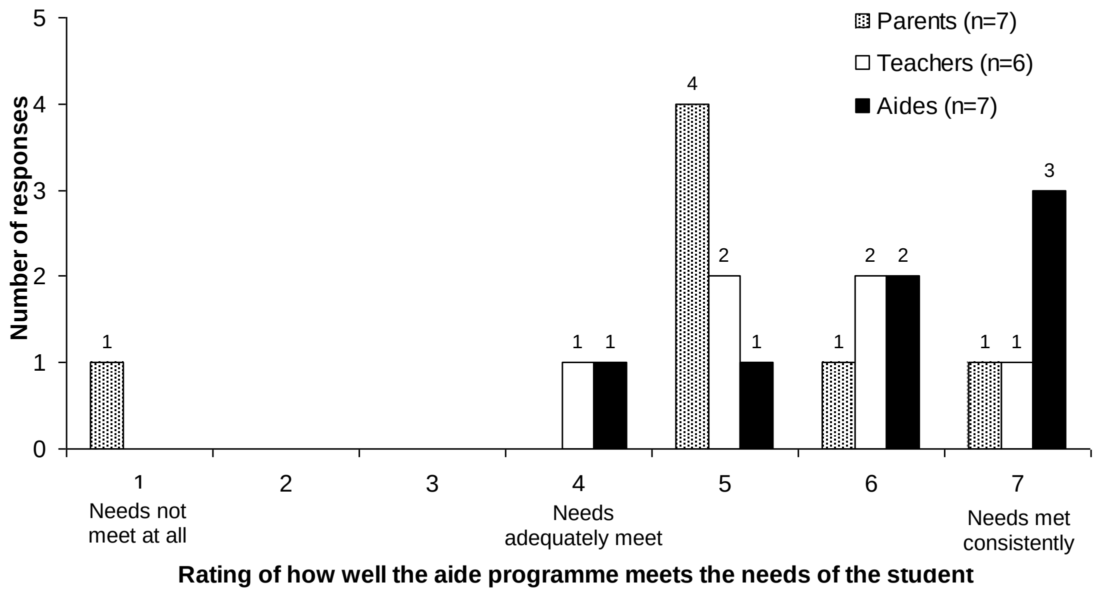

Figure 3.7: Parent, teacher, and aide ratings of how well they think the aide program is meeting the needs of the student.

3.5.2. Impact of knowledge and support on student outcomes

Table 3.9 displays the results of correlations between ratings of how well the students' needs were met (as rated by parents, teachers, and aides) with aides' and teachers' self-rated levels of knowledge and support. The results reveal no significant correlations. The correlation between the teacher ratings of support provided and parent ratings of how well student needs were met approached significance. While there were also two other correlations with the parent rating of how well students' needs were met which approached significance (with aide rating of knowledge and support), both of these correlations were negative and not in the expected direction.

Table 3.9: Correlation matrix between ratings of how well the aide program meets students' needs and ratings of teacher and aide levels of knowledge and support (two-tailed) (*n*=6, unless otherwise indicated).

	Aide rating of knowledge	Aide rating of support provided	Teacher rating of knowledge	Teacher rating of support provided
	r (p)	*r (p)*	*r (p)*	*r (p)*
Parent ratings of how well students' needs met	-.76 (.08)	-.76 (.08)	-.36 (.49)	.76 (.08)
Teacher ratings of how well students' needs met	-.38 (.46)	-.23 (.66)	-.52 (.29)	.00 (1.00)
Aide ratings of how well students' needs met	.54 (.21)^	.51 (.24)^	.31 (.55)	-.07 (.90)

Notes: ^: *n* = 7

3.5.3. Qualitative data from parents on the impact of the aide program

From the qualitative information gathered from parents, the impact of the aide program was seen as positive when students had an increased access to the curriculum. This appeared to occur through the provision of interventions for cognitive deficits to complete academic work. Parents noted that these interventions resulted in increased organisation and productivity of the student, as well as the provision of program modifications.

The impact of the aide program was also seen as positive by parents when improvements were seen in students' classroom behaviours. Examples of improved classroom behaviour included decreased reactivity to others, and less distracting to others in the class. As one parent stated:

"Her behaviour is better when the aide is present because the aide can recognise signs of frustration and either support, redirect, distract, or remove her."

From the parents perspective the helping style of the aide greatly impacted on the outcome of the aide program. One parent noted that the helping style of the aide was likely to impact on how the student was perceived by their peers:

"Aides can have a negative impact in regards to the student's peers if they help the student overtly."

Similarly, another parent commented that: *"An aide who is embarrassing doesn't work."*

From their comments, parents described that a positive helping style included having a good relationship with the student, an awareness of the student's social needs, knowing how to set limits with the student, being able to provide modifications and assistance as required, and also allowing the student some independence.

Two parents also saw the provision of the aide program as having a negative impact for students. For these two parents, the impact of the aide program was seen as negative when it led to the student feeling frustrated or embarrassed in the classroom. As one parent explained:

"The difference [in what happens when the aide is present] is that aide makes the student frustrated in the classroom."

Thus, for parents assessing the impact of the aide program they tended to focus on the outcomes of the student's behaviours, as well as the student's feelings towards the aide.

3.5.4. Qualitative data from students on the impact of the aide program

Six of the seven students interviewed identified that the aide program had a positive impact at least some of the time. For these students, the impact of the aide program was seen as positive when: they were provided with assistance to monitor their behaviours in the classroom, they were provided with better access to the curriculum, and the aide had a positive helping style.

The assistance to monitor their behaviours, as noted by the students, included being redirected by the aide when required, being less distracted in the classroom, and being less distracting to their peers in the classroom. For example, John, a student, noted:

"She [the aide] makes sure I keep on track and that no one distracts me. Mondays are distractible days."

The increased access to the curriculum as noted by the students when the aide was present included: being provided with modified work, and being provided with an increase in the level of support to complete their work. One student, William, noted that he was only provided with school work when his aide was present, and that: "*When the aide isn't there I draw and colour in".*

Another participant, Betty, stated:

"If the aide is not there and I have hard work, the teacher is not as good at helping because the aide has been there longer and sometimes the teacher is helping other kids."

John noted that the provision of the aide program ensures he is provided with all the required information: *"If I run out of time aide writes info from board and gives it to me later."* This theme of increased access to the curriculum highlights a positive outcome for these students which may not be achieved without the provision of an aide program in the classroom.

Lastly, students also saw the impact of the aide program as positive when they perceived the aide to have a positive helping style. A positive helping style included the aide nicely asking the student to complete activities (rather than 'nagging' the students), and the aide providing the student with assistance to complete work instead of providing the answers. Through the use of a positive helping style, students obtained a sense of independence within the classroom.

Three of the seven students interviewed also identified negative impacts of the aide program. The students identified that they felt annoyed, embarrassed, or frustrated at times as a result of the aide program. These negative impacts where most often identified when the students were made to stand out from their peers rather than fit-in, and also when they felt their aide lacked specialist knowledge of the curriculum.

For students, a poor fit with their peers was most often highlighted when they felt embarrassed or annoyed at the way in which the aide provided support. While students conceded the need for the aide program, the way in which support was provided to them would sometimes result in a negative impact. As Paul, a student in secondary school stated:

"[Annoyed]: Even if I don't need help the aide will ask if I need help. Then when I say I don't need help she will still hang around and ask me what I'm up to… I don't hate or love her [the aide] because she is useful, but embarrassing."

Another secondary school student, Jane, also focused on how the aide program made her feel in the classroom:

"I feel frustrated because she [the aide] ... begins explaining the next question when I'm still on the previous question…she butts in… she sits next to me [instead of waiting for me to ask for help]."

For these students, the frustration and embarrassment they felt around how the aide provided support to them, often meant they tried to actively avoid the aide in the classroom, and/or would be less accepting of support provided by the aide.

The students were also more likely to state negative outcomes of frustration and annoyance at the aide program when they saw the aide as lacking the specialist knowledge required to be able to provide effective assistance. As Paul stated:

"It would be good if the aide was expert in every subject so she can help me more. For example, the aide won't know an answer to an information technology question."

Given that is only those students in secondary school (aged 12 and above) who identified negatives themes around receiving assistance from an aide, these students were then asked to describe their ideal aide. The responses from these students on what constitutes an ideal aide can be categorised into three main themes: one who has a positive helping style, one who helps them fit-in with their peers, and, one who has adequate knowledge of their cognitive deficits and of the curriculum. Appendix 8 provides the response narratives of these four students describing their perfect aide.

CHAPTER FOUR: DISCUSSION

It has been well established that the cognitive sequelae following paediatric ABI are likely to impact on both the academic outcomes and classroom performance of students with an ABI. As a result, numerous educational interventions for these students have been put forward in the literature. Despite the plethora of educational interventions provided, there is a lack of evaluation studies focusing on the outcomes of these interventions. In particular, there has been no research that has specifically investigated the impact of aide programs for students with an ABI.

The current study attempted to address this gap in the research literature by investigating the impact of aide programs on the classroom performance of students with an ABI. Both qualitative and quantitative data were obtained to thoroughly explore factors which are likely to lead to positive outcomes when aide programs are used for this student population.

The following discussion addresses the results of the current study with specific reference to previous research and the hypotheses of this study. The initial section of the discussion will focus on the observed relationship between cognitive functioning and the number of observed negative behaviours in the classroom. The second section will discuss the impact that aide programs were found to have on the classroom behaviour of students with an ABI. Thirdly, factors which are thought to lead to positive outcomes of aide programs will be discussed. Lastly, a model for the positive provision of aide programs will be presented.

The main aims of this exploratory study were to investigate the impact of aide programs on the classroom behaviours of students with an ABI and to examine what factors may lead to positive outcomes.

4.1. Cognitive Performance and Classroom Behaviours

The first hypothesis of the current study (that poorer performance on neuropsychological assessment would be negatively correlated with a higher number of observed negative behaviours in the classroom setting) was supported for three out of the four cognitive domains examined. Specifically, poorer performance on formal assessment measures of memory, attention, and executive function (EF) were shown to be significantly associated with higher counts of observed negative behaviours. The correlation between performance on formal measures of speed of processing (SOP) and the total count of observed negative behaviours was not found to be significant.

Given the distinct lack of research that has compared the results of formal neuropsychological assessments with direct observations of classroom behaviours of students with an ABI, comparison of results to previous research will be limited in the following section.

4.1.1. Attention

Based on the limited research into this area, the ecological validity of formal measures of attention are often described as poor (Hawley, 2005; Silver, 2000; Stavinoha, 2005). Consistent with this, three of the five formal measures of attention used in the current study (Selective Attention, Sustained Attention, and Divided Attention) were not found to be significantly correlated with the count of negative behaviours in the classroom, with only one of these correlations in the expected direction. These findings are consistent with the conclusions of Silver (2000) and Stavinoha (2005) who, after conducting a review of the literature, noted that formal measures of attention were unlikely to accurately predict the everyday functioning of children in the classroom. Similarly, Hawley (2005), who conducted a case study of a student with an ABI, found that formal measures of attention, using the Children's Memory Scale Attention/Concentration index score, did not accurately match teacher reports of attentional performance in the classroom setting.

In contrast with this previous literature, two formal measures of attention were found to have a significant correlation with classroom behaviours. Specifically, Short Term Auditory Attention (STAA) and Switching Attention were found to be negatively correlated with the count of negative behaviours thought to be from deficits in attention. They were also the only two measures of attention which were found to be significantly correlated the total count of negative behaviours observed across all four of the cognitive domains. While this finding contradicts those of Hawley (2005), Hawley's conclusion was based on a single case study and thus it is likely that the findings from the current study are more robust. The results of the current study begin to provide evidence in support of the ecological validity of these measures. Further research with greater numbers of participants would also be worthwhile to confirm the findings of the current study.

The reason why only STAA and Switching Attention demonstrated significant correlations with total negative behaviours remains unknown. It may be that these two measures have a higher ecological validity than other measures used. Alternatively, it may indicate that the behaviours in the observation chart used in the current study were more reflective of deficits in these two areas of attention. Without further investigation this would be difficult to confirm, as the authors who provided examples of how attention deficits may manifest in the classroom (i.e., Blosser & DePompei, 2003; Cohen 1991; DePompei, 2005; Dickman et al., 2001; Keyser-Marcus et al., 2002) did not delineate between the various aspects of attention.

The lack of significant correlations between the remaining three formal measures of attention with negative behaviours due to attention may also be explained by the strong relationship known to exist between attention and memory functioning (Cowan, 1995). Indeed, a very strong and significant negative correlation was noted in the current results between Sustained Attention and behavioural manifestations of memory deficits. Given the well known dependency on attentional processes for adequate memory performance (Cowan, 1995), it should possibly have been expected that behaviours thought to be manifestations of memory deficits would be correlated instead with attention deficits.

Thus, given that deficits in attention may manifest as negative behaviours due to memory this creates limitations in accurately delineating the underlying cause of behaviours. This is consistent with Bennett et al. (2003) who noted that the performance of each cognitive domain does not occur in isolation, and that strong relationships or interactions exist between cognitive domains. Indeed, a consistent pattern of interactions between cognitive domains was noted throughout the current study. These interactions between domains are likely to hinder attempts to examine the ecological validity of formal assessment measures. Given this, future studies seeking to further explore the ecological validity of formal measures of attention should also consider examination of correlations with behaviours thought to be due from deficits in memory.

4.1.2. Memory

Given that a large percentage of school based learning is through verbal communication, deficits in memory are thought to have particular negative implications for students with an ABI (V. Anderson et al., 1999; Catroppa & Anderson, 2002). Given this, the results of the current study were surprising in that none of the five formal measures of memory were found to have significant correlations with the counts of observed negative behaviours thought to be due from memory deficits. Despite this lack of significant correlation, the correlations were all in the negative direction. This lack of correlation in the current study may be more reflective of the small sample size, rather than a lack of ecological validity. The ecological validity of these assessment measures are unknown in the paediatric population (Silver, 2000), and thus replication of this study with a larger sample is required.

Encouragingly, when calculations were conducted using the total count of all observed negative behaviours (i.e., not just those thought to be due to memory deficits), very strong significant negative correlations were found with both New Learning and Delayed Recall. However, the remaining three measures of memory (Immediate Recall, Learning Interference, and Recognition Memory) were not significantly correlated to the total number of behaviours, but the correlations were approaching significance. These findings suggest that as performance on formal measures of memory declined, the total number of overall negative behaviours increased. These results support the earlier findings of Kinsella et al., (1995) who noted that poor performance on measures of new learning were likely to interfere with classroom performance. Numerous other authors have also suggested that memory deficits following a paediatric ABI are likely to manifest as negative behaviours in the classroom (e.g., Blosser & DePompei, 2003; Dickman et al., 2001; Keyser-Marcus et al., 2002).

The difficulty in isolating underlying causes of negative behaviours may again explain why formal measures of memory were significantly correlated with the total count of all behaviours, and not with behaviours specifically from memory deficits. For example, in the current study when a student displayed difficulty recalling information learnt in a previous lesson this was counted as a behavioural manifestation of a memory deficit. However, it could also be attributed to negative behaviour due from attention (i.e., the student may not have been paying attention to the class when the information was delivered), speed of information processing (the student may have had difficulties with keeping up with the pace of learning which impacted on their memory of this information), or executive functioning (the students may have had difficulties in organising the information to assist with encoding). Indeed, students with an ABI probably have deficits in each of these cognitive areas.

