A case study of

gifted visual-spatial learners

A thesis presented in partial fulfilment of

the requirements for the degree of

Masters in Education

Massey University, New Zealand

Sharon Mansfield, 2014

Acknowledgements

Carrying out educational research and writing up the results to share what has been found has been an exciting opportunity. Sharing personal experiences with an unknown audience has been slightly daunting for me and I sincerely thank those who have similarly put themselves into my hands, and had faith in my ability to express the essence of their experiences. The fact that participants in this research project were, without exception, so eager to contribute, is a measure of their common desire to add what they could to the telling of this story. It was truly a special privilege to be welcomed into your homes, classrooms and workplaces and I am very grateful for the open and reflective conversations that took place between us.

I would especially like to acknowledge with love, my two wonderful gifted visual-spatial learner sons. This whole journey has been about and for you. Thank you for the insights you have shared with me as we have travelled this road together. Also, all the other gifted visual-spatial students I have had the pleasure of knowing and learning alongside – my wish for all of you is that you find a place of passion where your very special gifts can enhance your lives and be appreciated by others.

I would also like to acknowledge the positive support of my supervisors, whose continued faith in me was so valuable in maintaining the effort needed to complete what began as a gem of an idea and turned into a saga! Thank you for your genuine interest in my writing and the encouragement you have given me at every step of the way. I have learned so much and sincerely thank you both for your thoughtful and thought-provoking guidance.

Finally I would like to acknowledge all the teachers who work so hard in our schools throughout New Zealand. Your job is one that constantly challenges and I have so much admiration for the colleagues who I see daily, striving to make improvements to meet the diverse learning needs of their students. The contents of this research may necessarily challenge you some more. However I hope that what you find within this thesis will support you in responding with greater understanding to enable a further group of children to experience success with their learning.

Dedication:

This is for all gifted visual-spatial children – those with the gift of magic in their minds and potential to create unique solutions to common problems – children that the rest of the world need to nurture, now more than ever.

ABSTRACT

This thesis explores a group of learners who have exceptional visual-spatial abilities relative to their same age peers. These abilities give them the potential to achieve success in areas where the capability to visualise three dimensional images and manipulate those images in space contributes to a creative problem-solving mindset that is highly valued in today's globally competitive world of innovative technology.

Literature reviewed to background the investigation topic suggested characteristic differences in the way these learners process information can create barriers to successful classroom learning. It was reported that consequent areas of challenge within traditional academic domains, together with their exceptional ability being not often recognised or valued in schools, contributes to gifted visual-spatial learners being an "invisible group". These findings lead to the development of a primary research aim to describe these differences and explore how they affect the learning experiences of these students. As part of this investigation, the extent to which the exceptional visual-spatial abilities were recognised and how well their need for a differentiated curriculum was understood was also evaluated.

A case study approach has been utilised to create in-depth descriptions of three students who, following completion of a cognitive assessment profile by a professional with acknowledged expertise and knowledge about gifted students, had been identified as gifted visual-spatial learners. A photo elicitation technique was incorporated into the case study methodology as it was considered that this would mesh well with the characteristic processing style of the participants. Semi-structured interviews were conducted with participants using photographs that they had taken in response to stimulus questions posed at an initial meeting. The photographs provided a concrete visual product that linked to personal experiences as a prompt for communication to encourage meaningful discussion. Observations were undertaken of the learners in learning environments and semi-structured interviews were carried out with teachers and parents. Further data was gathered from analysis of unobtrusive artefacts such as assessment reports and samples of work.

The resulting information is presented as three case descriptions followed by a discussion section. Particular attention has been given to describing learning characteristics that set these students apart and discussion of how these differences impact on academic achievement. Aspects that supported successful learning experiences were also identified and recommendations for classroom practice and for future research have been made.

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Chapter One

Introduction:

1.1 Context of the Study

Recognising that personal experiences will have unavoidably flavoured the subsequently presented material in this thesis, one purpose of this preliminary chapter is to gift to readers some background that will help them with making sense of the viewpoints that are offered within. Readers of this work will have a wide-ranging beliefs and experiences of their own and these will colour the lens through which they view what is written. Some may closely share the perspective given; others may find their own ideas and opinions contrast markedly. This divergence is to be expected.

An important motivational aspect for me in writing this thesis has been that I have a story to tell. Through sharing some of the background of my own experiences and the knowledge that I have gained and thereby placing this research within a lived experience, I hope that readers will understand a little more clearly the ethos that has informed both my research decision-making process and the conclusions that have been drawn from the resulting data.

The research phase for this thesis was in fact unwittingly begun 14 years ago when it was suggested to me by a new school principal that the cause of my then 9 year old son's difficulties at school could probably be attributed to his giftedness. The proposal that he might be considered gifted was not one that I had previously entertained; giftedness was a novel idea that I knew nothing of beyond its application to the very few profoundly gifted individuals who had achieved acclaim for their exceptional ability in a field – the Mozarts and Einsteins of the world. However this one comment proved a catalyst that saw me set off down a very long path of discovery, uncovering many illuminating findings along the way.

While everyone who travels this road experiences the journey differently due to individual circumstances, experience has shown me that generally parents share a very empathetic perception of the joys and the tribulations of raising a gifted child. An integral component of the concept of giftedness is that it describes a human condition wherein the gifted individual is significantly different to most others around

them, and this difference can have far-reaching effects. It would be fair to say that it is typically the more negative aspects of the experience that sends one in search of information. The down-side of being an exceptional learner includes concerns such as difficulties faced at school because of unconventional behaviours. An example of this could be the questioning attitude that grows out of exceptional cognitive ability or manifestations of frustration from a student when academic content fails to meet their need for appropriate challenge. Exploration of gifted education resources very quickly triggers recognition and a sense of familiarity with many of the concepts and concerns described. That is certainly how it was for me and I expect many parents who read this thesis could share a similar story.

I was to discover that both my two sons are strongly visual-spatial gifted learners. Both also often found school to be a hostile environment where those who worked with them lacked knowledge that was needed to understand their differences and to appropriately support their learning and development. For me, a real turning point came in 2005 when I attended a presentation by Linda Kreger Silverman. Linda came to New Zealand to speak on the topic of gifted visual-spatial learners. Listening to her talk about her work in the United States with these children, I recognised so many of the issues that had challenged my own boys' learning. At this point my elder son's giftedness had been confirmed by a cognitive assessment carried out by an educational psychologist. The difficulties he experienced at school had been explained as being due to his giftedness with complications of dyslexia and a question mark had been raised over a possible attention deficit disorder but until this point, the consequences of his exceptional visual-spatial ability had not been understood.

As well as my parenting experience, I also taught for a number of years in a one day a week gifted withdrawal programme. Over this time I had the very special privilege of working with many other young gifted visual-spatial learners and their families. While designed for gifted learners generally, students who had exceptional visual-spatial strengths often found their way into this programme as their parents searched to find understanding of their child's distinctive and unusual style of understanding and learning. Witnessing first hand in a very personal way just how it is for children in our classrooms who are gifted visual-spatial learners has provided motivation for me to pursue answers as to why they can often struggle and how they can be helped.