Consistent with this difficulty in correctly attributing behaviours to one specific cognitive domain, one formal measure of memory (Immediate Recall) was found to have a strong significant negative correlation with the number of observed behaviours due to executive function (EF) deficits. Based on the results of the current study the nature of the relationship between these two variables remains unknown. Interestingly, previous research by Arroyos-Jurado et al. (2006) and Wright and Limond (2004) found that poor EF skills will negatively impact on memory performance. Thus, further research into this correlation, with a larger number of participants, would be useful in clarifying the nature of this relationship. Given the difficulty in specifically identifying the underlying cause of observed negative behaviours it may be of more use that future studies examining the ecological validity of assessment measures consider correlations with all observed behaviours, rather than limiting correlations to behaviours presumed to be from one specific cognitive domain.

4.1.3. Speed of Information Processing

Similar to the memory domain, there were no significant correlations found between formal measures of speed of information processing (SOP) and the count of behaviours specifically thought to be due to deficits in SOP. Aside from the likely impact of the small sample size used in this study, there may be other influential factors that resulted in this lack of significant correlations. The first explanation is that despite the majority of participants having performed below average on at least one of the two formal SOP tasks, only a very small number of negative behaviours due to SOP deficits were noted during the observational sessions. The low count of negative behaviours from SOP deficits may reflect the limited examples of SOP deficits provided in the observation reference table (only three, compared to the five or more in the other domains). It may also be that the behavioural manifestations of SOP deficits are difficult to observe, or perhaps deficits in SOP do not result in negative behaviours in the classroom. Indeed, the literature focuses on SOP as being likely to impact on the learning and retention of new information (Mulhern & Butler, 2004; Wright & Limond, 2004), rather than providing numerous examples of possible behavioural manifestations of SOP deficits.

While this lack of observed negative behaviours would certainly impact on any calculation of correlation, it does not account for the lack of significant correlations between formal measures of SOP and the total count of all observed negative behaviours. However, for the correlations with the total count of all negative behaviours, these correlations were at least in the expected direction. This perhaps suggests that with a higher number of participants significant correlations would be observed.

Another reason for the lack of significant correlations in the current study is that, once again, strong interactions were observed between cognitive domains. In the current study interaction between SOP and memory was reflected in the results, with a significant negative correlation found between formal measures of SOP and behaviours due to memory deficits. These results indicate that negative behaviours due to deficits in SOP may have manifested as negative behaviours due to memory. This finding is consistent with Mandalis et al. (2007) who noted that a reduction in SOP may subsequently impact on an individual's memory capacity. Given this difficulty in isolating SOP and memory performance, providing support for the ecological validity of SOP assessment measures will continue to prove difficult. As SOP has been found to interact with other domains, future research with larger numbers would be useful in examining if SOP deficits did have a predictive ability for the total count of negative behaviours observed in the classroom setting.

4.1.4. Executive Functions

Assessments of executive functions (EF) using formal neuropsychological measures in structured assessment setting are often described as having poor ecological validity for children with an ABI (Gioia & Isquith, 2004; Silver, 2000). Consistent with this previous research, no formal neuropsychological measures of EF in the current study were found to be significantly correlated with the count of negative behaviours thought to be due from EF deficits. However, the correlation with Planning and Organisation was in the expected negative direction and close to significance. The correlations with other the remaining three formal measures of EF used (Idea Generation, Working Memory, and Size Relative Difficulty) were also all in the expected negative direction, with a trend towards significance noted. Research with a larger number of participants would be useful to explore these correlations further.

Consistent with the results in the other cognitive domains, measures of EF demonstrated better correlations when they were compared with the total count of observed negative behaviours. Planning and Organisation demonstrated a significant negative correlation with the total count of observed negative behaviours, and the correlations between the other three formal measures of EF were all close to significance. The very strong correlation noted between Planning and Organisation with the total count of observed negative behaviours may indicate that this measure has a higher predictive capacity for negative behaviours in the classroom compared with the other measures of EF. Another possible explanation may be that the examples of EF behaviours provided in the observational reference table could be attributed to specific difficulties in planning and organisation, with fewer examples of manifestations of working memory and idea generation deficits provided.

Gioia and Isquith (2004) also noted that neuropsychological tests are likely to lack ecological validity when they only measure one component of EF at a time, as in reality these functions are called upon concurrently. Thus, it may also be that the Planning and Organisation measure examined more than the one aspect of EF. Future research utilising a factor analysis could be useful to determine if this measure is a pure measure of planning and organisation or if there are other EF components used when completing this task. Further research with larger numbers of participants would also be useful in further examining the ecological validity of the other EF assessment measures used in the current study.

In addition to the formal neuropsychological measures of EF obtained within a structured assessment setting, self-administered questionnaires on EF were completed by teachers, aides, and parents. Unlike the formal neuropsychological assessment measures of EF used in this study, this questionnaire (the Behaviour Rating Inventory of Executive Function, BRIEF) was developed to be ecological valid (Gioia and Isquith, 2004). The significant correlations found between each of the teachers' index scores on the BRIEF and observed negative behaviours thought to be due from EF deficits. This supports the finding of Vriezen and Pigott (2002) that the BRIEF is an ecologically valid measure of executive dysfunction. In contrast with the findings of Vriezen and Pigott (2002), only one of the three aide-reported index scores of EF difficulties was close to significance. In addition, none of the parent-reported index scores were found to have a significant correlation with the observed behavioural manifestations of EF deficits.

The findings of inconsistent correlations between the BRIEF teacher and aide index scores and the count of observed negative behaviours are puzzling. It could be argued that aides may be a better judge of student's EF abilities than teachers as they work more closely with the student. Alternatively, it could be proposed that teachers are more accurate in the reporting of EF abilities as they have more opportunity to observe how students perform independent of assistance. As no research into the inter-rater reliability between teachers and aides has been conducted on the BRIEF this would be an interesting area for future research.

The non-significant correlations between parent-reported indices on the BRIEF and observed negative behaviours is consistent with Gioia and Isquith (2004) who found that the BRIEF parent form had lower internal consistency and test-retest reliability than the teacher form. In the current study this lack of a significant correlation may reflect the different questions used in the parent questionnaire, which focused less on school-based behaviours than the teacher questionnaire. Despite this lack of significant correlation the trend of the parent-reported indices was towards significance with both the observed EF behaviours and the total observed behaviours. This suggests that further investigation employing a study design with higher power is warranted.

Similar to the other areas of cognition discussed previously a number of correlations were observed between formal measures of EF and manifestations of behaviour from other cognitive domains. This finding is consistent with reports from Ylvisaker and Feeney (1998) who stated that impairments in EF will often impact on other cognitive areas. In particular, relationships were observed between formal measures of EF and behaviours thought to be due from memory and attention deficits. These relationships across domains again highlighted the difficulty in isolating one underlying cognitive domain as the cause of a negative behaviour.

4.1.5. Implications for future research

Overall, when the total count of observed behaviours was used, strong associations with performance on formal neuropsychological assessment measures were found. The only cognitive domain in which no significant correlations were found with the total count of observed behaviours was for the SOP domain. Therefore, the initial hypothesis that poorer performance on neuropsychological measures would be correlated with a greater number of observed behaviours in the classroom was mostly supported.

The strongest four correlations between formal assessment measures and the total count of all behaviours were found with the measures of Switching Attention, Delay Recall (memory), New Learning (memory), and Planning and Organisation (EF). Given the small sample size of the current study and the strength of these correlations this suggests that the above neuropsychological tests have strong ecological validity for predicting negative behaviour in the classroom setting for students with an ABI. Overall, the results from this first section have provided formal support to the literature which proposed that cognitive deficits would negatively impact on the classroom behaviours of students with an ABI (e.g., Blosser & DePompei, 2003; Cohen, 1991; DePompei, 2005; Dickman et al., 2001; Keyser-Marcus et al., 2002).

Despite these positive findings only eight out of the 25 formal assessment scores used had a significant correlation with the total number of observed negative behaviours. While all of the remaining 17 assessment scores were correlated with the total count of observed negative behaviours in the expected direction, the lack of statistically significant correlations highlights the limited ecological validity of these measures for students with an ABI. These results are consistent with Perrott et al. (1991) and Ylvisaker et al. (2001) who stated that the classroom performance of students with an ABI cannot be predicted by formal tests alone.

One of the most probable reasons for the lack of correlations found in the current study was the small sample size and the consequent lack of statistical power. The need for a larger sample is highlighted through the presence of numerous variables known to impact on cognitive performance following an ABI (such as differences in injury severity, medical treatment regime, and age at injury). This suggests that with a study with adequate power, stronger relationships between performance on cognitive assessment tasks and negative behaviours in the classroom may be revealed. Overall, this research has begun to provide evidence towards the ecological validity of formal measures of attention, memory, and EF in predicting classroom performance for students with an ABI, as called for by Silver (2000).

4.2. Impact of Aide Programs on Classroom Performance

The main focus of this exploratory study was to investigate the impact of aide programs on the classroom performance of students with an ABI. In the following section, both qualitative and quantitative findings will be discussed to examine the impact of aide programs on students with an ABI.

4.2.1. Targeted interventions

One of the ways in which aides are proposed to assist students with an ABI is that, unlike teachers, they are able to spend the majority of their attention providing direct interventions to the student with an ABI (Todis et al., 1997). Based on this premise, the second hypothesis of this study was that students would receive a greater number of targeted interventions when an aide was present. As expected, it was found that students received more targeted interventions when an aide was present. This difference approached, but did not reach, statistical significance. When the count of interventions provided was examined by cognitive domains (i.e., the count of interventions provided for deficits in memory, SOP, attention, or EF), there was a statistically significant increase in interventions for SOP and attention deficits when the aide was present. Thus, the second hypothesis was partially supported.

Despite the hypothesis only being partially supported, the results still provided clinically significant information on the impact of aide programs for students with an ABI. For example, the results demonstrated that when an aide was present, students were provided with an average of eight targeted intervention per class. When the aide was not present students only received an average of two targeted interventions per class. The data also clearly demonstrated that following an observable negative behaviour students were twice as likely to receive an intervention from an aide rather than a teacher.

Overall, the results of this study support the notion of Todis et al. (1997) who postulated that aides are better able to provide direct support in the classroom to students with an ABI than teachers. That the focus of aides is generally on the one student could result in aides observing more instances of negative behaviour than the teacher. It may also allow aides to provide the student with prompt support when negative behaviours are observed. The teacher may have their attention spread over 30 other students and as such are less likely to provide prompt support.

In addition to a greater number of interventions being provided, the results also showed that when no aide was present in the classroom students did not receive any targeted interventions for deficits in the areas of SOP or attention. This is a new and novel finding and there is no comparable existing research. It is possible that deficits in these areas may be less conspicuous for teachers compared to deficits in memory or executive function. For example, a student who does not have the correct materials for class may be noticed more readily by the teacher compared to the student who is sitting quietly at their desk daydreaming. It could also be more difficult for a teacher in a busy classroom to provide support for deficits in the areas of attention and SOP, or that teachers are unclear what interventions to provide for deficits in these areas. Future research could focus on examining the reasons behind this finding.

The presence of an aide was also found to result in a reduction of the average number of interventions that teachers provided to students with an ABI. Teachers provided less than one intervention per class on average when an aide was present compared with an average of two when there was no aide. This finding is consistent with the observational study by Rees and Skidmore (2008) who found that some teachers of students with an ABI "carried less responsibility for the pupil with an ABI" (p. 93) when the aide was present. Based on observations of students with disabilities across four schools, Giangreco, Broer, and Edelman (2001) also noted that some teachers would disengage with the student with a disability when the aide was present. Interestingly, Giangreco, Broer, et al. (2001) found that teacher disengagement was associated with poorer integration of the student with a disability in the classroom.

In their article, Giangreco, Broer, et al. (2001) listed possible reasons underlying teacher disengagement when an aide was present. These included teachers not wanting to engage, not knowing if they are supposed to engage, and not knowing how to engage with the student with a disability. Given that the current study found teachers were likely to disengage with students with an ABI when an aide was present, research into the underlying reasons for this is important to ensure that student integration into mainstream classrooms is not hindered by the provision of an aide program. Teachers and aides may require support on how to cooperatively support students with an ABI. Teachers should also be encouraged to engage with students with an ABI when their aide is present.

While this study found an increase in the number of interventions provided to students in the presence of an aide, this difference was not statistically significant. It is likely that this finding was impacted once again by the small sample size in this study. Despite the fact that this finding was not statistically significant, there is evidence of students with an ABI having received a greater number of interventions when an aide was present. The findings also demonstrated a difference in teacher engagement when the aide was present, highlighting an area for future research to ensure positive outcomes are achieved for students with an ABI.

4.2.2. Decrease in negative behaviours

In the current study, one way in which the outcome of aide programs was measured was by tallying the number of negative behaviours which occurred and the number which were discontinued. Consistent with previous reports of negative behaviours occurring in students who have sustained an ABI (D. Anderson et al., 2001; Armstrong et al., 1999; Catroppa et al., 2008; Deidrick & Farmer, 2005; Lahteenmaki et al., 2007; Upton & Eiser, 2006), negative behaviours due to cognitive deficits were noted across all observation sessions in this study. Although the difference was not significant, slightly more negative behaviours occurred in classes in which an aide was present. This is consistent with authors who have found that a higher number of negative behaviours post paediatric ABI has been found to predict higher levels of educational assistance (Ewing-Cobbs, Barnes et al., 2004; Hawley, 2004; Kinsella et al., 1995; Mealings, 2006; Taylor et al., 2002). Of concern, Sohlberg et al. (1998) and Todis et al. (1997) have both noted that in some instances student dependence on aides may increase over time. Given this, further investigation could be done to ensure that the higher number of negative behaviours in classes when the aide was present was not due to other factors such as learned helplessness or other forms of dependency.

The results of the current study clearly demonstrated that when an aide was present significantly higher proportions (32% more) of negative behaviours were discontinued. Thus, the third hypothesis that a higher number of observed negative behaviours would be discontinued when an aide was present was supported. These findings are in line with expectations based on the recent literature which has demonstrated that the provision of interventions within the classroom setting are likely to decrease negative behaviours in students with an ABI (Dise-Lewis et al., 2009; Feeney & Ylvisaker, 2003, 2006, 2008). Consequently, the impact of aide programs for students with an ABI was found to be positive as the programs resulted in a reduction of the continuation of negative behaviours due to cognitive deficits in the classroom. As behavioural problems in the classroom are often the most difficult for schools to contend with (Ylvisaker et al., 1994), the significance of this positive outcome is highlighted.

While the higher number of interventions provided by the aide was likely to have contributed to the decrease in behaviours for these students, it was unlikely to be the sole factor. Thus, we will discuss the types of interventions provided by aides and teachers.

4.2.3. Teaching strategies used

Consistent with the literature on educational strategies for students with an ABI, the strategies provided by teachers and aides in the current study were grouped according to two main categories: compensatory strategies and remediation strategies. Strategies were categorised as compensatory when they focused on lessening the cognitive load for students (Mateer & Sohlberg, 2003). Examples of compensatory strategies observed in the current study included class-work being modified, the provision of reminders, and redirection of students back to task. Strategies were categorised as remediation when they appeared to teach the student cognitive skills such as problem solving solutions to questions (McDonald, 1998; Rees, 2006; Sterling, 1994). An example of a remediation strategy observed in the current study included students being prompted to break down the steps to complete a task independently.

A noticeable difference when comparing the type of strategies provided by teachers and aides was observed. Teachers tended to provide students only with compensatory strategies. In contrast, aides provided students with a combination of compensatory and remediation strategies. These findings suggest that without aide support students with an ABI are not likely to be provided with remediation strategies. This finding is extremely important in terms of outcomes for students with an ABI as McDonald (1998) postulated that without the use of remediation strategies students would not be provided with the opportunity to increase their cognitive capacity to undertake tasks more independently with time. As remediation strategies are generally viewed as more time consuming (i.e., to assist a student in working out the solution to a problem, rather than providing them directly with the answer), the pattern for teachers to only provide compensatory strategies may be reflective of their time constraints in the classroom.

Thus, the difference between providing an aide program versus no aide program was not found to be the number of strategies provided to students, but the type of strategies used. Based on the results of the current study it appears likely that the combination of both compensatory and remediation strategies by the aide was more effective at reducing the continuation of negative behaviours when compared to the provision of compensatory strategies alone. This is consistent with previous research which has suggested that the combination of compensatory and remediation strategies is most effective for assisting students with an ABI (McDonald, 1998; Rees & Skidmore, 2008; Sterling, 1994). Future research would be useful to investigate the long-term benefits of using remediation strategies as they are postulated to increase the independence of students with an ABI. As there are very few studies that have examined the outcomes of providing both compensatory and remediation strategies to students with an ABI these findings are useful to extend the evaluative literature in this area.

4.2.4. Perceptions of students and parents

When asked directly, the vast majority (95%) of parents in the current study stated that the aide program more than adequately met the needs of the student. This is consistent with a previous study by Bourke (2008) who found that parents felt the support provided by aides to their children with disabilities had a positive effect. Similarly, the students in the current study also described the provision of an aide program as having a positive impact. This result is again consistent with previous qualitative studies by Bruce et al. (2008) and Mealings (2006). While neither of these studies specifically examined the impact of an aide program on students with an ABI, the students in their studies did make some reference to aides having a positive impact on their school performance when discussing their experience at school.

In the current study parents and students described the aide program as having two main positive outcomes. Firstly, aide programs resulted in a decrease in negative behaviours. Secondly, aide programs increased students' access to the curriculum. Importantly, these qualitative themes are consistent with the quantitative data gathered which demonstrated a decrease in the continuation of negative behaviours and an increase in the number of supports provided to the students when an aide was present.

While the outcome of increased access to the curriculum in the current study is only based on qualitative reports of parents and students, it is a consistent finding with Feeney and Ylvisaker (2003, 2006, 2008). Feeney and Ylvisaker (2003, 2006, 2008) found that when they implemented an educational program focused on reducing negative behaviours this resulted not only in a reduction of negative behaviours, but an increase in the quantity of completed work. Unlike Feeney and Ylvisaker, the current study specifically reported on the impact of aides in these educational programs for students with an ABI. From the Feeney and Ylvisaker studies it is unclear what role, it any, aides had in their intervention. Thus, future research may be useful to delineate the extent that aide programs impact on students' access to the curriculum.

4.2.5. Implications for practice

Overall, there are many converging lines of evidence in the current study that indicate that aide programs for students with an ABI impact on the continuation of negative behaviours and on students access to the curriculum. Based on the data of the current study it is speculated that one of the factors that lead to these positive outcomes of the aide program is the combination of strategies provided by the aide. In particular, the use of remediation strategies which are seen to increase cognitive capacity over time were seen as particularly important.

Aside from the type of teaching strategies used and the number of interventions provided there are likely to be further factors which influenced the outcome of aide programs in the current study. From the qualitative information gathered from parents and students it was apparent that the provision of an aide program did not lead to positive outcomes in all instances. Given this, we thought it was important to examine the factors which lead to positive outcomes so that this information can be used to inform future practice guidelines. As such, additional factors which were found to impact on the outcomes of aide programs will be discussed in the following section.

4.3. Factors Leading to Positive Outcomes

In discussing what factors are required to encourage positive outcomes of any education program for students with an ABI, the majority of quantitative literature has focused on the importance of understanding the individuals' cognitive profile (Mateer & Sohlberg, 2003; Ylvisaker et al., 2005) and the provision of training and support for teachers and aides (Mohr & Bullock, 2005; Vaidya, 2002). Recent evidence from qualitative studies has identified further factors also thought to impact on outcomes for students with an ABI. These factors include aides' level of knowledge of the curriculum and the perceived helping style of the person providing supports (Feeney & Ylvisaker, 2003, 2006, 2008; Mealings, 2006; Sharp et al., 2006). The impact of these factors on the outcomes of aide programs in the current study will now be discussed.

4.3.1. Knowledge

Previous research has shown that that the provision of education on the sequelae of paediatric ABI to parents, teachers and other school staff leads to an increase in self-ratings of knowledge and competence, as well as improved ratings of student outcomes (Dise-Lewis et al., 2009; Vaidya, 2002). Given this observation from previous research, the lack of correlations in the current study between self-ratings of knowledge (by teachers and aides) and how well the aide program met student needs (as rated by teachers, aides, and parents) was surprising. The only correlation that was close to significance was between the aides' ratings of their knowledge and parents' ratings of how well student needs were met. Furthermore, as this correlation was negative it suggested that as the aides ratings of the levels of knowledge increased, parents perceptions on how well student needs were met decreased.

Aside from the small sample size there are four main plausible reasons for this lack of correlation between knowledge and student outcomes. The first reason for a lack of correlation may have been due to inaccurate self-ratings of knowledge. This assumption is in line with the findings of Bennett et al. (2004) who reported that teaching staff commonly held various misconceptions about the sequelae following paediatric ABI. Indeed, from examination of the qualitative data it appeared that those aides and teachers who demonstrated a higher level of insight into the complexity of students with an ABI were more likely to rate their own levels of knowledge as low. Paradoxically, it may be that in completing the self-rating scales of knowledge teachers and aides with an accurate knowledge of paediatric ABI may have been aware of the limitations of their knowledge; while those whose level of knowledge may have been inaccurate may not have been aware of their limitations.

This postulation that a more accurate awareness of the sequelae following paediatric ABI serves to highlight a lack of knowledge is consistent with a study by Mohr and Bullock (2005). Mohr and Bullock (2005) found that it was only teachers who had already received training on ABI who were more likely to express interest in further training. The findings of the current study taken together with those of Mohr and Bullock (2005) suggest that educators are not likely to be aware of limitations in their knowledge until they have gained an initial understanding of the complexities in supporting students with an ABI.

The second possible reason for a lack of correlation may have been due to the term "knowledge" not being clearly defined in the current study. In asking teachers and aides to rate their knowledge about working with students with an ABI, it was implied that the question referred to their level of formally acquired knowledge on the sequelae of paediatric ABI. This definition of knowledge is the most common definition discussed in the paediatric ABI literature. Indeed, it is this type of knowledge which is seen within the literature as being required to ensure positive outcomes for students with an ABI (Vaidya, 2002). Most certainly, it was this type of knowledge referred to by Dise-Lewis et al. (2009) when they found a positive relationship between knowledge and student outcomes. However, based on the responses provided and examination of the qualitative data, it appears that aides and teachers may have inadvertently rated their affective knowledge of the individual student, such as their knowledge of the student's strengths, weaknesses, and personality, etc.

Affective knowledge is generally learnt through on-the-job experience (Bourke, 2008). If, as suspected, aides and teachers had rated their affective knowledge of the individual student (rather than any formally acquired knowledge of paediatric ABI in general), we would expect a higher rating of knowledge from the aides as they generally spend more one to one time with the student than the teacher. In accordance with this, 71% of aides recorded at least an adequate level of knowledge of students with an ABI. By comparison, only 33% of teachers recorded at least an adequate level of knowledge. Thus, it appears that that the correlation between knowledge and how well the students needs were met inadvertently measured aides and teachers affective knowledge.

While the correlation between affective knowledge with student outcomes does not appear to have been discussed in the literature on students with an ABI, it has received attention in the literature on students with congenital disabilities. Within the literature on students with congenital disabilities affective knowledge of the individual student is seen as an important aspect of an aide program. In particular, it is argued that affective knowledge is necessary in the development of positive working relationships with the students (Bourke, 2008; Groom, 2006). Additionally, it is seen that aides and teachers are required to have affective knowledge for the successful inclusion of students with disabilities into mainstream classrooms (Groom, 2006; Takala, 2007). Given this previously established link between affective knowledge and student outcomes the lack of positive correlations between knowledge and ratings of student outcomes in the current study is still puzzling.

A third possible explanation for this lack of correlation may be that teachers and aides exaggerated their levels of knowledge. As the ratings scales were not completed anonymously, aides and teachers may have inflated their levels of knowledge to provide a good impression of themselves and their school. This may be especially true in the case of the aides who perhaps felt they should have a high level of knowledge of the child to whom they were providing one to one support.

Lastly, the ratings of how well student needs were met may also require closer examination and definition. It is possible that parents, teachers, and aides based their ratings on different outcomes (e.g., how happy the student was at school, how well the student was achieving academically, how well the student interacted with their peers, etc.). To circumnavigate these issues in future research it may be useful to utilise more specific questions of both knowledge and how well the students' needs are being meet. A test of knowledge could also be utilised to gain an accurate and objective measure of teachers and aides' knowledge of the sequelae of paediatric ABI, such as that described by Bennett et al., (2004). The use of a pre-and-post test design may also be useful in examining the impact of knowledge on student outcomes.

Thus, in the current study the correlation between teachers and aides' knowledge on students with an ABI and how well the students' needs were met was not found to be statistically significant. However, several limitations in the measurement of knowledge were discussed and make this finding inconclusive. Given that two different types of knowledge were identified in this study (formally acquired knowledge and affective knowledge), further research could investigate the impact of each of these on outcomes for students with an ABI.

Despite the lack of statistical significance between knowledge and outcomes for students with an ABI, the results of this study still revealed important information on how teachers and aide acquire their knowledge on students with an ABI. It appears that although numerous authors have highlighted the importance of providing teaching staff with information and training on the sequelae of paediatric ABI this is still rarely put into practice. In the current study only two out of the 13 teachers and aides interviewed indicated that they had received any specific training and/or consultation around working with students with an ABI. No teacher or aide appeared aware of any of the excellent resources on students with an ABI which are freely available (i.e., those mentioned in Table 1.2). Unfortunately this means that the findings of Mohr and Bullock (2005), who suggested that the large body of freely available resources on students with an ABI were not being effectively disseminated to teaching staff, extends into the present day.

The majority of teachers and aides in the current study stated that they gained their knowledge about working with students with an ABI from more informal sources including parents, the internet, working with the treating team, and through on-the-job learning. These sources of knowledge are consistent with two other recent Australian studies on the experience of aides working with students with congenital disabilities. Both Howard and Ford (2007) and Bourke (2008) noted that the aides in their studies gained knowledge about working with children with disabilities through on-the-job learning, the internet, and through collaborating with other members of the students' team. Howard and Ford (2007) also found, again consistent with the current study, that aides were expected to attend any available professional development sessions in their own time. Thus, the results of this study highlighted that despite the consistent recommendation for the provision of training for teachers and aides working with students with an ABI (Blosser & DePompei, 2003; Glang et al., 2004; Sharp et al., 2006; Stavinoha, 2005; Ylvisaker et al., 2001), this is an area which is still sadly lacking in Australian schools.

4.3.1.1. Knowledge of the curriculum

In addition to types of knowledge discussed above, a third type of knowledge was also noted as being an important factor in student outcomes following the provision of an aide program. This was knowledge of the curriculum. The students in the current study stated that in addition to knowledge of their cognitive strengths and weaknesses, it was important that aides have an adequate knowledge of the curriculum. Based on the qualitative information gathered from students, knowledge of the curriculum was a factor which lead to positive outcomes when present and negative outcomes when absent. Students noted that aides were not able to provide effective assistance to them if they lacked knowledge of the curriculum, leaving students to feel frustrated at the aide program. Interestingly, it was only the students in secondary school (those 12 years of age and older) who noted that aides curricular knowledge, or lack thereof, would impact on the outcomes of the aide program. This is likely to be a reflection of the increased complexity of the curriculum in secondary school.

The relationship between lack of curricular knowledge and poor outcomes is consistent with the results of Howard and Ford (2007) who interviewed 14 aides around their roles in supporting students with special needs. Howard and Ford found that aides perceived their poor knowledge of the curriculum as having a negative impact on students. Similar to the students in the current study, the aides in the study by Howard and Ford (2007) reported feeling frustrated when they had to provide academic support in an area of curriculum which was unfamiliar to them. Unfortunately, Howard and Ford's study was limited to interviews of aides so the perception of students is unknown. While concern around their lack of curricular knowledge was not raised by the aides in the current study this may be indicative of a limitation of the semi-structured interview used.

Interestingly, while knowledge of the curriculum is a factor raised by students with an ABI as influencing the impact of aide programs, it is mainly only the formally acquired knowledge around ABI which is recommended for aides. Knowledge of the curriculum, on the other hand, has not been frequently discussed in the ABI literature. The only known mention of knowledge of the curriculum was by Walker and Wicks (2005) who recommend that for aides to be effective they require teachers to provide them with information in advance, and to be provided with adequate preparation time. Given that the aides' knowledge of the curriculum has now been raised as an influential factor in the outcome of aide programs, it should be considered when creating position descriptions for aides. This is likely to be especially important for those students in secondary school.

4.3.2. Support

In the current study support was defined as the provision of ongoing training and consultation to assist aides and teachers in working with students with an ABI. The provision of ongoing supports is seen as paramount in order to effectively meet the needs of students with an ABI (Blosser & DePompei, 1991, 2003; D'Amato & Rothlisberg, 1996; Glang et al., 2004; Savage & Wolcott, 1988; Sharp et al., 2006; Stavinoha, 2005; Ylvisaker et al., 2001). As such, it was assumed there would be a significant positive correlation between teachers and aides self-reported levels of support received with ratings of how well student needs were met. However, the results were similar to those correlations found with ratings of knowledge with no statistically significant correlations observed.

The one correlation close to statistical significant in the positive direction was between teacher ratings of support received with parent ratings of how well student needs were met. In contrast, the correlation between the aides reported levels of support and parents ratings of how well student needs were met was close to significance in the negative direction. This suggested that as aides rated themselves as having higher levels of support the parent ratings of how well student needs were met declined. While the lack of statistical significance in the results and the correlation in the negative direction were unexpected, there is a lack of previous research available for comparison that has directly compared levels of support received with the outcomes of students with an ABI.

As research into the relationship between student outcomes and support for teaching staff is important and called for (Giangreco, Edelman et al., 2001), future research could benefit from repeating this correlation with a larger sample. As with the assessment of knowledge, future research may also benefit from pre-and-post intervention design to further examine the impact of support on student outcomes.

Even though the quantitative results around supports did not reveal any conclusive findings the results still provided valuable information on how well teachers and aides felt supported. For instance, a significant difference was noted between the self-rated levels of support received by teachers when compared to aides. While all teachers felt more than adequately supported to work with the student with an ABI the majority of aides felt adequately supported. These results are consistent with qualitative information that demonstrated that despite being at the same school and supporting the same student there was often a disparity between the supports received by teachers and by aides. The qualitative data indicated that teachers perceived their supports to come from people internal to their school, such as the Integration Coordinator or the aide. In contrast, the majority of aides perceived their support to be provided by people external to the school, including the student's parents, therapy teams, and other specialists. Only two of the seven aides interviewed noted the Integration Coordinator as being a source of support for them and none mentioned the teacher as being a source of support.