1.2 Justification of the Need for this Research

The underlying motivation for this study came therefore, from my own experiences of living and working with children who shared the characteristics, strengths and difficulties that were described by Silverman. The purpose of this research is to provide understandings around how gifted visual-spatial learners learn and to encourage further study and research into this topic. As a parent I found very little understanding of the differences that shaped the way that my gifted visual-spatial learner sons could learn best was held by their teachers. As a teacher myself, I see that educators work extremely hard to put in place programmes to support the learning of their students. The programmes that they use are designed on the back of research findings that support what works. My objective in undertaking this study has been to provide a platform to build from in considering the special needs of, and what works best for, this up until now under-recognised and under-served group of students.

Lubinski and Kell (2013) observed recently that the importance of spatial ability to achievement within STEM fields (Science, Technology, Engineering and Mathematics) has long been recognised. They pointed out that many eminent scientists and technologists have described how their use of image-based thinking played a central role in their creative breakthroughs. They also reviewed five recent major investigations that all confirmed the critical role played by visual-spatial ability in occupations that encompass creative endeavours. Innovation is critical to the wealth and well-being of a nation and as such people who have these aptitudes should be valued and nurtured, as resources that can contribute to improving the quality of life for all. Enabling their success should feature highly among the priorities of a country's leadership. In aiming to "Grow New Zealand for All", New Zealand's Ministry of Business, Innovation and Employment seek to provide a desirable lifestyle for all New Zealanders by encouraging more productive and internationally competitive business opportunities and thereby increasing employment to contribute to sustainable economic growth (Ministry of Business, Innovation and Employment, 2014). The New Zealand Government has in recent times instigated a number of initiatives in recognition of benefits to be gained from closer collaboration between sectors, including the Ministerial Cross-Sector Forum on Raising Achievement which recognises the importance of quality information-based teaching to raise achievement

and enable educational success for all learners (Ministry of Education, 2014). However awareness of the differences that students with high visual-spatial ability have and how these differences affect their learning has received no ministerial recognition in New Zealand, and both their potential value and their educational needs remain unacknowledged.

Lubinski and Kell (2013) explored the value historically assigned to spatial ability internationally. In the gate-keeping role that education plays in allowing individuals to progress to positions of advanced scholarship, it is suggested that the implications of high spatial ability have not featured in any significant way. Spatial ability is considered by Lubinski and Kell to have been stereotypically viewed as appropriate to trades and not of relevance to those pursuing professional careers. College admission in the United States is based largely on SAT (Scholastic Assessment Test) scores which measure verbal and quantitative reasoning only. The implied assumption is that reading and writing ability indicates the intelligence needed to succeed in academic settings and that spatial ability does not. More recently however, the importance of spatial ability to success in a variety of domains has been acknowledged through inclusion of a Spatial Test Battery within the assessments that can be carried out to identify talented youth and provide appropriately for their educational needs (Stumpf, Mills, Brody and Baxley, 2013).

In New Zealand, when schools think about the needs of those who are deemed to be gifted and talented, they are urged to consider the abilities of their students in a multi-categorical fashion (Ministry of Education, 2012). In this way, our educational policy could be seen as equally valuing all domains of giftedness. And yet, it seems there is an imbalance here whereby we believe that all domains should be valued equally on one hand, however in terms of significance given within educational provision, we also continue to fail to follow through with equitable provision for exceptional abilities that are not based upon verbal and quantitative reasoning capabilities.

1.3 The Research Problem

Identification in New Zealand schools of this group of learners has been noted to be problematic and understanding of the visual-spatial learner concept limited. Questions raised by the literature review findings included asking how well the impact that having exceptional visual-spatial abilities has on how these students learn is understood. More fundamentally, what can be done to ensure that our young citizens who have exceptional visual-spatial abilities are provided with appropriate educational experiences that will see them develop these optimally?

The primary aim of this study has been to describe the nature of the differences demonstrated by this group of children and to describe how these differences affect their experiences and in particular their learning, within a New Zealand context. A secondary objective of the investigation - to ascertain the extent to which the gifted visual-spatial learners in this study are recognised, valued and empowered to develop their exceptional abilities through equitable access to differentiated and culturally responsive provisions (Ministry of Education, 2012) - has further guided the data collection process.

Research questions used to focus this study were:

1. In what ways does the gifted visual-spatial learner experience learning?
2. What do they know and how do they feel about their learning differences?
3. What do their teachers, parents and significant other adults know about their learning differences?
4. How does each of these individuals respond to these differences?

The information elicited has been of the type that provides insight into how gifted visual-spatial learners perceive, store and use information. This study has sought to describe how they and significant others in their lives recognise the aspects of their learning that set them apart and how these differences are responded to. This thesis describes the procedure used to collect this data and reports on findings.

1.4 Organisation of this Thesis

This thesis comprises eight chapters, a reference list and appendices.

Chapter One introduces the thesis and provides the researcher's personal background. An outline of the justification for the topic leads into a description of the research problem.

Chapter Two reviews literature on gifted and talented learners, highlighting issues around definition. Background to the gifted visual-spatial learner concept is explored and identification practices are discussed. Literature around the topic of how visual-spatial learners learn is also reviewed.

Chapter Three describes the case study methodology and research design used in this study. The data gathering tools are described with particular discussion of the photo elicitation technique used. The process undertaken to collect data and analyse the results is outlined. Ethical considerations that were accounted for are then discussed.

Chapter Four introduces the Case Descriptions and then describes Case A, beginning with learner characteristics. Learning strengths and challenges are described followed by elements that support learning.

Chapter Five describes Case B, beginning with learner characteristics. Learning strengths and challenges are described followed by elements that support learning.

Chapter Six describes Case C, beginning with learner characteristics. Learning strengths and challenges are described followed by elements that support learning.

Chapter Seven provides discussion on the three cases, beginning with a section that describes the different way these learners process information. Aspects that are challenging for them are discussed followed by examples of responsive teaching and learning and other elements that meet needs outlined earlier. Finally, differences observed in the understanding of significant others in the gifted visual spatial learners' lives are explored together with the extent of their self knowledge.

Chapter Eight describes conclusions reached. The nature of differences observed is summarised, together with how these differences affect the learning experiences of the three case study participants. The extent to which the exceptional abilities these students possess are recognised and valued is described. Implications of these findings are summarised and recommendations for teacher practice and professional learning opportunities provided. Finally, limitations to the scope of this research are discussed and recommendations for future research are made.

Chapter Two

Literature Review:

Creating one inclusive definition for the term 'gifted and talented' is not a simple task because, for one thing, those who the term seeks to describe are such a diverse group (Reis & Sullivan, 2009). In New Zealand, the Ministry of Education, recognising that any definition must fit the context in which it operates, expects that each school will research, consult and formulate an appropriate definition for their own setting (Ministry of Education, 2012). In accordance with this philosophy, the first section of this chapter provides a brief overview of key considerations to be taken into account when designing a definition, in order that the subject of discussion here, gifted visual-spatial learners, are contextually understood. This involves an outline of the term 'gifted and talented' with particular reference to a New Zealand context, followed by an explanation of the background behind the term 'visual-spatial' learner. Having described this group of learners, the next section discusses barriers to their identification and looks at a variety of tools that can be used to identify students who have exceptional visual-spatial abilities. The final Literature Review section explores research that has been conducted into the different way that these learners process information and learn. The chapter concludes by touching on the importance of providing those who have exceptional visual-spatial abilities with opportunities to use and develop these skills.