These qualitative findings are consistent with recent research which examined the experience of aides working with students with congenital disabilities. For example, Howard and Ford (2007) noted that aides will often feel poorly supported from the teacher. Likewise, Giangreco, Broer, et al. (2001) found that aides did not always receive support from Integration Coordinators. While Giangreco, Broer, et al. (2001) suggested that this lack of support was possibly due to the time constraints of the Integration Coordinator, it does not explain why in the current study teachers felt supported by the Integration Coordinator. It is possible that teachers may have felt a lesser need for supports than aides and consequently rated the level of support they received as more than adequate. Given that teachers in the current study were found to disengage with the student when the aide was present this may be particularly true.

Aides were more likely to rate support as poor when it was provided in a one-off manner, or if the person providing the support was difficult to contact. Equally, aides rated support more highly when they felt it was provided to them over the longer-term, by a person whom they felt was approachable and, more importantly, accessible in times of need. As aides in the current study only rated their support as adequate information on what type of support they prefer and rate more highly is important to know when attempting to address this gap.

Both knowledge and support have been put forward as influencing the outcomes of aide programs for students with disabilities (Giangreco et al., 2005). However, the results of the current study indicate that the fourth hypothesis (that teachers and aides who rated their levels of knowledge and support as being high would better meet the needs of these students) was not supported. Given the factors mentioned above, it is likely that the lack of correlation between knowledge, support, and outcome was due more to limitations of the assessment measures utilised, rather than a true lack of correlation. Importantly, the results highlighted that the provision of knowledge and support to aides is an area requiring improvement in Victorian schools.

4.3.3. Helping style

Another factor found to lead to positive outcomes of the aide program was if students perceived aides to have a positive helping style. In the current study, students perceived aides to have a positive helping style when they provided encouragement and assisted the student to complete their work independently rather than completing work for them. These qualities of what students deemed as a positive helping style are strikingly similar to those found by Mealings (2006) in her recent Australian study. Importantly, these qualities also appear to be consistent with remediation strategies which focus on improving students' independence.

In both the current study and the study by Mealings (2006), the main impact of a positive helping style appeared to be that students were more likely to accept assistance when they perceived the person providing assistance to have a positive helping style. While the students in the study by Mealings (2006) described the positive helping style based on qualities of both teachers and aides, the students in the current study only described the helping style of aides. Despite this difference between the two studies, there was a very high level of consistency of what students perceived as helpful and leading to positive outcomes. This consistency provides support for the generalisation of these results to other students with an ABI.

In addition to a positive helping style three students in the current study also noted that positive outcomes were achieved when the aide did not make them feel embarrassed about receiving supports. The importance of fitting in with peers is consistent with findings from another study on students with an ABI (Sharp et al., 2006). Sharp et al. (2006) found that students valued those supports which allowed them to fit-in with their peers. Likewise, in a study based on observations of students with congenital disabilities Giangreco, Broer, et al. (2001) found that students were not willing to accept one to one supports where it made them stand out from their peers. Interestingly, the three students in the current study who were concerned about fitting-in had varying views on how they wanted the aide to provide support to them in the classroom to ensure this fit with their peers. This individuality highlights the need for student involvement in the planning and ongoing review of their aide program.

Of interest, the three students in the current study who noted feeling embarrassed and different from their peers at times due to their aide program were all aged 12 years and older. Similarly, the students in the study by Sharp et al., (2006) were aged between 14 years and 17 years. This is consistent with developmental theories that suggest the concept of fitting-in is critical during adolescence as students develop an increased sensitivity to the reactions and opinions of their peers (Lashbrook, 2000). One implication of this finding is that the way in which aide programs are provided to students with an ABI needs to be flexible and adaptive as students' progress through adolescence.

In the current study, only one of the seven students interviewed identified the aide program as having no positive impacts at all. Consistent with the above discussion on the importance of positive helping style, this student perceived the aide as having a poor helping style. This poor helping style was characterised by the student perceiving the aide to have lacked an understanding of how they wanted supports provided to them. Consequently, the student actively avoided support from the aide. While this result of a poor helping style is only based on one student it is consistent with another case study described by Giangreco et al. (2005). In their case study, Giangreco and colleagues (2005) found that a poor helping style of aides resulted in increased negative behaviours in the classroom when the aide was present.

Based on the results of the current study and the study by Giangreco et al. (2005), it appears that a poor helping style is the result of the student's needs not being adequately understood. According to Sharp et al. (2006), a poor fit between supports and students was more likely to occur when there had been inadequate assessment of individual need and planning. This need for individual assessment was also highlighted in the current study, with students and parents noting that positive outcomes of the aide program were more likely to be achieved when aides and teachers had knowledge of the students' individual cognitive profile.

These findings around what the student perceives as a positive helping style has important implications for the provision of support for students with an ABI. In addition to an assessment of their cognitive profile, assessment of social needs also need to be taken into consideration when implementing an aide program. This appears to be of particular importance for those students in secondary school.

4.3.4. Implications for practice

Based on the consistency of the current results when compared with the studies of both Mealings (2006) and Sharp et al. (2006), it appears that the factors of knowledge (of ABI and of the curriculum), support, positive helping style, fit with peers, and individual assessment of need are all important in promoting positive outcomes of aide programs for students with an ABI. While the factors of knowledge of ABI, support for teaching staff, and individual assessment of need are often discussed and recommended for any educational program for students with an ABI the current findings suggest that these may only be the first steps in creating positive outcomes for students. These initial three factors could be considered as the foundation steps which need to be considered in the initial planning process.

Parents and students were also more likely to perceive the aide program as having a positive impact when aides had a sound knowledge of the curriculum, a positive helping style, and did not hinder the student in fitting-in with their peers. The lack or inverse of these factors was found to influence the outcome of aide program negatively, by causing the student to feel embarrassed, frustrated, and annoyed. Based on this information these results extend the foundation steps by adding three further minimum requirements to ensure that students with an ABI are receptive towards receiving supports from an aide within the classroom setting.

Despite the small sample size in this study these findings are consistent with previous Australian research on students with an ABI by Mealings (2006) and Sharp et al. (2006). As both of these previous studies also had small sample sizes (three and eight respectively), the results of the current study provides further validity of their results. This increasing volume of consistent qualitative research findings provides further support for the generalisation of these results to other students with an ABI. Given this, it will be important to consider the factors of assessment of individual need, knowledge and support, knowledge of the curriculum, positive helping style, and students perceived fit to ensure positive outcomes of aide programs for students with an ABI.

4.4. Conclusions and Future Directions

While the main limitation of this study was its small sample size, a great strength was the utilisation of both qualitative and quantitative data collection methods. The qualitative data gathered allowed for both an in-depth analysis of what the outcomes of aide programs were, as well as what factors lead to positive outcomes. Overall we found many converging lines of evidence which provided support for aide programs resulting in positive outcomes for students with an ABI. Based on the results of the current study positive outcomes of an aide program included a reduction in the continuation of negative behaviours and increased access to the curriculum. Furthermore, the results also provided initial research findings into the ecological validity of neuropsychological tests for children with an ABI.

In the review of the literature several key factors were continually raised as being imperative in any educational support program for students with an ABI to ensure positive outcomes. These factors included: ongoing individual assessments of each student's cognitive profile; the provision of education to teaching staff in the impact of ABI; and the provision of support to teaching staff to understand the students' cognitive profile and to program effectively for this. From the results of the current study, and consistent with other recent qualitative research by Mealings (2006) and Sharp et al. (2006), three further important factors need to be considered in any aide program for students with an ABI to ensure positive outcomes. These factors included aides having an adequate knowledge of the curriculum, aides being able to provide support through a positive helping style, and awareness of the students' perceived fit with their peers. The current study also demonstrated that an absence of these factors would lead to negative outcomes of aide programs such as avoidance behaviours towards the aide.

Thus, based on the literature review and results of the current study a model was proposed for the six basic factors which we see as the minimum requirements to achieve positive outcomes of an aide program for students with an ABI. Figure 4.1 demonstrates this model.

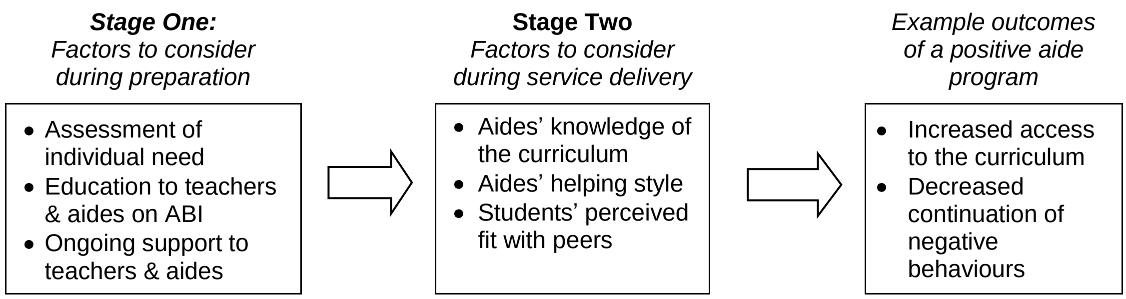

Figure 4.1: A proposed model to provide aide programs with positive outcomes for students with an ABI.

This model combines widely known factors with factors which have only recently been identified through qualitative studies. The first three factors need to be considered during the preparation stage (before aide program implementation), and the next three factors need to be considered during service delivery (i.e., in the classroom). Importantly, the factors to consider during service delivery are based on what students perceive as critical and are required to ensure supports are accepted by the student.

Each of the factors in this model should be taken into consideration to promote positive outcomes of aide programs for students with an ABI. The literature has also demonstrated that the cognitive and social needs of students with an ABI are not static, and are likely to differ with time. As such, both stages of this model should be revisited regularly. This adaptive approach is likely to assist in avoiding negative outcomes.

It would be relevant and interesting for future studies to examine the longitudinal outcomes of aide programs for students with an ABI to provide further insight into what these students are able to achieve when provided with appropriate and positive supports. While future research with a larger number of participants and a control group is likely to be useful in extending on these findings, the findings from this exploratory evaluation provide strong evidence for the continued use of aide programs for students with an ABI. In conclusion, the findings of what factors impact on the outcome of aide programs extend the existing literature. Through the above model we provided guidance around the factors for consideration once the aide is in the classroom setting.

REFERENCES

Agency for Health Care Policy and Research. (1999). *Rehabilitation for traumatic brain injury in children and adolescents: Summary*. Retrieved 1st May 2009, from http://www.ahrq.gov/clinic/epcsums/tbisum2.htm

Anderson, D., Rennie, K., Ziegler, R., Neglia, J., Robison, L., & Gurney, J. (2001). Medical and neurocognitive late effects among survivors of childhood central nervous system tumors. *Cancer, 92*(10), 2709-2719.

Anderson, V., Catroppa, C., Haritou, F., Morse, S., & Rosenfeld, J. V. (2005a). Functional plasticity or vulnerability after early brain injury? *Pediatrics, 116*(6), 1374-1382.

Anderson, V., Catroppa, C., Haritou, F., Morse, S., & Rosenfeld, J. V. (2005b). Identifying factors contributing to child and family outcome 30 months after traumatic brain injury in children. *Journal of Neurology, Neurosurgery, and Psychiatry, 76*(3), 401-408.

Anderson, V., Catroppa, C., Morse, S., & Haritou, F. (1999). Functional memory skills following traumatic brain injury in young children. *Pediatric Rehabilitation, 3*(4), 159-166.

Anderson, V., Catroppa, C., Morse, S., Haritou, F., & Rosenfeld, J. (2005). Attentional and processing skills following traumatic brain injury in early childhood. *Brain Injury, 19*(9), 699-710.

Anderson, V., Fenwick, T., Manly, T., & Robertson, I. (1998). Attentional skills following traumatic brain injury in childhood: a componential analysis. *Brain Injury, 12*(11), 937-949.

Anderson, V., & Moore, C. (1995). Age at injury as a predictor of outcome following pediatric head injury: A longitudinal perspective. *Child Neuropsychology, 1*(3), 187-202.

Anderson, V., Smibert, E., Ekert, H., & Godber, T. (1994). Intellectual, educational, and behavioural sequelae after cranial irradiation and chemotherapy. *Archives of Disease in Childhood, 70*(6), 476-483.

Armstrong, F. D., Blumberg, M. J., & Toledano, S. R. (1999). Neurobehavioral issues in childhood cancer. *School Psychology Review, 28*(2), 194.

Arroyos-Jurado, E., Paulsen, J., Ehly, S., & Max, J. (2006). Traumatic brain injury in children and adolescents: Academic and intellectual outcomes following injury. *Exceptionality, 14*(3), 125-140.

Arroyos-Jurado, E., & Savage, T. A. (2008). Intervention strategies for serving students with traumatic brain injury. *Intervention in School & Clinic, 43*(4), 252-254.

Auerbach, C., & Silverstein, L. (2003). *Qualitative Data: An Introduction to Coding and Analysis*. New York: New York University Press.

Australian Institute of Health and Welfare. (2006a). *National Community Services Data Dictionary.* Canberra: Australian Institute of Health and Welfare (Ver 4. Cat. no. HWI 91).

Australian Institute of Health and Welfare. (2006b). *Disability updates: Children with disabilities.* Canberra: Australian Institute of Health and Welfare (Bulletin no. 42., Cat. no. AUS 19).

Australian Institute of Health and Welfare. (2007). *Disability in Australia: Acquired Brain Injury.* Canberra: Australian Institute of Health and Welfare (Bulletin no. 55., Cat no. AUS 96).

Australian Paediatric Cancer Registry. (2009). Annual and Sex breakdown for ICD-0 Sites C710 to C719. (Personal Communication).

Babikian, T., & Asarnow, R. (2009). Neurocognitive outcomes and recovery after pediatric TBI: Meta-analytic review of the literature. *Neuropsychology, 23*(3), 283-296.

Barrera, M., Shaw, A., Speechley, K., Maunsell, E., & Pogany, L. (2005). Educational and social late effects of childhood cancer and related clinical, personal, and familial characteristics. *Cancer, 104*(8), 1751-1760.

Beaulieu, C. L. (2002). Rehabilitation and outcome following pediatric traumatic brain injury. *Surgical Clinics of North America, 82*, 393-408.

Bennett, S., Good, D., & Kumpf, J. (2003). *Educating educators about ABI: Resource manual*. St. Catharines, Canada: Ontario Brain Injury Association. Retrieved 23rd January 2009, from http://www.abieducation.com/

Bennett, S., Good, D., Zinga, D., & Kumpf, J. (2004). Children with acquired brain injury: A silent voice in the Ontario school system. *Exceptionality Education Canada, 14*(1), 115-131.

Block, G. W., Nanson, J. L., & Lowry, N. J. (1999). Attention, memory, and language after pediatric ischemic stroke. *Child Neuropsychology, 5*(2), 81 - 91.

Blom, I., Schryver, E., Kappelle, L., Rinkel, G., Jennekens-Schinke, A, & Peters, A. (2003). Prognosis of haemorrhagic stroke in childhood: a long-term follow-up study. *Developmental Medicine & Child Neurology, 45*(4), 233-239.

Blosser, J. L., & DePompei, R. (1991). Preparing education professionals for meeting the needs of students with traumatic brain injury. *Journal of Head Trauma Rehabilitation, 6*(1), 73-82.