2.1 Gifted and Talented Learners

'Gifted and Talented' is an umbrella term that needs to be unpacked in order that a shared understanding of the subject of this study is reached. The sections that follow explore some background to the usage of the term in New Zealand together with a selection of international theory that has informed its development here. New Zealand based research and policy designed to guide schools in creating their gifted and talented definition is explored along with some of the values that colour individual perception of the concept. Behavioural characteristics that are commonly noted to apply to gifted learners are examined and the importance of their inclusion as part of a multi-dimensional identification process is discussed. Finally, a definition of 'gifted and talented' is proposed for the purposes of this study.

2.1.1 How is 'Gifted and Talented' Defined in New Zealand?

The closest the Ministry of Education has come recently to suggesting a national definition for gifted and talented was in 2002 with the publication of a gifted and talented education policy statement *Initiatives for gifted and talented learners* wherein they stated, "Gifted and talented learners are those with exceptional abilities relative to most other people. These individuals have certain learning characteristics that give them the potential to achieve outstanding performance" (Office of the Minister of Education, 2002 cited in McDonough & Rutherford, 2011). Although this policy statement is no longer available online, this excerpt is currently quoted on the Ministry's resource webpage TKI under the heading 'Being Gifted' (Ministry of Education, n.d.a) where it is suggested as a good definition of giftedness. Acknowledgement of exceptionality in relation to peers is also highlighted as a criterion for development of a school-based definition of giftedness and talent within the Ministry's Handbook for meeting the needs of New Zealand gifted and talented students (Ministry of Education, 2012). It has been adopted by many New Zealand schools as part of their school definition and certainly seems a good place to start.

2.1.2 Gifted? Talented? Gifted *and* Talented?

There are different conceptual views encompassing the meaning of the words gifted and talented. The simplest approach to the terminology is to consider the two words to be synonymous and use the 'double-barrelled' label as a kind of catch-all and this is a common practice. However this approach reflects a lack of depth of understanding of the theory behind the concept. Some theorists assign some kind of differentiation and an understanding of their reasoning can help to enrich our ability to recognise our gifted and talented learners and to appropriately support them. It also helps to highlight some of the myths and misunderstandings that can exist as roadblocks to effective identification and provision.

Tannenbaum (2003) wrote that giftedness was a status to be attained upon excelling and that while children may show "promise" they can not be considered gifted until they have demonstrated the kind of superior accomplishment that is achieved later in life. However this belief does little to assist educators to foster talents in a way that

will help students who show promise to have the assistance they need to develop into accomplished adults. Rather, it promotes the unfortunate view that the gifted are the cream that will rise to the top, without any assistance (Cathcart, 2005).

Borland (1997) considered the word 'gifted' to be a term invented in order to conveniently label a group of supposedly superior human beings such that it is a socially constructed term rather than a 'real entity'. This critical analysis is reflective of an egalitarian view, explained by Adams et al. (2000) as an ethos that is concerned with achieving a society which has social equality. Social equality is an admirable aim, however Borland is himself applying a value statement to the reality that some individuals have the physical or mental capability to achieve results that others cannot. In considering Borland's viewpoint, the concept of Olympic medallists is a similarly socially-invented term; however we freely acknowledge the reality that some athletes are physically superior to a degree that enables them to outperform their competing rivals, and we honour them for this. His opinion does however highlight the importance of giftedness being viewed as a multi-cultural concept that is to be found across all socio-economic strata, that it takes more than ability alone to achieve success and that we need to acknowledge the barriers to achievement that many of our gifted young people face.

Callahan (1997) wrote that usage of the appendage 'talented' had been applied in an inconsistent and unclear way throughout the history of the field known as gifted education. Sometimes it has been used to distinguish between academic giftedness and other non-intellectual forms, sometimes to denote a lower level of "potential" giftedness, and most recently it has supplanted the term gifted altogether.

A very different view was taken by Gagne (1995) who proposed that giftedness be used to describe outstanding *natural* abilities, or aptitudes, and talent be applied to *systematically developed* abilities, or competencies. He felt that this differentiation acknowledged that giftedness could be found very early on in a child's life in the form of genetically endowed capacity, and that use of the term talent to signify abilities that have developed over time as a result of the influences of environmental and intrapersonal factors, highlighted the importance of providing effective support to aid positive development.

One of the key words in the Ministry's definition given above is 'potential'. This suggests, and rightly so, that the target group have some core aspect or aspects of their developmental make-up that give them the capability to become an expert in their area of ability. This thesis will advance the view that giftedness can be difficult to recognise in an academic setting. We are helped when we can identify what those core aspects look like and understand how they can feed, or sometimes hinder, a student's progress.

This variety of viewpoints emphasises the importance of schools having a clear grasp of current research and policy that exists to provide for the needs of their gifted and talented students. It draws attention to some of the pitfalls that exist and need to be considered as educators construct their understandings in response to the task of recognising and providing for the gifted and talented students that they teach. Also highlighted is the critical factor that informed and supportive adults, in all settings that impact on the learners' development, are an essential element in enabling educational success for this group of students.

2.1.3 Ministry of Education Guidelines

The Ministry of Education in New Zealand has set out clear guidelines, grounded in current research, to assist schools as they wrangle with defining the concept for their own purpose. In their publication *Gifted and Talented Students: Meeting their Needs in New Zealand Schools* (Ministry of Education, 2012) the Ministry notes the movement that has occurred away from defining giftedness and talent solely in terms of intellectual aptitude, describing it instead as a multi-categorical concept that involves a much wider range of abilities. Students may have exceptional ability in relation to their peers, in one or more areas. Also, the abilities and qualities ascribed will be those that are valued in our schools' communities, and as such must reflect the multicultural perspectives that are present in our school populations. In particular, the cultural values and conceptions of giftedness and talent that are upheld by Maori must be incorporated within each school's definition and provision.

Beyond the abilities themselves, a definition should also consider the social, emotional and motivational aspects that present and create educational needs for

gifted students. In line with this, behavioural characteristics such as advanced language and thought, curiosity, early abstract thinking and intrinsic motivation, that will form part of a holistic concept of giftedness and talent must be considered and accounted for (Ministry of Education, 2012).

Finally, the guidelines direct that however the two terms are understood, it is important for gifted and talented education to recognise and foster potential as well as demonstrated performance. Provision of a responsive programme is recommended in recognition that giftedness and talent may emerge at different times (Ministry of Education, 2012).