Blosser, J. L., & DePompei, R. (2003). *Pediatric Traumatic Brain Injury: Proactive Intervention*. Canada: Delmar Thomson Learning.

Bourke, P. E. (2008). *The Experience of Teacher Aides who Support Students with Disabilities and Learning Difficulties: A Phenomenological Study*: Unpublished Doctorate of Philosophy thesis, Queensland University of Technology, Brisbane, Australia.

Bowen, J. M. (2005). Classroom interventions for students with traumatic brain injuries. *Preventing School Failure, 49*(4), 34-41.

British Society of Rehabilitation Medicine. (1998). *Rehabilitation after traumatic brain injury. A working party report of the British Society of Rehabilitation Medicine*. London.

Bruce, B. S., Chapman, A., MacDonald, A., & Newcombe, J. (2008). School experiences of families of children with brain tumors. *Journal of Pediatric Oncology Nursing, 25*(6), 331-339.

Butler, R. W., & Copeland, D. (2002). Attentional processes and their remediation in children treated for cancer: A literature review and the development of a therapeutic approach. *Journal of the International Neuropsychological Society, 8*(1), 115-124.

Butler, R. W., Copeland, D. R., Fairclough, D. L., Mulhern, R. K., Katz, E. R., Kazak, A. E., et al. (2008). A multicenter, randomized clinical trial of a cognitive remediation program for childhood survivors of a pediatric malignancy. *Journal of Consulting and Clinical Psychology, 76*(3), 367-378.

Catroppa, C., & Anderson, V. (1999). Recovery of educational skills following paediatric traumatic brain injury. *Pediatric Rehabilitation, 3*(4), 167-175.

Catroppa, C., & Anderson, V. (2002). Recovery in memory function in the first year following TBI in children. *Brain Injury, 16*(5), 369-384.

Catroppa, C., & Anderson, V. (2003). Children's attentional skills two years post-traumatic brain injury. *Developmental Neuropsychology, 23*(3), 359 - 373.

Catroppa, C., & Anderson, V. (2006). Planning, problem-solving and organizational abilities in children following traumatic brain injury: Intervention techniques. *Pediatric Rehabilitation, 9*(2), 89-97.

Catroppa, C., Anderson, V., Morse, S., Haritou, F., & Rosenfeld, J. (2008). Outcome and predictors of functional recovery 5 years following pediatric traumatic brain injury (TBI). *Journal of Pediatric Psychology, 33*, 707-718.

Chapman, S. (2006). Neurocognitive stall. A paradox in long term recovery from pediatric brain injury. *Brain Injury Professional, 3*(4), 10-13.

Cohen, S. B. (1991). Adapting educational programs for students with head injuries. *Journal of Head Trauma Rehabilitation, 6*(1), 56-63.

Conklin, H., Salorio, C., & Slomine, B. (2008). Working memory performance following paediatric traumatic brain injury. *Brain Injury, 22*(11), 847-857.

Copeland, D., deMoor, C., Moore, B., & Ater, J. (1999). Neurocognitive development of children after a cerebellar tumor in infancy: A longitudinal study. *Journal of Clinical Oncology, 17*(11), 3476-3486.

Cowan , N (1995). *Attention and Memory: An Integrated Framework.* New York: Oxford University Press.

D'Amato, R. C., & Rothlisberg, B. A. (1996). How education should respond to students with traumatic brain injury. *Journal of Learning Disabilities, 29*(6), 670 - 683.

Dawson, P., & Guare, R. (2004). *Executive Skills in Children and Adolescents: A Practical Guide to Assessment and Intervention*. New York: Guilford Press.

De Schryver, E., Kappelle, J., Jennekens-Schinkel, A., & Peters, A. (2000). Prognosis of ischemic stroke in childhood: a long-term follow-up study. *Developmental Medicine & Child Neurology, 42*(5), 313-318.

Deidrick, K.K., & Farmer, J. E. (2005). School re-entry following traumatic brain injury. *Preventing School Failure, 49*(4), 23-33.

Department of Education of Early Childhood Development. (2009). Program for students with disabilities guidelines 2010. Retrieved 31st July 2009, from http://www.eduweb.vic.gov.au/edulibrary/public/stuman/wellbeing/Program_for_Students_with_Disabilities_Guidelines_2010.pdf

DePompei, R. (2005). *Educating Students with ABI: Strategies and Transitions.* Paper presented at the 6th World Congress on Brain Injury, 6th - 8th May 2005, Melbourne, Australia.

Dickman, G., MacPhail, M., & Popp, N. (2001). *Acquired Brain Injury: Managing Cognitive Impairment. An Introduction for Teachers*. Ballarat: The Department of Human Services.

Dise-Lewis, J., Lewis, H., & Reichardt, C. (2009). BrainSTARS: Pilot data on a team-based intervention program for students who have acquired brain injury. *Journal of Head Trauma Rehabilitation, 24*(3), 166-177.

Division of Special Education. (2004). *Special Education Evaluation and Services for Students with Traumatic Brain Injury: A Manual for Minnesota Educators*. Minnesota: Minnesota Department of Education. Retrieved 19th December 2008, from http://education.state.mn.us/mdeprod/groups/SpecialEd/documents/Manual/001755.pdf

Donders, J. (1994). Academic placement after traumatic brain injury. *Journal of School Psychology, 32*(1), 53-65.

Donders, J., & Warschausky, S. (2007) Neurobehavioural outcomes after early versus late childhood traumatic brain injury. *Journal of Head Trauma Rehabilitation 22*(5), 296-302.

Duval, J., Dumont, M., Braun, C. M., & Montour-Proulx, I. (2002). Recovery of intellectual function after a brain injury: A comparison of longitudinal and cross-sectional approaches. *Brain and Cognition, 48*(2-3), 333-365.

Ewing-Cobbs, L., Barnes, M., Fletcher, J. M., Levin, H. S., Swank, P. R., & Song, J. (2004). Modelling of longitudinal academic achievement scores after pediatric traumatic brain injury. *Developmental Neuropsychology, 25*(1/2), 107-133.

Ewing-Cobbs, L., Fletcher, J., Levin, H., Lovino, I., & Miner, M. (1998). Academic achievement and academic placement following traumatic brain injury in children and adolescents: A two-year longitudinal study. *Journal of Clinical & Experimental Neuropsychology, 20*(6), 769-781.

Ewing-Cobbs, L., Prasad, M. R., Kramer, L., Cox, C. S., Baumgartner, J., Fletcher, S., et al. (2006). Late intellectual and academic outcomes following traumatic brain injury sustained during early childhood. *Journal of Neurosurgery: Pediatrics, 105*(4), 287-296.

Ewing-Cobbs, L., Prasad, M. R., Landry, S. H., Kramer, L., & DeLeon, R. (2004). Executive functions following traumatic brain injury in young children: A preliminary analysis. *Developmental Neuropsychology, 26*(1), 487-512.

Fay, T. B., Yeates, K. O., Wade, S. L., Drotar, D., Stancin, T., & Taylor, H. G. (2009). Predicting longitudinal patterns of functional deficits in children with traumatic brain injury. *Neuropsychology, 23*(3), 271-282.

Feeney, T. J., & Ylvisaker, M. (2003). Context-sensitive behavioral supports for young children with TBI. Short term effects and long-term outcome. *Journal of Head Trauma Rehabilitation, 18*(1), 33.

Feeney, T. J., & Ylvisaker, M. (2006). Context-sensitive cognitive-behavioral supports for young children with TBI: A replication study. *Brain Injury, 20*(6), 629-645.

Feeney, T. J., & Ylvisaker, M. (2008). Context-sensitive cognitive-behavioral supports for young children with TBI – A second replication study. *Journal of Positive Behavior Interventions, 10*(2), 115-128.

Florida Department of Education. (2005). Understanding and Teaching Students with Traumatic Brain Injury: What Families and Teachers Need to Know. Retrieved 20th September 2009, from http://www.fldoe.org/ese/pdf/trauma.pdf

Fortune, N., & Wen, X. (1999). *The definition, incidence and prevalence of acquired brain injury in Australia*. Canberra: Australian Institute of Health and Welfare.

Ganesan, V., Hogan, A., Shack, N., Gordon, A., Isaacs, E., & Kirkham, F. J. (2000). Outcome after ischaemic stroke in childhood. *Developmental Medicine and Child Neurology, 42*(7), 455-461.

Gerber, N., Zehnder, D., Zuzak, T., Poretti, A., Boltshauser, E., & Grotzer, M. (2008). Outcome in children with brain tumours diagnosed in the first year of life: long-term complications and quality of life. *Archives of Disease in Childhood, 93*(7), 582-589.

Giangreco, M. F., Broer, S. M., & Edelman, S. W. (2001). Teacher engagement with students with disabilities: Differences between paraprofessional service delivery models. *Journal of the Association of Persons with a Severe Handicaps, 26*(2), 75-86.

Giangreco, M. F., Edelman, S. W., Broer, S. M., & Beth, D. M. (2001). Paraprofessional support of students with disabilities: Literature from the past decade. *Exceptional Children, 68*(1), 45-63.

Giangreco, M. F., Yuan, S., McKenzie, B., Cameron, P., & Fialka, J. (2005). "Be careful what you wish for ...": Five reasons to be concerned about the assignment of individual paraprofessionals. *Teaching Exceptional Children, 37*(5), 28-34.

Gillett, J. (2004). The pediatric acquired brain injury community outreach program (PABICOP) - An innovative comprehensive model of care for children and youth with an acquired brain injury. *NeuroRehabilitation, 19*, 201-218.

Gioia, G. A., & Isquith, P. K. (2004). Ecological assessment of executive function in traumatic brain injury. *Developmental Neuropsychology, 25*(1/2), 135-158.

Gioia, G. A., Isquith, P. K., Guy, S., & Kenworthy, L. (2000). *BRIEF: Behaviour Rating Inventory of Executive Function. Professional Manual*. Odessa, Florida: Psychology Assessment Resources, Inc.

Gioia, G. A., Isquith, P. K., Retzlaff, P. D., & Espy, K. A. (2002). Confirmatory factor analysis of the Behavior Rating Inventory of Executive Function (BRIEF) in a clinical sample. *Child Neuropsychology, 8*(4), 249 - 257.

Glang, A., Singer, G., Cooley, E., & Tish, N. (1991). Using direct instruction with brain injured students. *Direct Instruction News, Fall 1991*, 23-28.

Glang, A., Todis, B., Thomas, C. W., Hood, D., Bedell, G., & Cockrell, J. (2008). Return to school following childhood TBI: Who gets services? *NeuroRehabilitation, 23*(6), 477-486.

Glang, A., Tyler, J., Pearson, S., Todis, B., & Morvant, M. (2004). Improving educational services for students with TBI through statewide consulting teams. *NeuroRehabilitation, 19*(3), 219-231.

Glang, A., Ylvisaker, M., Stein, M., Ehlhardt, L., Todis, B., & Tyler, J. (2008). Validated instructional practices: Application to students with Traumatic Brain Injury. *Journal of Head Trauma Rehabilitation, 23*(4), 243-251.

Gravetter, F., & Wallnau, L. (2007). *Statistics for the Behavioral Sciences* (7th ed.). Belmont, USA: Thomason Wadsworth.

Groom, B. (2006). Building relationships for learning: The developing role of the teaching assistant. *Support for Learning, 21*(4), 199-203.

Hale, S. (1990). A global developmental trend in cognitive processing speed. *Child Development, 61*(3), 653-663.

Hall, L. J., McClannahan, L. E., & Krantz, P. J. (1995). Promoting independence in integrated classrooms by teaching aides to use activity schedules and decreased prompts. *Education and Training in Mental Retardation and Developmental Disabilities, 30*(3), 208-217.

Hawley, C. A. (2004). Behaviour and school performance after brain injury. *Brain Injury, 18*(7), 645-659.

Hawley, C. A. (2005). Saint or sinner? Teacher perceptions of a child with traumatic brain injury. *Pediatric Rehabilitation, 8*(2), 117-129.

Hawley, C. A., Ward, A. B., Magnay, A. R., & Mychalkiw, W. (2004). Return to school after brain injury. *Archives of Disease in Childhood, 89*, 136 - 142.

Heaton, S., Readerm, S., Preston, A., Fennell, E., Puyana, O., Gill, N., et al. (2001). The Test of Everyday Attention for Children (TEA-Ch): Patterns of performance in children with ADHD and clinical controls. *Child Neuropsychology, 7*(4), 251-264.

Hebb, D. O. (1942). The effect of early and late brain injury upon test scores, and the nature of normal adult intelligence. *Proceedings of the American Philosophical Society, 85*(3), 275-292.

Hebb, D. O. (1949). *The Organization of Behavior*. Mahwah, NJ: L. Erlbaum Associates.

Hogan, A. M., Kirkham, F. J., & Isaacs, E. B. (2000). Intelligence after stroke in childhood: Review of the literature and suggestions for future research. *Journal of Child Neurology, 15*(5), 325-332.

Hooper, S. R., Alexander, J., Moore, D., Sasser, H. C., Laurent, S., King, J., et al. (2004). Caregiver reports of common symptoms in children following a traumatic brain injury. *NeuroRehabilitation, 19*(3), 175-189.

Howard, R., & Ford, J. (2007). The roles and responsibilities of teacher aides supporting students with special needs in secondary school settings. *Australasian Journal of Special Education, 31*(1), 25 - 43.

Hurvitz, E., Warschausky, S., Berg, M., & Tsai, S. (2004). Long-term functional outcome of pediatric stroke survivors. *Topics in Stroke Rehabilitation, 11*(2), 51(59).

Johnson, P., Thomas-Stonell, N., Rumney, P., & Oddson, B. (2006). Long-term outcomes of pediatric acquired brain injury. *Brain and Cognition, 60*(2), 205-206.

Keyser-Marcus, L., Briel, L., Sherron-Targett, P., Yasuda, S., Johnson, S., & Wehman, P. (2002). Enhancing the schooling of students with traumatic brain injury. *Teaching Exceptional Children, 34*(4), 62-67.

Kennard, M. A. (1938). Age and other factors in motor recovery from precentral lesions in monkeys. *American Journal of Physiology, 115*, 138-146.

Kinsella, G., Ong, B., & Murtagh, D. (1999). The role of family for behavioural outcome in children and adolescents following traumatic brain injury. *Journal of Consulting and Clinical Psychology, 67*(1), 116-123.

Kinsella, G., Prior, M., Sawyer, M., Murtagh, D., Eisenmajer, R., Anderson, V., et al. (1995). Neuropsychological deficit and academic performance in children and adolescents following traumatic brain injury. *Journal of Pediatric Psychology, 20*(6), 753-767.

Kinsella, G., Prior, M., Sawyer, M., Ong, B., Murtagh, D., Eisenmajer, R., et al. (1997). Predictors and indicators of academic outcome in children 2 years following traumatic brain injury. *Journal of the International Neuropsychological Society, 3*, 608-616.

Klasassen, J. (1999). *What is the reality for school professionals working with students who have an acquired brain injury.* Paper presented at the Children, Young People and Brain Injury: Doing the Best in School and Community

Lahteenmaki, P., Harila-Saari, A., Pukkala, E., Kyyronen, P., Salmi, T., & Sankila, R. (2007). Scholastic achievements of children with brain tumors at the end of comprehensive education: A nationwide, register-based study. *Neurology, 69*(3), 296-305.

Lash, M., Wolcott, G., & Pearson, S. (2005). *Signs and Strategies for Educating Students with Brain Injuries*. North Carolina, USA: Lash and Associates Publishing/Training Inc.