2.1.4 The Political Context

In much the same way that the Ministry of Education has directed New Zealand schools to formulate their own definition that will fit into their local context, in composing a definition in the New Zealand context for this thesis, it follows that consideration should be given to the political situation into which this work will be situated. Historically, the international field of gifted education has been fraught with tension as those who have championed the cause of fighting to have the needs of gifted children met have struggled against inequities that often arise out of myth-based belief systems. These include the belief that the advanced abilities of gifted students give them all they need to succeed with no other assistance required (Bain, Bliss, Choate & Sager-Brown, 2007; Cathcart, 2005; Tomlinson, Tomchin, & Callahan, 1994) and the social injustice myth that holds the gifted are an unfairly advantaged elite class (Borland, 1997, McCoach & Siegle, 2007).

These inequities can be further promulgated by political agendas. When the political eye is focused sharply on the dollar sign that sits on the bottom line, it seems that meeting the needs of gifted children assumes importance only when they are viewed as future assets that require capital investment in order for those in power to reap the greatest return from them when they mature. The concept of 'gifted and talented' viewed through the lens of this value set can differ to that viewed from the perspective of those for whom a successful outcome is a well rounded young person who has received the best assistance a system can offer and therefore stands ready to take their

place in society in whatever capacity they themselves and their own culture, find rewarding.

Gross (2003) wrote of this tension, stating that there are two significant outcomes to be gained by meeting the needs of gifted and talented students. Firstly, she acknowledged that investment in assisting them to reach their potential will benefit society in general (termed the "national resource" rationale). Secondly, she recognised that individual gifted students have significantly different learning needs from other children and that they have the right to an education that meets these (referred to as the "special education" rationale). Gross refers to the 'equity vs excellence' debate as a barrier in earning support for gifted and talented provision. She describes how, in the deeply class conscious United Kingdom, cultural bias against intellectually gifted children and fears of elitism were major barriers to successful policy implementation.

The same egalitarian values are a hurdle to provision in New Zealand. The set of core principles adopted by our Ministry of Education (Riley, Bevan-Brown, Bicknell, Carroll-Lind & Kearney, 2004) are very clear about the diversity of gifted and talented students that need to be reflected upon when designing their definitions; however in allocating funding at the coalface, it remains problematic that gifted and talented students are seen as competing with other 'special needs' programmes in an inequitable way.

This clash of values is mentioned because of its tendency to colour every other aspect of the discussion around definition and provision for gifted and talented children. There are many elements that we can discuss to add to our understanding of the gifted and talented population but in order to depict or view them accurately these must be placed in the socio-political context in which they are grounded (Adams & Bethell, 2004). In New Zealand, this means including also the unique cultural background of our bicultural heritage as well as reviewing recent policy changes, all the while being mindful that these too, have been constructed under the political framework operating at the time.

2.1.5 Behavioural Characteristics

In their 2008 review of New Zealand schools' provision of gifted and talented education, the Education Review Office wrote that effective definitions should be multi-categorical and multi-cultural, recognise multiple intelligences and recognise potential and demonstrated giftedness and talent. Furthermore, they recognised that teachers needed the ability to recognise "the diversity of characteristics and behaviours for gifted and talented students, including ways of learning, creative thinking, motivation, social leadership and self-determination" (Education Review Office, 2008, pg 6) in order to appropriately identify gifted and talented students. Beyond looking for success within academic domains, schools that recognise and understand the characteristics and behaviours displayed by gifted students will more effectively identify and provide for their gifted and talented population. As stated by Delisle (2000), rather than considering giftedness as something students do, a more practical approach is to think of it as something that they are.

Moltzen (1996) pointed out that when the full gamut of categorical, cultural and social diversity is contemplated, presenting a standardised list of characteristics of giftedness becomes unfeasible. However such lists abound and while the qualities specified differ depending on whether the focus of the list is on general intellectual ability, creativity, leadership or a specific academic ability, knowledge about the recognised traits of each is necessary if schools and teachers are to respond appropriately to the learning needs that these behaviours create.

Recognised "subtypes" of giftedness complicate the task of defining who the gifted and talented are within a school's population. This wide diversity within the concept of giftedness and talent is a barrier to effective identification and provision (Education Review Office, 2008). While high achieving and conforming students are most likely to be identified as gifted and talented there are other categories of gifted students who often, for a variety of reasons, fail to meet with success at school and fail to have their exceptional abilities recognised and nurtured (Betts & Neihart, 2010; Heacox, 1991).

Within the literature on gifted and talented education one doesn't have to look far to come across a range of characteristics that describe the less positive side of this concept.

Betts and Neihart (2010) include high creativity coupled with frustration and boredom, students who resist authority, are disruptive or off task, as examples of traits that can lead to difficulties at school. Heacox (1991) adds students who are risk-averse, or complacent, to the list of barriers that can preclude gifted learners from achieving to the level that they otherwise appear capable of. Porter (2009) writes that gifted students who have a preferred learning style that places them at odds with most commonly used teaching methods can appear to be unmotivated and their behaviour may lead to them being perceived not to be gifted at all.

Asynchronous development is another commonly noted characteristic of gifted learners that can complicate their identification and add to their special education needs. Asynchrony is the term used to describe the way that physical, emotional and intellectual development can be markedly uneven within a gifted individual and also places the student out of step with their age peers (Raethel, 1982). Asynchronous development was the cornerstone of the gifted definition arrived at in 1991 by the Columbus Group in the United States:

> *Giftedness is asynchronous development in which advanced cognitive abilities and heightened intensity combine to create inner experiences and awareness that are qualitatively different from the norm. This asynchrony increases with higher intellectual capacity. The uniqueness of the gifted renders them particularly vulnerable and requires modifications in parenting, teaching and counseling in order for them to develop optimally.*
>
> (Morelock, 1992)

Another characteristic commonly attributed to gifted individuals is that of intensity. Winner (1996) agreed that gifted children share the three primary characteristics that are mentioned above. Firstly, she described precocious development that is significantly advanced when compared with their age peers. Secondly, Winner saw that they have a qualitatively different way of learning that often sees their precocity developing through an ability to work independently on self-directed tasks. Thirdly, she wrote of observing this intrinsic motivation highlighted within their capacity for intense concentration and desire to make sense of their world. This third characteristic is expanded on by Delisle (2000) who described it in context of the relationship between intensity and the gifted child's exceptional capacity for thought, sense of purpose, emotional response, spiritual

connection and reflection on philosophical questions, and the intellectual, social and emotional needs that these combinations create.

The intensities described above are often related in the literature to exceptional sensitivity. The concept of overexcitabilities described within Dabrowski's Theory of Positive Disintegration has been adopted widely within gifted education due to its capacity to describe many forms of intensity that commonly affect gifted students. Dabrowski wrote that "overexcitability is a higher than average responsiveness to stimuli due to heightened sensitivity to nervous system receptors" (Dabrowski, 1972 cited in Mendaglio, 2008). Mendaglio (2008) wrote that those so endowed perceive the world differently, in a multi-faceted manner and with more intensity than those without.