Lashbrook, J. (2000). Fitting in: Exploring the emotional dimension of adolescent peer pressure. *Adolescence, 35*(140), 747 -757.

Leigh, L., & Miles, M. (2006). Educational issues for children with cancer. In P. Pizzo & D. Poplack (Eds.), *Principles and Practice of Pediatric Oncology* (5th ed., pp. 1515- 1530). Philadelphia: Lippincott, Williams and Wilkins.

Levin, H. S., & Hanten, G. (2005). Executive functions after traumatic brain injury in children. *Pediatric Neurology, 33*(2), 79-93.

Levine, S. C., Kraus, R., Alexander, E., Suriyakham, L.W., & Huttenlocher, P.R. (2005). IQ decline following early unilateral brain injury: A longitudinal study. *Brain and Cognition, 59*, 114-123.

Lezak, M., Howieson, D., & Loring, D. (2004). *Neuropsychological Assessment* (4th ed.). New York, USA: Oxford University Press.

Limond, J., Dorris, L., & McMillan, T. M. (2009). Quality of life in children with acquired brain injury: Parent perspectives 1 - 5 years after injury. *Brain Injury, 23*(7), 617 - 622.

Lorenzi, M., McMillan, A., Siegel, L., Zumbo, B., Glickman, V., Spinelli, J., et al. (2009). Educational outcomes among survivors of childhood cancer in British Columbia, Canada. *Cancer, 115*(10), 2234-2245.

Mabbott, D., Spiegler, B., Greenberg, M., Rutka, J., Hyder, D., & Bouffet, E. (2005). Serial evaluation of academic and behavioral outcome after treatment with cranial radiation in childhood. *Journal of Clinical Oncology, 23*(10), 2256-2263.

Mackey, M., & Gordon, A. (2007). Stroke in children. *Australian Family Physician, 36*(11), 896-902.

Mandalis, A., Kinsella, G., Ong, B., & Anderson, V. (2007). Working memory and new learning following pediatric traumatic brain injury. *Developmental Neuropsychology, 32*(2), 683 - 701.

Manly, T., Anderson, V., Nimmo-Smith, I., Turner, A., Watson, P., & Robertson, I. A. (2001). The differential assessment of children's attention: The test of everyday attention for children (TEA-Ch), normative sample and ADHD performance. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 42*(8), 1065-1081.

Manly, T., Robertson, I. A., Anderson, V., & Nimmo-Smith, I. (1999). *TEA-Ch: The Test of Everyday Attention for Children*. Bury St, Edmunds, England: Thames Valley Test Company.

Mateer, C., & Sohlberg, M. M. (2003). Cognitive rehabilitation revisited. *Brain Impairment, 4*(1), 17-24.

Max, J., Robin, D., Taylor, G. H., Yeates, K. O., Fox, P., Lancaster, J., et al. (2004). Attention function after childhood stroke. *Journal of the International Neuropsychological Society, 10*(7), 976-986.

McDonald, S. (1998). The SCEMA scheme: A worthy project as yet underspecified, overestimated and unproven. *Aphasiology, 12*(12), 1076 - 1080.

McKay, K., Halperin, J., Schwartz, S., & Sharma, V. (1994). Developmental analysis of three aspects of information processing: Sustained attention, selective attention, and response organization. *Developmental Neuropsychology, 10*, 121-132.

Mealings, M. (2006). *Return to School Following Traumatic Brain Injury: Adolescent Insiders Perspectives.* Unpublished post graduate diploma thesis, La Trobe University, Melbourne, Australia.

Miller, L. J., & Donders, J. (2003). Prediction of educational outcome after pediatric traumatic brain injury. *Rehabilitation Psychology, 48*(4), 237-241.

Ministry of Special Education. (2001). *Teaching Students With Acquired Brain Injury. A Resource Guide For Schools*. British Columbia: Ministry of Special Education, Special Programs Branch. Retrieved 13th February 2009, from http://www.bced.gov.bc.ca/specialed/docs/moe_abi_resource_rb0116.pdf

Mitby, P., Robison, L., Whitton, J., Zevon, M., Gibbs, I., Tersak, J., et al. (2003). Utilization of special education services and educational attainment among long-term survivors of childhood cancer. *Cancer, 97*(4), 1115-1126.

Mohr, J. D., & Bullock, L. M. (2005). Traumatic brain injury: Perspectives from educational professionals. *Preventing School Failure, 49*(4), 53-57.

Mulhern, R. K., & Butler, R. W. (2004). Neurocognitive sequelae of childhood cancers and their treatment. *Pediatric Rehabilitation, 7*(1), 1.

Mulhern, R. K., Merchant, T. E., Gajjar, A., Reddick, W. E., & Kun, L. E. (2004). Late neurocognitive sequelae in survivors of brain tumours in childhood. *The Lancet Oncology, 5*(7), 399-408.

Muscara, F., Catroppa, C., & Anderson, V. (2008). The impact of injury severity on executive function 7-10 years following pediatric traumatic brain injury. *Developmental Neuropsychology, 33*(5), 623-636.

Nadebaum, C., Anderson, V., & Catroppa, C. (2007). Executive function outcomes following traumatic brain injury in young children: A five year follow-up. *Developmental Neuropsychology, 32*(2), 703 - 728.

National Stroke Foundation, Royal Children's Hospital, & Strokidz. (2009). Childhood Stoke. Retrieved 14th January 2010, from http://www.strokefoundation.com.au/news/latest/new-childhood-stroke-booklet

Ness, K. K., Mertens, A. C., Hudson, M. M., Wall, M. M., Leisenring, W. M., Oeffinger, K. C., et al. (2005). Limitations on physical performance and daily activities among long-term survivors of childhood cancer. *Annals of Internal Medicine, 143*(9), 639-647.

O'Flaherty, S. J., Chivers, A., Hannan, T. J., Kendrick, L. M., McCartney, L. C., Wallen, M. A., et al. (2000). The Westmead pediatric TBI multidisciplinary outcome study: Use of functional outcomes data to determine resource prioritization. *Archives of Physical Medicine and Rehabilitation, 81*(6), 723-729.

Palmer, S., Reddick, W., & Gajjar, A. (2007). Understanding the cognitive impact on children who are treated for medulloblastoma. *Journal of Pediatric Psychology, 32*(9), 1040-1049.

Palmer, S., Wallace, D., Bonner, M., Raggl, R., Chapieski, L., Janzen, L., et al. (2009). A longitudinal study of processing speed among children treated for medulloblastoma (MB), supratentorial primitive neuroectodermal tumor (SPNET), or atypical teratoid rhabdoid tumor (ATRT). *Journal of Clinical Oncology, 27*(15s), 10028.

Parkin, A., Maas, F., & Rodger, S. (1996). Factors contributing to successful return to school for students with acquired brain injury: parent perspectives. *Australian Occupational Therapy Journal, 43*(3/4), 133-141.

Pavlovic, J., Kaufmann, F., Boltshauser, E., Capone, M., Gubser Mercati, D., Haenggeli, C., et al. (2006). Neuropsychological problems after paediatric stroke: Two year follow up of Swiss children. *Neuropediatrics, 37*, 13-19.

Penkman, L. (2004). Remediation of attention deficits in children: A focus on childhood cancer, traumatic brain injury and attention deficit disorder. *Pediatric Rehabilitation, 7*(2), 111-123.

Perrott, S., Taylor, H. G., & Montes, J. (1991). Neuropsychological sequelae, familial stress, and environmental adaptation following pediatric head injury. *Developmental Neuropsychology, 7*(1), 69-86.

Petit-Zeman, S. (2002). *Missing Out. The lifelong impact of children's acquired brain injury*. Yorkshire, UK: The Children's Acquired Brain Injury Interest Group.

Prigatano, G., Gray, J., & Gale, S. (2008). Individual case analysis of processing speed difficulties in children with and without traumatic brain injury. *The Clinical Neuropsychologist, 22*(4), 603 - 619.

Queensland Studies Authority. (2007). Acquired brain injury. Retrieved 8th April 2009, from http://www.qsa.qld.edu.au/downloads/learning/kla_special_needsinfo_abi.pdf

Rees, S. A. (2006). *Rehabilitation through education post ABI.* Paper presented at the International HOPE Conference, November 2006. Retrieved 9th May 2008, from http://www.shipsproject.org.uk/abi-and-education.htm.

Rees, S. A., & Skidmore, D. (2008). The classical classroom: enhancing learning for pupils with Acquired Brain Injury. *Journal of Research in Special Educational Needs, 8*(2), 88-95.

Reeves, C., Palmer, S., Reddick, W., Merchant, T., Buchanan, G., Gajjar, A., et al. (2006). Attention and memory functioning among pediatric patients with medulloblastoma. *Journal of Pediatric Psychology, 31*(3), 272-280.

Rey-Casserly, C., & Meadows, M. E. (2008). Developmental perspectives on optimizing educational and vocational outcomes in child and adult survivors of cancer. *Developmental Disabilities Research Reviews, 14*(3), 243-250.

Roberts, C. (2007). *A teacher's perspective: What does the school want from therapists?* Paper presented at the VBIRA Workshop, Developing Pathways to the Future: Negotiating Childhood and Adolescence with an ABI on the 21 September, Melbourne, Australia.

Roncadin, C., Guger, S., Archibald, J., Barnes, M., & Dennis, M. (2004). Working memory after mild, moderate, or severe childhood closed head injury. *Developmental Neuropsychology, 25*(1/2), 21-36.

Rose, S. A., Feldman, J. F., & Jankowski, J. J. (2002). Processing speed in the first year of life: A longitudinal study of preterm and full-term infants. *Developmental Psychology, 38*(6), 895-902.

Savage, R. C., DePompei, R., Tyler, J., & Lash, M. (2005). Paediatric traumatic brain injury: A review of pertinent issues. *Pediatric Rehabilitation, 8*(2), 92-103.

Savage, R. C., & Wolcott, G. (1988). *An Educator's Manual: What Eductors Need to Know About Students with Traumatic Brain Injury*. USA: National Head Injury Association.

Schutz, L. E., & Schutz, J. A. (2000). Successful educational re-entry after severe traumatic brain injury: The contribution of cognitive compensation strategies. *Florida Journal of Communication Disorders, 20*, 28-36.

Semrud-Clikeman, M. (2001). *Traumatic brain injury in children and adolescents: Assessment and intervention*. New York, NY: The Guilford Press.

Sharp, N. L., Bye, R. A., Llewellyn, G. M., & Cusick, A. (2006). Fitting back in: Adolescents returning to school after severe acquired brain injury. *Disability & Rehabilitation, 28*(12), 767-778.

Silver, C. H. (2000). Ecological validity of neuropsychological assessment in childhood traumatic brain injury. *Journal of Head Trauma Rehabilitation, 15*(4), 973- 988.

Slomine, B. S., Gerring, J. P., Grados, M. A., Vasa, R., Brady, K. D., Christensen, J. R., et al. (2002). Performance on measures of 'executive function' following pediatric traumatic brain injury. *Brain Injury, 16*(9), 759-772.

Sohlberg, M. M., Todis, B., & Glang, A. (1998). SCEMA: A team-based approach to serving secondary students with executive dysfunction following brain injury. *Aphasiology, 12*(12), 1047 - 1061.

Spiegler, B. J., Bouffet, E., Greenberg, M. L., Rutka, J. T., & Mabbott, D. J. (2004). Change in neurocognitive functioning after treatment with cranial radiation in childhood. *Journal of Clinical Oncology, 22*(4), 706-713.

Stargatt, R., Rosenfeld, J. V., Maixner, W., & Ashley, D. (2007). Multiple factors contribute to neuropsychological outcome in children with posterior fossa tumors. *Developmental Neuropsychology, 32*(2), 729 - 748.

Stavinoha, P. L. (2005). Integration of neuropsychology in educational planning following traumatic brain injury. *Preventing School Failure, 49*(4), 11-16.

Sterling, L. (1994). *Students with Acquired Brain Injuries in Primary and Secondary Schools*. Canberra: Australian Government Publishing Service.

Stewart-Scott, A., & Douglas, J. (1998). Education outcomes for secondary and postsecondary students following traumatic brain injury. *Brain Injury, 12*(4), 317-331.

Strauss, E., Sherman, E., & Spreen, O. (2006). *A Compendium of Neuropsychological Tests. Administration, Norms, and Commentary* (3rd ed.). New York, USA: Oxford University Press.

Student and Professional Support Services. (2000). *Children with Acquired Brain Injury: Planning and Support Guide for Schools, Preschools and Childcare Services*. Adelaide: Department of Education, Training and Employment. Retrieved 18th July 2009, from http://www.decs.sa.gov.au/speced2/files/pages/chess/hsp/Pathways/original_abi_book.pdf

Takala, M. (2007). The work of classroom assistants in special and mainstream education in Finland. *British Journal of Special Education, 34*(1), 50-57.

Taylor, H. G. (2004). Research on outcomes of pediatric traumatic brain injury: Current advances and future directions. *Developmental Neuropsychology, 25*(1/2), 199-225.

Taylor, H. G., & Alden, J. (1997). Age-related differences in outcomes following childhood brain insults: An introduction and overview. *Journal of the International Neuropsychological Society, 3*, 555-567.

Taylor, H. G., Wade, S. L., Stancin, T., Yeates, K. O., Drotar, D., & Minich, N. (2002). A prospective study of short- and long-term outcomes after traumatic brain injury in children: Behaviour and Achievement. *Neuropsychology, 16*(1), 15-27.

Taylor, H. G., Yeates, K. O., Wade, S. L., Drotar, D., Stancin, T., & Montpetite, M. (2003). Long-term educational interventions after traumatic brain injury in children. *Rehabilitation Psychology, 48*(4), 227-236.

Todis, B., Glang, A., & Fabry, M. (1997). Family, school, child: A qualitative study of the school experiences for students with ABI. In A. Glang, G. Singer & B. Todis (Eds.), *Children with Acquired Brain Injury: The School's Response.* (pp. 33-72). Baltimore, MD: Paul H. Brookes.

Tucker, A., Ewing, J., & Oguzkaya, E. (2009). The Controlled Animal Fluency Test, a test of executive functioning: Norms for children and adolescents. *(Unpublished manuscript)*.

Tucker, A., Ewing, J., & Ross, N. (1996). *Animal Fluency - a new test of executive functioning: Normative data and clinical experience.* Paper presented at the Second National Conference of the College of Clinical Neuropsychologists of APS., Sydney, Australia.

Tyler, J., & Grandinette, S. (2003). Effective teaching strategies. *Brain Injury Source, 6*(3), 38-41.

Upton, P., & Eiser, C. (2006). School experiences after treatment for a brain tumour. *Child: Care, Health & Development, 32*(1), 9-17.

Utah State Office of Education, & Utah State University. (1993). *Educator Guidelines for Serving Students with Traumatic Brain Injuries. Revised Edition.* Utah: Utah State Office of Education.

Vaidya, A. (2002). Issues relating to school re-entry following traumatic brain injury. *Cognitive Technology, 7*(1), 38 - 45.

von Hoff, K., Kieffer, V., Habrand, J.-L., Kalifa, C., Dellatolas, G., & Grill, J. (2008). Impairment of intellectual functions after surgery and posterior fossa irradiation in children with ependymoma is related to age and neurologic complications. *BMC Cancer, 8*(1), 15.