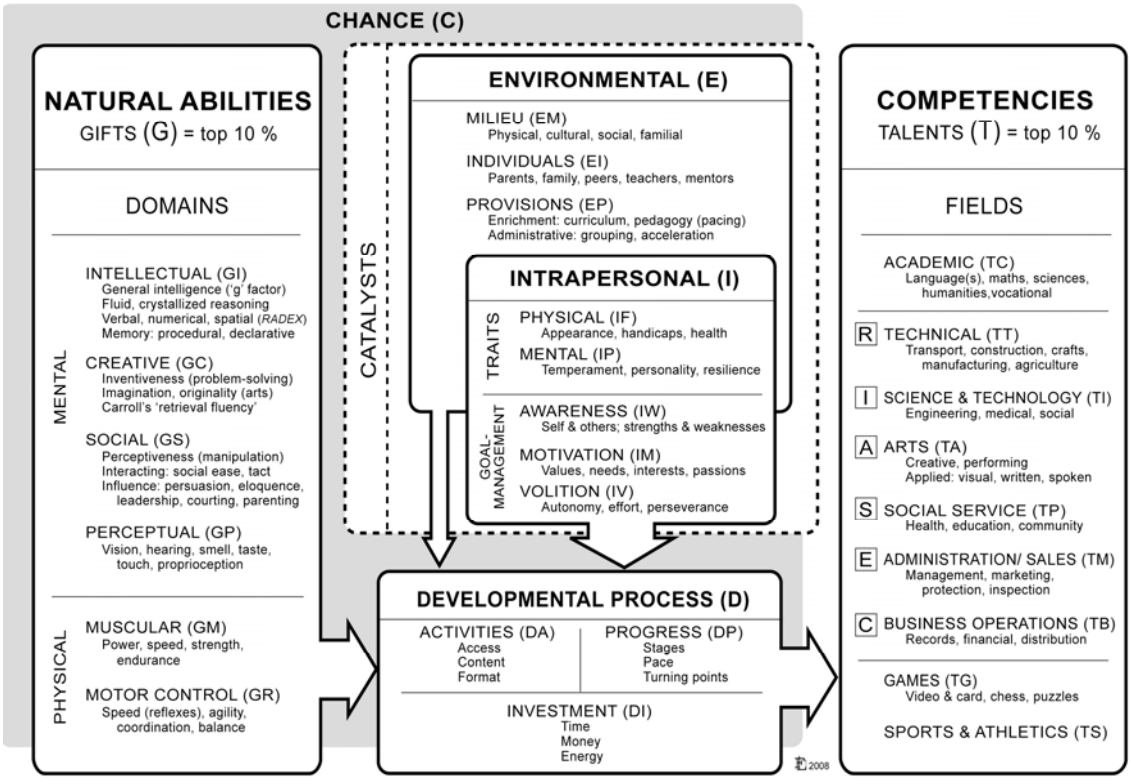
Overexcitabilities are classified into five forms: psychomotor, sensual, imaginational, intellectual and emotional. These intensities can result in the gifted child displaying behaviours others may be uncomfortable with and find to be overwhelming. For example the increased sensitivity of sensual overexcitability can cause a child to feel over stimulated by or uncomfortable with sensory input. They may seek out physical sensations or alternatively, they may withdraw from stimulation. Sensually overexcitable children may find clothing tags, classroom noise, or smells from the cafeteria so distracting that schoolwork becomes secondary (Lind, 2001).

Webb et al. (2004) added to the list of problematic behaviours associated with characteristic strengths in gifted children. They warn of the danger of mis-labeling that derives from a lack of knowledge among professionals about normal gifted behaviours thus leading to incorrect assumptions of pathology and inappropriate diagnoses of disorders such as Attention Deficit Hyperactivity Disorder, Oppositional Defiant Disorder, Bi-Polar and other Mood Disorders. Behaviours such as sensitivity, idealism, impatience, and questioning the status-quo aren't in and of themselves a problem, but when coupled with the characteristic intensity of the gifted child the result often creates a major problem that most significantly occurs within unsympathetic environments (Webb & Kleine, 1993). We need to keep these issues in mind as we move on towards discussion that focuses on gifted visual-spatial learners as a group who are at risk of underachievement and misidentification.

The Ministry of Education suggests reversing such underachievement must begin by ensuring that gifted students who are displaying these behaviours are identified (Ministry of Education, 2012). Identification processes that restrict identification to a narrow group of already successful students feed the myth of gifted and talented provision being elitist and that these students don't require any additional support to meet their potential. Blackett and Webb (2011) point out that studies that find gifted and talented students to be well adjusted and to have qualities that advantage them in meeting social and emotional challenges have generally utilised academically talented students for their study subjects, sourced from programmes that have identified them because of their success.

2.1.6 Finding the Hidden Groups

As previously mentioned, Gagne's Differentiated Model of Giftedness and Talent (DMGT) defines and describes the natural abilities or gifts possessed by very young children (G), along with all of the moderating factors (C, E and I: Gagne's 'catalysts') that act upon these abilities as children progress along a developmental path (D) towards resulting competencies or talents (T) (as shown in Figure 1 below).



[Figure 1, Differentiated Model of Giftedness and Talent, Gagne, 2009]

Gagne's contribution to the field is included in this section of the discussion because of the inherent concept he espouses - that students will not necessarily be displaying evidence of talent or even of their giftedness in our regular classroom settings. This particularly applies to gifted visual-spatial learners, for reasons that will be made clear. He also recognised intellectually gifted and academically talented as the group that are most likely to be targeted by current gifted and talented educational provisions (Gagne, 1995). While the common but somewhat superficial identification practice of identifying intellectually gifted and academically talented students accounts for those who have successfully negotiated and benefited from a systematic program of training and practice, it fails to acknowledge gifted students who are in need of programme modifications and/or extra support with any of the catalytic aspects identified in Gagne's model in order to reach their potential. Gagne's DMGT has been recommended by the Ministry of Education as "one that connects to the principles and practices advocated … (and) demands a multi dimensional approach to identification" (Ministry of Education, n.d.b).

Among other aims, the Education Review Office's 2008 investigation looked to see how inclusive and appropriate schools' definitions of their gifted and talented population were. They stated that gifted and talented learners "represent diverse ethnic backgrounds and ages, with a multiplicity of gifts and talents. Concepts of giftedness and talent vary across cultures. Schools' definitions and ways of identifying should reflect the beliefs, values, attitudes, and customs of the school community" (Education Review Office, 2008, pg 14). This principle is grounded in a substantial body of research that has been carried out in New Zealand into Maori perspectives of giftedness (e.g. Bevan-Brown, 1993, 1996, 2003) and the writing of New Zealand academics such as McAlpine (2004) who supported the dynamic nature of the concept of giftedness by tracing its development both internationally and within New Zealand.

The Education Review Office looked for evidence that the schools' definitions of giftedness and talent reflected the context and values of the school community, were multi-categorical, incorporated both Māori and multicultural concepts, and were grounded in sound research and theories. Searching for these features, they found that

only 5% of New Zealand schools were highly inclusive and appropriate, 23% were not inclusive or appropriate with the remainder falling somewhere between these two extremes (Education Review Office, 2008).

The three main reasons for the under representation of minority groups in gifted and talented programmes found by Frasier, Garcia and Passow (1995) are test bias, selective referrals and reliance on deficit-based paradigms. Language and cultural issues within standardised testing make it unfair and therefore invalid for students from ethnic minorities. When teachers base their judgement of a student's ability on their performance in class-work that requires high levels of literacy and numeracy together with their standardised test results, they will see the student's deficits and in turn focus their attention on the student's weak areas such that they fail to recognise the strengths that they have. Gifted visual-spatial learners sit alongside ethnic minorities as another minority group for whom these observations also hold very true, and for whom invisibility is presently an even greater issue (Frasier, Garcia & Passow, 1995; Shea, Lubinski & Benbow, 2001; Wai, Lubinski & Benbow, 2009; Kerr & McKay, 2013).

2.1.7 Gifted and Talented Definition for this Thesis

To conclude this section, the following is the working definition and justification of gifted and talented students used for this thesis:

Gifted and talented learners have exceptional abilities relative to their same age peers. They have learning characteristics that give them the potential to achieve outstanding performance in one or more areas. These qualities and areas of achievement will be those that are valued within each school's multi-cultural community.

The characteristic behaviours demonstrated by gifted and talented learners must be recognised and understood. They have specific academic, social, emotional and motivational needs that can impact on their ability to achieve success in our education system.

2.2 Visual-spatial Learners

Having placed visual-spatial learners (VSL) in context as a group of students whose gifts and talents lie outside those most commonly recognised by New Zealand teachers, the next section of this review traces some background of the visual-spatial learner concept and provides a description of the characteristics of this processing style.

2.2.1 Background to the Visual-Spatial Learner Concept

There are a number of writers in the field of gifted education who have contributed to the understanding that gifted and talented youth are a much wider demographic than academic high achievers. Most significant to this thesis, Horn (1976) and Cattell (1971) made a distinction between crystallised intelligence being that which is taught using sequential logic and can be learned through practice, applied and reproduced in its original form; and fluid intelligence being that which uses more intuitive reasoning that perceives, transforms and produces knowledge incidental to that being taught (Horn, 1976). Students who fail to follow the process as taught may not score well on tests, even though they may well develop their own way of producing correct answers and in fact have creative abilities beyond the capacity of those who score more highly.

Seeley (2003) acknowledged the link between the idea of high fluid ability and high risk gifted youth. He noted also that Silverman (1998) has pursued the idea of a connection between high fluid ability, underachievement and a visual-spatial learning style with her visual-spatial learner model which recognises that fluid abilities are grounded in more holistic visual imagery, drawn from non-linear, spatial thinking that allows them to master complex material easily, but typically struggle with more simple, sequential tasks. These learners are considered at risk because our education system currently values and rewards sequential tasks and curriculum is designed in such a way that is demotivating for these students and incompatible with their visual-spatial learning styles (Gohm, Humphreys & Yao, 1998, Mahoney & Seeley, 1982, Seeley 1987, 2003).

2.2.2 Linda Kreger Silverman

Silverman is a major contributor to literature on the field of visual-spatial learners. She describes visual-spatial learners as those who think in images, as distinct from those who think using words, who she describes as auditory-sequential learners (ASL) (Silverman, 2002). This dichotomy of information processing style between visual-spatial learners and auditory-sequential learners is described by Maxwell in an appendix to Silverman's 2002 text, *Upside-Down Brilliance*. Maxwell says that VSLs are visual, spatial, holistic, focused on ideas; they seek patterns, are divergent, sensitive and intense, and display variable 'asynchronous' development. They organise their world using space as a whole. Pattern recognition leads to 'Aha' moments as they 'see' a relationship – this is an all or nothing phenomenon for them - only when pieces come together do they make sense – on their own they are meaningless. Because VSLs think in images, it can take them longer to express themselves verbally, as they need to 'translate' their visual thoughts into words and sometimes they struggle to find the right words. They are very observant and do well at tasks that require strong visualisation skills, such as design, mechanics, or technology. VSLs often find classroom learning difficult; they don't learn easily when material is presented in the usual sequential order. Rather, they are global thinkers, who need to see the big picture first. They may succeed at complex tasks, while finding simple steps incomprehensible (Maxwell, in Silverman, 2002).

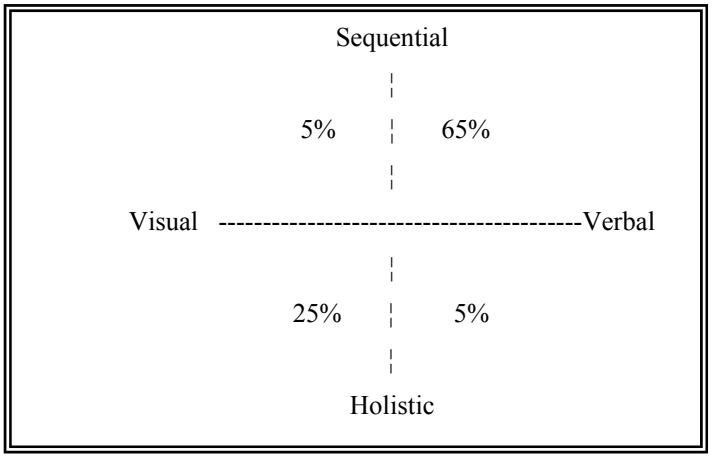
ASLs on the other hand, are described by Maxwell as auditory, sequential, detail-oriented, convergent learners who focus on format. This means they organise information following a logical sequence of steps to a conclusion, ordering everything in a linear way, e.g. writing from left to right, building an outline from the top down. They process what they hear quickly, understanding step by step explanations, and are usually very competent at expressing their thoughts verbally. When faced with something complex, ASLs will break it down into small steps and work through the easier bits first, gradually working into the more difficult parts. They learn well at school, because content is generally presented in ways that make understanding easy for them (Maxwell, in Silverman, 2002).

Silverman noted characteristics such as extraordinary capability on tasks with spatial components, e.g. mazes, puzzles, duplicating block designs and mental rotations. She suggests the Block Design subtest of the Weschler Intelligence Scales for Children to be one of the best indicators of a visual-spatial learning style, along with the Abstract Visual Reasoning section of the Stanford Binet IV and the Raven's Progressive Matrices (Silverman, 1995).

Further behavioural characteristics observed by Silverman in visual-spatial learners include examples of exceptional visual memory and children pulling things apart to see how they work. She noted that introverted VSLs will rehearse mentally before attempting anything new and that they often spend hours building with construction toys. They enjoy challenge and novelty, and have a love of numbers. Spatial abilities often equate with mathematical talent, creativity, science, computer science, technology, architecture, mechanics, aeronautics, engineering, arts and music, however VSLs may dislike school because of the emphasis on lecturing, rote memorisation, drill and practice exercises and the lack of sufficient stimulus of their powerful abstract visual reasoning abilities (Silverman, 1995).

2.2.3 Louise Porter

In writing about identifying giftedness Porter (2009) also acknowledges a clear distinction that can be made between the learning "styles" of students.