Vriezen, E. R., & Pigott, S. E. (2002). The relationship between parental report on the BRIEF and performance-based measures of executive function in children with moderate to severe traumatic brain injury. *Child Neuropsychology, 8*(4), 296 - 303.

Walker, S., & Wicks, B. (2005). *Educating Children with Acquired Brain Injury*. London: David Fulton Publishers.

Wechsler, D. (2003). *Wechsler Intelligence Scale for Children - Fourth Edition (WISC-IV)*. San Antonio: The Psychological Corporation.

Wright, I., & Limond, J. (2004). A developmental framework for memory rehabilitation in children. *Pediatric Rehabilitation, 7*(2), 85-96.

Yeates, K. O., Armstrong, K., Janusz, J., Taylor, H. G., Wade, S., Stancin, T., et al. (2005). Long-term attention problems in children with traumatic brain injury. *Journal of the American Academy of Child and Adolescent Psychiatry, 44*(6), 574-584.

Yeates, K. O., & Taylor, H. G. (2006). Behavior problems in school and their educational correlates among children with traumatic brain injury. *Exceptionality, 14*(3), 141-154.

Yeates, K. O., Taylor, H. G., Wade, S. L., Drotar, D., Stancin, T., & Minich, N. (2002). A prospective study of short- and long-term neuropsychological outcomes after traumatic brain injury in children. *Neuropsychology, 16*(4), 514-523.

Ylvisaker, M., Adelson, D., Braga, L., Burnett, S., Glang, A., Feeney, T. J., et al. (2005). Rehabilitation and ongoing support after pediatric TBI: Twenty years of progress. *Journal of Head Trauma Rehabilitation, 20*(1), 95-109.

Ylvisaker, M & DeBonis, D. (2000) Executive function impairment in adolescence: TBI and ADHD. *Topics in Language Disorders, 20*(2), 29-57.

Ylvisaker, M., & Feeney, T. J. (1998). School re-entry after traumatic brain injury. In M. Ylvisaker (Ed.), *Traumatic Brain Injury: Children and Adolescents* (Second ed.). Boston: Butterworth-Heinemann.

Ylvisaker, M., & Feeney, T. J. (2002). Executive functions, self-regulation, and learned optimism in paediatric rehabilitation: a review and implications for intervention. *Pediatric Rehabilitation, 5*(2), 51-70.

Ylvisaker, M., Hartwick, P., Ross, B., & Nussbaum, N. (1994). Cognitive Assessment. In R. C. Savage & G. F. Wolcott (Eds.), *Educational Dimensions of Acquired Brain Injury* (pp. 69-119). Austin, Texas: Pro-ed.

Ylvisaker, M., Todis, B., Glang, A., Urbanczyk, B., Franklin, C., DePompei, R., et al. (2001). Educating students with TBI: Themes and recommendations. *Journal of Head Trauma Rehabilitation, 16*(1), 76-93.

Zinga, D., Bennett, S., Good, D., & Kumpf, J. (2003). Educating educators about acquired brain injury: A program description. *Journal on Developmental Disabilities, 10*(1), 159-163.

Zinga, D., Bennett, S., Good, D., & Kumpf, J. (2005). Policy and practice: Acquired brain injury in Canadian educational systems. *Canadian Journal of Educational Administration and Policy, 43*, 1-23.

Appendix 1: Recruitment advertisement

ATTENTION
SUBJECTS NEEDED FOR STUDY…..

School performance of students with acquired brain injury: What is the impact of aide support?

My name is Ruth Tesselaar and I am currently completing my Doctorate in Clinical Neuropsychology at Victoria University. As part of my Doctorate, I am undertaking a thesis looking at the school performance of students with Acquired Brain Injury (ABI).

In Victoria, where varying levels of aide support is provided to students with ABI, this study will aim to measure the impact of aide support which is provided to students with ABI. This impact will be measured by classroom and academic performance. It will also consider the impact of the level of training and support that each school and aide receives around students with ABI.

STUDY PLAN:
We plan to study at least 10 students with an acquired brain injury across primary and secondary schools. It is anticipated that subjects will be from a variety of age groups, school levels, geographic areas, and have various types of brain injuries.

We will be conducting two school observational session for each subject; once with the aide present and once without the aide. We will also be gathering information on school performance, cognitive abilities and adaptive behaviours from teachers, aides and parents.

INVOLVEMENT IN THE STUDY
This study will require the student with ABI to complete five (5) psychological tests to gather information on classroom behaviour and executive performance. It is anticipated that these five tests will take approximately 1 – 1.5 hours. If your child has had a neuropsychological assessment in the past six to twelve months it may be possible to utilise some of the information gathered from that report so as reduce the testing time needed.

Brief questionnaires will also given to parents, aides and teachers to collect information on your child's classroom functioning and behaviour. Teachers and aides will also be asked about the amount of support and training they receive when working with the student with ABI.

BENEFITS
Your participation will help in improving our understanding of the school performance of students with acquired brain injury, and what impact aide support has on this performance. It is hoped that the findings of this thesis can be used to inform funding bodies on best practice models for the return to school of children following ABI.

VOLUNTARY PARTICIPATION
Your participation in this project is entirely voluntary. You will have the right to withdraw from the project at any time.

CONFIDENTIALITY
All information obtained during the course of this study will be strictly confidential and, to the extent permitted by the applicable laws and regulations, will not be made publicly available. Data may be reported in scientific journals and will not include any information that identifies your child as a subject in this study.

CONCERNS
If you have any concerns about your involvement in this study, please feel free to contact my supervisor, Dr Gerard Kennedy at anytime on (03) 9919 2481.

PARTICIPATION
If you and your child are interested in taking part in this research, please contact me via phone, (03) 9689 9886, or email ruth.tesselaar@live.vu.edu.au to discuss further.

Thankyou for your interest in this study,

Ruth Tesselaar
Neuropsychological Doctoral Student
Victoria University
ruth.tesselaar@live.vu.edu.au
Phone: 9689 9886

Appendix 2: CAFT administration instructions

Controlled Animal Fluency Test (CAFT) Administration Instructions

For each of the three categories allow 60" for the child to complete the task. If the child is silent for 15" or more, repeat basic instructions. Write down each animal name in the order said.

Instructions:

1. Animals Automatic

"Tell me as many different animals as you can, in any order, until I say stop"

2. Animals by Size

"I want you to tell me as many animals as you can, but this time I want you to put them in order of their size. That is, I want you to tell me the smallest animal you can thin of first, then one just a little bit bigger, and a little bit bigger and so on, making sure that each one is bigger than the one before it. Don't get too big too quickly or you'll run out of animals. Keep going until I say stop."

3. Animals by Alphabet

Pretest: *"Before we start this part I need you to say the alphabet for me." (If the child is unable to say the entire alphabet then discontinue).*

Test: *"Now I want you to tell me as many animals as you can but this time I want you to order them according to the alphabet. That is, the first one is to begin with A, then next one with B, then C and so on. Say only one animal for each letter and keep going until I say stop."*

Trial 1: Animals Auto	Trial 2: Animals by size	Trial 3: Animals by Alpha
Total correct:	*Total correct:*	*Total correct:*

Relative difficulty score = [(Animals Auto - Animals Size) / Animals Auto] x 100= ____

Appendix 3: Semi-structured interviews

Student semi-structured interview

1. What is the most important thing to you about school?

2. What do you think you need help with at school?

3. What does the aide help you with?

4. Do you find any differences in the classroom when the aide is there or not?

5. How do you feel about having an aide help you out in the classroom?

6. Do you get along well with your aide? Why/Why not?

7. Do you get along well with teachers at your school? Why/Why not?

8. Would you like anything to happen differently at school?

9. Do you attend PSG (Program Support Group) meetings at school?

Parent semi-structured interview

Child's Demographics

Age ______________________

DOB ______________________

Sex ______________________

Medical Information

Date of Injury ______________________ Age at Injury _________________________

Type of Injury___________________ Glascow Coma Score______________________

Length of PTA_______________ Length of Hospital Stay________________________

Diagnosed medical or behavioural condition prior to or since injury (Developmental Delay or Learning Difficulty, Respiratory Problems, Behavioural Problems, Medial Problems) ____

____

Current Physical Difficulties? ____

Current Behavioural Difficulties? ____

____

Past and Current Therapy

(note length of time received for, or if ongoing – Speech, Physio, OT, Behavioural, Tutor, Aide) etc.,____

____

____

School

1. Current Grade Level______________________
2. Years at current school ___________________
3. Date of school return following injury____________________________________
4. Number of hours at school currently _____________________________________

____

5. Current needs/issues at school? _______________________________________

____

____

____

____

6. Are these needs being met by the aide?

   (Not met at all) 1-----2-----3-----4-----5-----6-----7 *(Met consistently)*

7. Are you aware of differences in classroom behaviour/ability between when the aide is present and not present?

____

____

____

____

____

8. Further Comments:

____

____

____

____

____

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____

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____

____

Teacher semi-structured interview

What subjects do you currently teach the student in?________________________

____

How many periods per week do you see them?____________________________

How many of those periods have aide support?___________________________

How long have you taught the student for?______________________________

Planning

When was the school informed of the student's brain injury (re: how far in advance did planning for this student begin?)

____

____

Current Educational Program

1. Is this student currently provided with any educational supports, modifications? Why/Why not? (e.g., –behav/academic concerns in class, not needed, application rejected by DeeT, financial supports unavailable etc)

____

____

2. If receiving funding, what is the source of funding for this student i.e., TAC, DeeT
   a. Under what category is this student funded?
   b. What level funding does this student receive?

3. How many hours per week is this student provided with aide support? _______

4. Is this aide support inside or outside the classroom environment? ___________

5. How many aides support this student? ________________________________

6. What modifications are currently made for the student? (E.g., Extra time for exams and assignments , Computer Assistance, Clarification of Information, Daily Diary Assistance, Modification of Assignments, Classroom Buddy.)

____

____

____

____

School/Staff Training and Support

7. Have you worked with students with an ABI previously? YES/NO

Details____

____

____

8. How would you rate your own knowledge about working with students with ABI:

(*No knowledge at all)* 1-----2-----3-----4-----5-----6-----7 (*Very knowledgeable*)

Comments____

____

____

9. Do you feel that you require more support to work with this student?

(*No extra supports)* 1-----2-----3-----4-----5-----6-----7 (*Extra supports would be beneficial)*

Comments____

____

____

10. Have you ever received any resources (e.g., training or literature) about students with ABI? Yes:____ No:____

Details of resources: ____

____

____

11. How would you rate the level of support provided to you (by the school or external services) to work with this student with ABI:

(No Support at all) 1-----2-----3-----4-----5-----6-----7(*Extremely well supported*)

Details of Support Received and from whom/where___________________________

____

____

____

12. How would you rate the school in terms of support it offers the student with ABI:

(No Support at all) 1-----2-----3-----4-----5-----6-----7(*Extremely well supported*)

Comments____

____

____

____

____

13. Which school staff are involved with this student currently? (i.e., Student Welfare Officer, School Psychologist, School Speech Therapist).

____

____

____

____

14. Are any external supports to the school currently involved with this student? (i.e., Visiting Teacher, Education Consultant, ABI Specialist, Therapy Team).

____

____

____

____

15. What do you perceive this student's needs are at school? (Why did they have an aide in the first place?)

____

____

____

____

16. Do you believe that the student's needs are being met by the current aide program?

(*Not at all*) 1-----2-----3-----4-----5-----6-----7(*Extremely well*)

Why/ Why not? ____
____
____
____

17. Do you believe that the student's needs are being met by the school?

(*Not at all*) 1-----2-----3-----4-----5-----6-----7(*Extremely well*)

Why/ Why not? ____
____
____
____

Aide semi-structured interview

What subjects do you currently support the student in?________________________

____

How many periods per week do you see them?______________________________

How long have you worked with the student for?____________________________

1. Have you worked with students with an ABI previously? YES/NO

Details____

____

2. How would you rate your own knowledge about working with students with ABI:

(*No knowledge at all*) 1-----2-----3-----4-----5-----6-----7 (*Very knowledgeable*)

Comments____

____

____

3. Do you feel that you require more support to work with this student?

(*No extra supports)* 1-----2-----3-----4-----5-----6-----7 (*Extra supports would be beneficial)*

Comments____

____

____

4. Have you ever received any resources (e.g., training or literature) about students with ABI? Yes:____ No:____

Details of Resources:

____

____

____

5. How would you rate the level of support provided to you (by the school or external services) to work with this student with ABI:

(No Support at all) 1-----2-----3-----4-----5-----6-----7(*Extremely well supported*)

Details of Support Received and from whom/where___________________________

____

____

____

6. How would you rate the school in terms of support it offers the student with ABI:

(No Support at all) 1-----2-----3-----4-----5-----6-----7(*Extremely well supported*)

Comments____

____

____

____

7. What do you perceive this student's needs are at school?

____

____

____

8. Do you believe that the student's needs are being met by the current aide program?

(Not at all) 1-----2-----3-----4-----5-----6-----7(*Extremely well*)

Why/ Why not? ____

____

____

____

9. Do you believe the student's needs are being met by the school?

(Not at all) 1-----2-----3-----4-----5-----6-----7(*Extremely well*)

Why/ Why not? ____

____

____

____

Appendix 4: Observational reference table

Observational Reference Table:

Cognitive Impairment	Examples of functional classroom behaviours
Memory	• Unable to follow directions for task, especially multi-step directions. • Can't recall what learnt in last class. • Unable to recall where placed materials for class. • Poor retention of information over time. • Difficulty with learning new information.
Speed of processing	• Unable to formulate response to question in allocated time. • Displays difficultly with rate of information being presented. • Slower at completing tasks compared with peers.
Attention	• Fussing with things on desk instead of completing task at hand. • Looking around room, daydreaming. • Loses track of conversation with peers and or classroom discussion. • Difficulty copying material from board. • Unable to do two things at once such as listen to the teacher while taking notes. • Distracted by others in classroom.
Executive functioning	• Brings incorrect materials to class. • Difficulty beginning a task and staying on task. • Doesn't monitor own behaviour – doesn't realise when daydreaming, acting out, etc. • Disorganised and as a result unable to complete tasks. • Difficulty in thinking of new ways to solve a problem if initial plan didn't work. • Becomes lost in the details of tasks and is unable to carry them out.

Notes: Examples of functional classroom measures based on information from Blosser and DePompei (2003), Cohen (1991), DePompei (2005), Dickman, MacPhail, and Popp (2001), and Keyser-Marcus et al. (2002).

Appendix 5: Observational chart

Observational Chart

Participant Number _______ **Observation**: 1 / 2 **Aide Present**: Y / N

Observation date____________ Subject _________________

Length of period (mins)_______ Task/s___________________

Day of week________________ Time of day _________

Scoring Notes:

- Time period = 5 mins
- Circle Y/N if the a behavioural manifestation occurred or not
- **Describe** the **manifestation** and **outcome** of behaviour
- Rate severity of behaviours from 1-5

Time Period	Memory	SOP	Attention	Executive Function
1	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5
2	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5
3	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5
4	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5
5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5
6	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5
7	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5	**Y/N** 1-2-3-4-5

Notes on physical environment factors which may be impacting on behaviour:

____

____

____

____

Overall observations: ____

____

____

____

____

Appendix 6: Ethics approval

MEMO

TO	Dr. Gerard Kennedy Department of Psychology St. Albans Campus	DATE	3/11/2006
FROM	Professor Michael Polonsky Chair Victoria University Human Research Ethics Committee		
SUBJECT	Ethics Application – HRETH 06/112		

Dear Dr. Gerard Kennedy,

Thank you for submitting this application for ethical approval of the project:

HRETH06/112 The impact of aide support on the school performance of students with acquired brain injury (HREC06/120)

The proposed amendments have been accepted by the Chair of Victoria University Human Research Ethics Committee and approval for application HRETH06/112 has been granted from 3/11/2006 to 3/11/2009.

Please note that the Human Research Ethics Committee must be informed of the following: any changes to the approved research protocol, project timelines, any serious or unexpected adverse effects on participants, and unforeseen events that may effect continued ethical acceptability of the project. In these unlikely events, researchers must immediately cease all data collection until the Committee has approved the changes.

If you have any queries, please do not hesitate to contact me on 9919 4625.

On behalf of the Committee, I wish you all the best for the conduct of the project.

Professor Michael Polonsky
Chair
Victoria University Human Research Ethics Committee

Appendix 7: Participant information sheets and informed consent

VICTORIA UNIVERSITY
PARTICIPANT INFORMATION SHEET
(Parents)

Project Title:
School performance of students with acquired brain injury: What is the impact of aide support?

The purpose of the study
This project is being carried out by a Doctorate in Neuropsychology student, Ruth Tesselaar, and will look at the school performance of students with Acquired Brain Injury (ABI) (such as your child) and the impact that Aide support has on this performance. While there has been a great deal of research which recommends supporting students with ABI at school, there is a current lack of research which looks at the outcome of providing this support. Thus, the purpose of this study is to look at the differences in performances between students with ABI who are provided with various levels of aide support.

Your involvement in the study
Involvement in this study will require you to complete a questionnaire and/or a semi-structured interview used to acquire demographic information (such as: age, date of birth, sex, grade level) and background medical information about your child (such as: date of injury, type of injury, severity of injury). You will also be asked to complete a behaviour rating inventory of executive functions. It is anticipated that your involvement will take approximately 0.5 –1 hours.

This study will also require your child to complete five (5) psychological tests that measure: planning, organisation, attention, memory and learning. It is anticipated that these five (5) tests will take approximately 1 – 1.5 hours. This testing will take place at a time and location convenient to you and your child.

Two observational session will take place with your child's classroom. Once with the aide present and once without. This information will be compared to that gathered from yourself, the teacher, aide, and from Neuropsychological testing.

Your child's aide and main classroom teacher will also be contacted if you agree to your child becoming involved in this study. They will be given two questionnaires and/or a semi-structured interview to collect information on your child's classroom functioning and behaviour. They will also be asked about the amount of support and training they receive when working with your child.

Risks and Inconvenience
There is a small risk that the subject matter of the questionnaires may upset or distress you. In the unlikely event that this happens or you become concerned for any reason, please do not hesitate to contact the supervisor of this project, Dr Gerard Kennedy on (03) 9919 2481 for further advice. Alternatively, you make like to contact a counsellor in your area to discuss any distressing issues with further. (Please see the attached sheet for a list of appropriate counsellors across Victoria).

Benefits
Your participation will help in improving our understanding of the school performance of students with acquired brain injury, and what impact aide support has on this performance.

Voluntary Participation
Your participation in this project is entirely voluntary. You have the right to withdraw from the project at any time. You may contact Dr Gerard Kennedy at anytime during the course of the
study on (03) 9919 2481.

Confidentiality
All information obtained during the course of this study is strictly confidential and, to the extent permitted by the applicable laws and regulations, will not be made publicly available. Data may be reported in scientific journals and will not include any information that identifies your child as a subject in this study.

Records of the project will be kept under safe storage, locked in a filing cabinet until your child is 25 years old in accordance with the University's Code of Conduct for Research. Records may be inspected for purposes of data auditing by authorised persons within the institution (ethics committee) or external regulatory bodies.

Questions
Any queries about your participation in this project may be directed to the researcher Dr. Gerard Kennedy on (03) 9919 2481.

If you have any queries or complaints about the way you have been treated, you may contact the Secretary of the University Human Research Ethics Committee via:

Telephone:
(03) 9919 4710

Post:
The Secretary
University Human Research Ethics Committee
Victoria University
PO Box 14428 MCMC
Melbourne 8001

Thankyou for your interest in this study,

Ruth Tesselaar
Neuropsychological Doctoral Student
Victoria University
ruth.tesselaar@research.vu.edu.au

<u>Available Psychological Services</u>

Metropolitan Melbourne	Service Name	Contact Details
Eastern Metro Region	Anglicare	9720 3488
Northern Region	Bouverie Family Therapy	9385 5100
Southern Region	Centacare	9793 2200
Western Region	Anglicare	9687 5200

Regional Victoria	Service Name	Contact Details
Barwon-South Western	Community Connections	1300 361 680
Gippsland	Anglicare	5133 9998
Grampians	Child and Family Services Ballarat Inc	5332 1434
Hume	Lifeworks	5721 5700
Loddon Mallee	Centacare	5021 2475

VICTORIA UNIVERSITY
PARTICIPANT INFORMATION SHEET
(Students)

Project Title:
School performance of students with acquired brain injury: What is the impact of aide support?

The purpose of the study
This project is being carried out by a Doctorate in Neuropsychology student, Ruth Tesselaar, and will look at the school performance of students with ABI (such as yourself) and the impact that Aide support has on this performance. While there has been a great deal of research which recommends supporting students with ABI at school, there is a current lack of research which looks at the outcome of providing this support. Thus, the purpose of this study is to look at the differences in performances between students with ABI who are provided with various levels of aide support.

Your involvement in the study
Involvement in this study will require you to complete five (5) psychological tests that measure: planning, organisation, attention, speed, memory and learning. It is anticipated that these five (5) tests will take approximately 1 to 1.5 hours.

Two observation session will be done in your classroom – once when the aide is present and once without the aide. Your classroom teacher and aide will also be contacted if you agree to being involved in this study. They will be asked questions about your school performance and they amount of support and training they provide and receive.

Your parents will also be asked some questions about you (such as how old you are), and about how and when you obtained your acquired brain injury.

Risks and Inconvenience
There is a small risk that the subject matter of the questionnaires may upset or distress you. In the unlikely event that this happens or you become concerned for any reason, please do not hesitate to contact the supervisor of this project, Dr Gerard Kennedy on (03) 9919 2481 for further advice. Alternatively, you make like to contact a counsellor in your area to discuss any distressing issues with further. (Please see the attached sheet for a list of appropriate counsellors across Victoria).

Benefits
Your participation will help in improving our understanding of the school performance of students with acquired brain injury, and what impact aide support has on this performance.

Voluntary Participation
Your participation in this project is entirely voluntary. You have the right to withdraw from the project at any time. You may contact Dr Gerard Kennedy at anytime during the course of the study on (03) 9919 2481.

Confidentiality
All information obtained during the course of this study is strictly confidential and, to the extent permitted by the applicable laws and regulations, will not be made publicly available. Data may be reported in scientific journals and will not include any information that identifies you as a subject in this study.

Records of the project will be kept under safe storage, locked in a filing cabinet until you are 25 years old in accordance with the University's Code of Conduct for Research. Records may be inspected for purposes of data auditing by authorised persons within the institution (ethics committee) or external regulatory bodies.

Questions
Any queries about your participation in this project may be directed to the researcher Dr. Gerard Kennedy on (03) 9919 2481.

If you have any queries or complaints about the way you have been treated, you may contact the Secretary of the University Human Research Ethics Committee via:

Telephone:
(03) 9919 4710

Post:
The Secretary
University Human Research Ethics Committee
Victoria University
PO Box 14428 MCMC
Melbourne 8001

Thankyou for your interest in this study.

Ruth Tesselaar
Neuropsychological Doctoral Student
Victoria University
ruth.tesselaar@research.vu.edu.au

VICTORIA UNIVERSITY A NEW SCHOOL OF THOUGHT

VICTORIA UNIVERSITY
PARTICIPANT INFORMATION SHEET
(Teachers and Aides)

Project Title:
School performance of students with acquired brain injury: What is the impact of aide support?

The purpose of the study
This project is being carried out by a Doctorate in Neuropsychology student, Ruth Tesselaar, and will look at the school performance of students with ABI and the impact that Aide support has on this performance. While there has been a great deal of research which recommends supporting students with ABI at school, there is a current lack of research which looks at the outcome of providing this support. Thus, the purpose of this study is to look at the differences in performances between students with ABI who are provided with various levels of aide support.

Your involvement in the study
Involvement in this study will require you to complete one questionnaire and a semi-structured interview to collect information on an identified students classroom functioning and behaviour. You will also be asked about the amount of support and training you provide and receive when working with this student. It is anticipated that this will take approximately half-an-hour maximum.

Two classroom observation sessions of the student will also be undertaken, one with the aide is present and one with no aide.

Risks and Inconvenience
There is a small risk that the subject matter of the questionnaires may upset or distress you. In the unlikely event that this happens or you become concerned for any reason, please do not hesitate to contact the supervisor of this project, Dr Gerard Kennedy on (03) 9919 2481 for further advice. Alternatively, you make like to contact a counsellor in your area to discuss any distressing issues with further.

Benefits
Your participation will help in improving our understanding of the school performance of students with acquired brain injury, and what impact aide support has on this performance.

Voluntary Participation
Your participation in this project is entirely voluntary. You have the right to withdraw from the project at any time. You may contact Dr Gerard Kennedy at anytime during the course of the
study on (03) 9919 2481.

Confidentiality
All information obtained during the course of this study is strictly confidential and, to the extent permitted by the applicable laws and regulations, will not be made publicly available. Data may be reported in scientific journals and will not include any information that identifies you or your school as having taken part in this study.

Records of the project will be kept under safe storage, locked in a filing cabinet until the identified student is 25 years old in accordance with the University's Code of Conduct for Research. Records may be inspected for purposes of data auditing by authorised persons within the institution (ethics committee) or external regulatory bodies.

Questions
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Thankyou for your interest in this study.

Ruth Tesselaar
Neuropsychological Doctoral Student
Victoria University
ruth.tesselaar@live.vu.edu.au

VICTORIA UNIVERSITY

Consent Form for Participants Involved in Research (Parents)

INFORMATION TO PARENTS:
We would like to invite you and your child to be a part of a study looking at the school performance of students with Acquired Brain Injury and the impact that differing amounts of Aides support (from no support to high levels of support) have on this performance.

CERTIFICATION BY PARENT/GUARDIAN

I, ___________________________________ of ___________________________________
certify that I am voluntarily giving my consent for myself (above mentioned) and my child
__________________________ to participate in the study entitled:

School performance of students with acquired brain injury: What is the impact of aide support?

being conducted at Victoria University by Dr Gerard Kennedy and Ruth Tesselaar.

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by Ruth Tesselaar and that I freely consent to my and my child's participation in the use of these procedures:

Procedures:

- Child:
  - Neuropsychological testing
  - Observations of classroom performance
- Parent:
  - Being asked about demographic information of your child (eg: age, date of birth) and background medical information about your child (eg: date of injury, type of injury, severity of injury).
  - Completing a behaviour rating inventory of executive functions
- Contacting my child's teacher and/or aide to collect information about my child's:
  - Classroom functioning and behaviour, and;
  - Support levels provided to and by the school.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed: **..**

Witness other than the researcher (as appropriate): **...**

Date: ....

Any queries about your participation in this project may be directed to the researcher (Dr Gerard Kennedy, ph. (03) 9919 2481). If you have any queries or complaints about the way you have been treated, you may contact the Secretary, Victoria University Human Research Ethics Committee, Victoria University, PO Box 14428, Melbourne, VIC, 8001 (telephone no: (03) 9919 4710).

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Consent Form for Participants Involved in Research (Students)

INFORMATION TO PARTICIPANTS:
We would like to invite you to be a part of a study that is looking at the school performance of students with Acquired Brain Injury and the impact that different amounts of Aide support have on this performance.

CERTIFICATION BY PARTICIPANT

I, ___________________________________of ___________________________________

certify that I am voluntarily giving my consent to participate in the study entitled:

School performance of students with acquired brain injury: What is the impact of aide support?

being conducted at Victoria University by:

Dr Gerard Kennedy and Ruth Tesselaar

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Ruth Tesselaar

and that I freely consent to my participation in the use of these procedures:

Procedures:
- Neuropsychological testing
- Observations of classroom performance

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed: **..**

Witness other than the researcher (as appropriate): **..**

Date: ....

Any queries about your participation in this project may be directed to the researcher (Dr Gerard Kennedy, ph. (03) 9919 2481). If you have any queries or complaints about the way you have been treated, you may contact the Secretary, Victoria University Human Research Ethics Committee, Victoria University, PO Box 14428, Melbourne, VIC, 8001 (telephone no: (03) 9919 4710).

VICTORIA UNIVERSITY A NEW SCHOOL OF THOUGHT

VICTORIA UNIVERSITY

Consent Form for Participants Involved in Research
(Teachers and Aides)

INFORMATION TO TEACHERS AND AIDES:
We would like to invite you to be a part of a study looking at the school performance of students with Acquired Brain Injury and the impact that differing amounts of Aides support (from no support to high levels of support) have on this performance.

CERTIFICATION BY TEACHER OR AIDE

I, ___________________________________of _____________________________________

certify that I am voluntarily giving my consent to participate in the study entitled:

School performance of students with acquired brain injury: What is the impact of aide support?

being conducted at Victoria University by:

Dr Gerard Kennedy and Ruth Tesselaar

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Ruth Tesselaar

and that I freely consent to my participation in the use of these procedures:

Procedures:

- Being interviewed on the topics of:
    - Current supports being provided for a specific student with ABI (where consent is also obtained by the parents and the student); and
    - Training and supports received about students with ABI
- Completing a behaviour rating inventory of the student's executive functions

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed: **..**

Witness other than the researcher (as appropriate): **...**

Date: ....

Any queries about your participation in this project may be directed to the researcher (Dr Gerard Kennedy, ph. (03) 9919 2481). If you have any queries or complaints about the way you have been treated, you may contact the Secretary, Victoria University Human Research Ethics Committee, Victoria University, PO Box 14428, Melbourne, VIC, 8001 (telephone no: (03) 9919 4710).

Appendix 8: The ideal aide as described by secondary school students with an ABI

The Ideal aide (as described by secondary school students with an ABI)

“No idea! Follow the rules. Give me breaks, but I won’t always need them. Ask me to do things nicely, rather than tell me….It would be good if the aide was an expert in every subject so they can help me more i.e., aides wont know the answer to an IT question. I have a good relationship with my main aide, she reminds me that I worked better in Year 7 and this motivates me to try harder. The other aides I don’t have all the time. I would prefer to have one main aide.”

- John, aged 15 years, 11 months.

“Is smarter. I want the aide to help everyone, not just me [so I am not singled out]. I need more independence; they should wait for me to ask for help. I want an aide to be more useful and less in my face. Useful would be smarter, explaining what to do and how answers are obtained, rather than just giving them to me. ”

– Paul, aged 14 years, 10 months.

“Is nice, but not too nice. Nice 90%, and mean 10%. They have to be able to tell me 'no'. An ideal aide doesn’t sit next to me, doesn’t sit on the corner of my table. They come when my hand it up. They are a non-smoker and dresses nice.”

- Jane, aged 15 years, 5 months.

“It would be good if the aide was there all day. But I don't want an aide at recess and lunch because I’ve got friends to hang out with.”

– George, aged 15 years, 3 months,