[Figure 2, Learning Style Preference of Students, Porter, 2009]

She sets out a graphic representation as shown above in Figure 2 that situates visual and verbal as two ends of a continuum and then a line that intersects at right angles portraying sequential and holistic as a further continuum of style. Porter differentiates those who favour an auditory-sequential style (65%) wherein they learn sequentially, mastering one idea at a time, analysing by breaking problems down into their parts and attending to details well. She notes these learners do well in school because of their ability to follow verbal instructions and plan in a logical, organised way. In opposition, Porter attributes the characteristics of Silverman's visual-spatial learners (25% of learners in Porter's estimation above) but in place of the term visual-spatial prefers to describe them as learners who use a conceptual (or holistic) style. In her description of conceptual or holistic learners, Porter doesn't explicitly distinguish between the two terms however she includes that these learners intuitively synthesise ideas to form a big picture or conceptual overview from which it could be inferred that they draw these ideas together in a holistic form, from multiple experiences and disciplines, recognising patterns and forming connections.

2.2.4 Brain Lateralisation

A further association discussed by Silverman are the left and right brain hemispheres and the nature of functions each have in the past been thought to specialise in. Time, sequencing and analytic thought have been commonly considered left-hemispheric strengths; with spatial, holistic processing and synthesis described as right-hemispheric strengths (Silverman, 1995). Technological advances mean that new knowledge is coming to light all the time. What is known for certain is that there is much we do not yet know about the brain and the way it works to process information. More recently, Kalbfleisch and Gillmarten (2013) have highlighted the results of neuro-imaging technologies that dispel the notion of hemispheric lateralisation. They counter 'neuromyths' including that visual-spatial abilities are primarily located in the brain's right hemisphere with research that has found no evidence of left brain/right brain lateralisation (Nielsen, Zielinski, Ferguson, Lainhart & Anderson, 2013). These researchers conclude that the construct of cognition is much too complex to be represented in such a simplistic manner (Kalbfleisch & Gillmarten, 2013). Silverman agreed that the integration of both hemispheres is necessary for higher-level thought processing. However she maintained that while

we all use both hemispheres it is common to favour one or the other mode or style of processing. She makes the point that this natural preference, or way of perceiving, should be honoured and appreciated rather than attempts being made to 'remake' one into the other (Silverman, 1995).

2.2.5 Visual-Spatial Definition for this Thesis

Kalbfleisch and Gillmarten (2013) include in their work a useful parsing of definitions of the skills involved in visual-spatial ability. In tracing the history of ways that description of these skills has evolved, they conclude that all current definitions of visual-spatial ability include three elements:

- thinking in images as a contributing factor in pattern recognition (or two dimensional reasoning),
- skill in mental manipulation or rotation of those images in space (or three dimensional reasoning) and
- spatial navigation, or problem solving that utilises holistic, as opposed to sequential strategies (requiring both two and three dimensional reasoning at different levels)

To conclude this section, this summary of skills informs the definition of a visual-spatial learner used for this thesis:

Visual-spatial learners can visualise three dimensional mental representations (think in 3D images) and manipulate those images in space. They use these abilities as they draw on holistic rather than sequential information processing strategies to solve problems.

2.3 Identification of Gifted Visual-Spatial Learners

Gifted visual-spatial learners are a 'hidden' group for whom a special focus is needed in order that their area of exceptional ability is identified. They may not be successful in academic settings for a number of reasons, and therefore may not appear gifted if it is academic giftedness that is looked for. A multi-method approach to identification is required, drawing from a continuum of identification tools that include information from a range of sources and settings, in order to successfully recognise visual-spatial ability within the diversity of talent to be found in each school community (Ministry of Education, 2012).

2.3.1 Current Identification Practices in Schools

The Education Review Office (2008) found standardised testing in literacy and mathematics together with teacher judgement to be the most common tools used for identification of gifted and talented students in New Zealand schools. The Ministry of Education (2012) point out positive features of standardised testing in that they are inexpensive, highly reliable, have a relatively high validity and effectively provide national norms against which to assess. However, they also acknowledge that their use in finding gifted and talented students who are capable of performing to a much higher level than the tests are designed for can be limited. The Education Review Office also recognised that dependence on achievement tests does not allow for the recognition of potential. They noted this was particularly the case for students who were speakers of English as an Additional Language, and for underachieving students (Education Review Office, 2008). In respect of gifted visual-spatial learners, the most commonly used standardised tests are not effective in assessing the divergent thinking style of creatively gifted students (Ministry of Education, 2012). Also important is that they are weighted towards verbal abilities, i.e. how well students read and express their thoughts in writing, which can be a weakness for visual-spatial students (L. Berresford, personal communication, 2013). The Education Review Office also noted that teachers often lacked the necessary conceptual understanding of giftedness and talent to make effective professional judgements (Education Review Office,

2008) and this would be the case even more so with hidden groups such as gifted visual-spatial learners.

Since the 1970's, schools in the United States of America have utilised the Talent Search Model established by Dr Julian Stanley, to identify students who have exceptional ability in mathematical, verbal and scientific reasoning using out-of-grade aptitude tests, rather than standardised achievement tests. Identified students are then eligible for a range of opportunities that provide additional challenge in their area of academic talent. In 1996, a computerised Spatial Test Battery, developed by the Centre for Talented Youth at John Hopkins University, was added to the range of tests available for use in the Talent Search process in response to research that suggested spatial abilities consist of separate skills to those used in verbal and mathematical reasoning and that spatial abilities are rarely assessed (Humphreys, Lubinski & Yao, 1993) despite recognition that they are a critical component in achieving to a high level in the career fields that lead to scientific innovation (Carter, Larussa & Bodner, 1987, Humphreys, et al. 1993). This body of research (Gohm, et al. 1998, Humphreys, et al. 1993, Humphreys & Lubinsky, 1996) identified gifted students with exceptional spatial reasoning ability as an under-served population, not easily recognised as gifted in traditional school settings because of their tendency towards introversion and the fact that their talent involves a non-verbal domain not commonly emphasised in academic environments. A correlation with lower socio-economic status groups compared with students who have mathematical or verbal abilities was also noted (Lubinski, 2003).

A study that sought to assess the learning potential of culturally diverse students carried out in Taiwan by Kuo, Chang and Wang (2008) noted that the current use of standardised tests to evaluate children's ability overlooks potential. Traditional identification of gifted and talented students in Taiwan emphasises fairness and standardised principles, therefore culturally diverse/disadvantaged students are said by Kuo et al., to rarely have the opportunity to be involved in gifted education programmes. This empirical study looked to identify "potentially gifted" students among culturally diverse/disadvantaged students by measuring how readily and rapidly they mastered new content with appropriate scaffolding. The 'Learning Potential Assessment Device' (LPAD) used in this study is described as a test-teach-

test method. The researchers identified behavioural traits including low verbal relations, logical reasoning and math reasoning but better mental abilities, especially visual search ability. They also noted a fear of difficult items and lack of confidence, nervousness under timed conditions, low comprehension of instructions and requirements and a lack of verbal tools that they considered to be limiting factors that greatly influenced students' performance and lead to under-estimation of their potential (Kuo et al, 2008).

In one instance of a New Zealand school seeking to use a wider range of assessment tools to find gifted visual-spatial learners, principal Graeme Miller reported that use of culturally neutral tests such as Torrance's Tests of Creativity and Ravens Progressive Matrices were found to identify gifted and talented Maori and/or Pasifika students who hadn't been found by traditional-style tests. Having read Silverman's accounts of visual-spatial learners, Miller used her visual-spatial identifier (see below for a description of this tool) across a sample of 1,600 mid and low ability Year 9 and 10 students at Hamilton Boys' High School during 2007-2009, to identify those with extreme visual-spatial characteristics. He then cross checked to find those who had high non-verbal reasoning subtest scores on a standardised Middle Years Information System (MidYIS) test undertaken by all Year 9 students at the school, and re-tested them using Ravens' Progressive Matrices. Miller reported finding several Maori boys in this way who would have been overlooked if standard tests had been the sole measure of ability, including two who hit the ceiling of the Ravens' test, with percentiles of 99+ (Miller, 2011).

2.3.2 **Cognitive Assessment Profiling**

While the account of Miller above describes an educator who utilised Silverman's visual-spatial identifier as part of an exercise to identify gifted visual-spatial learners in order that "hidden" gifted students were uncovered, in New Zealand this is not a common practice. While not all visual-spatial learners have academic difficulties, just as not all visual-spatial learners are gifted, these complications within a visual-spatial learning style often do co-exist (Silverman, 2002). At the present time, identification of gifted visual-spatial learners occurs here primarily when educational psychologists, or other professionals who are familiar with Silverman's work, encounter a student

within a clinical setting who has presented with learning difficulties. Administration of a battery of cognitive assessment testing and other diagnostic tools produces a profile that indicates typical visual-spatial learner strengths and weaknesses, along with recognisable learner characteristics. In this way a comprehensive assessment by an educational psychologist with professional expertise in this area can provide specialist knowledge needed in order to successfully provide for the academic and emotional-motivational needs of gifted visual-spatial learners.

Australian educational psychologist Lesley Sword wrote in 2000 that there was at that time no formal instrument for identifying gifted visual-spatial learners. However she recommended taking a comprehensive history and administering IQ tests, the results of which could then be analysed for a distinctive pattern. A large degree of "scatter" found on sub-tests with higher scores on non-verbal tasks in comparison with verbal tasks, and high scores on visual-spatial tasks such as block design and similarities, and low scores on auditory-sequential tasks such as mathematical computation and repeating digits from memory, are said by Sword to be indicative of a gifted visual-spatial learner. Sword cautioned that gifted visual-spatial learners who have been struggling with underachievement for any length of time are likely to present flatter profiles. She also provided a check list of characteristics while again cautioning that not all gifted visual-spatial learners will match every characteristic (Sword, 2000). Sword has worked in the United States with Silverman, whose work is now widely disseminated and followed by educational psychologists who specialise in working with gifted children in New Zealand. Thus gifted-visual-spatial learners are being identified by specialist professionals who are familiar with Silverman's work, using the above criteria, in this country.

Much research that has been carried out has relied on patterns of strength and weaknesses apparent in WISC-R cognitive assessments. Brown and Yakimowski, (1987) found the use of global IQ scores to be less accurate in identifying gifted students than patterns of WISC-R subtest scores. They noted that gifted students generated distinctive subtest patterns with verbal comprehension scores higher than the other factors. Learning disabled students generate even greater variance in the range of scaled scores with performance scores greater than verbal scores frequently

reported and patterns of deficits on Arithmetic, Coding, Information and Digit Span (ACID) subtests.

A study by Barton and Starnes (2010) sought to establish the existence or otherwise of a distinguishing pattern of characteristics of a gifted learning disabled profile that significantly differed from a gifted profile. They concluded that there was a distinctive cognitive pattern reflected in WISC-R subtest scores and that it may be more accurate to use this for identification than the magnitude of verbal-performance discrepancies or a set cut-off score. They also noted that it wasn't appropriate to use grade level performance as a criterion but that behaviours such as prolonged frustration were significant in that the nature of the motivational, self-concept and behavioural problems this engendered often created a greater barrier to achievement than the disability itself.

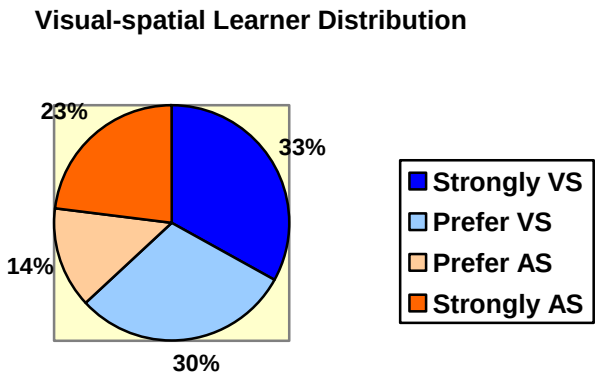
Important implications for identification, programming and future research include that teachers, gifted specialists and educational psychologists "need to be trained to look less at global scores and gross indicators and focus more on the patterns of scores that reflect the unique cognitive processing qualities that differentiate the gifted and talented/learning disabled from both the gifted and the learning disabled students of average intellectual ability" (p. 29). Barton and Starnes add that appropriate programming needs to account for heterogeneity of subgroups with individualised instruction provided that simultaneously meets academic strengths and emotional-motivational needs. Content should be relevant to cognitive ability not present skill level (Barton & Starnes, 2010).

2.3.3 The Visual-Spatial/Auditory-Sequential Identifier

Silverman's initial experiences of working with visual-spatial learners involved students who had been referred to her in her role of educational psychologist working with gifted children. She initially thought of visual-spatial learning as another (less popular) form of giftedness. However as she began to present on the topic more widely she discovered this 'way of thinking' had a much broader audience than just gifted education (Silverman, 2002).

Silverman devoted a significant amount of time to designing and validating an instrument for identifying visual-spatial children. Initially she had relied on patterns in test scores, supported by anecdotal information supplied by parent questionnaires. Realising that these methods were reliant on subjective clinical judgement, Silverman established a multi-disciplinary group that worked together over nearly a decade teasing out the characteristics of visual-spatial learners from symptoms of other concepts such as giftedness, AD/HD, sensory integration dysfunction and central auditory processing disorder. All of these were found by her to often go hand in hand with visual-spatial processing and she reported isolating indicators that related primarily to being a VSL to be very challenging (Silverman, 2002).

After many trials and re-workings, a fully validated 15-item questionnaire titled The Visual-Spatial/Auditory Sequential Identifier finally evolved. Rather than a cut-off above or below which point an individual is designated to be visual-spatial or auditory-sequential, the result indicates the degree to which one favours one learning style or the other. As illustrated in Figure 3 below, results of this study determined that approximately one third of the 750 students involved in the trials were strongly visual-spatial and about 23%, strongly auditory-sequential. The rest were considered to be a little of each (Silverman, 2002).



[Figure 3, Approximate distribution of preferred and strongly preferred learning styles among students in the regular classroom according to study by Silverman, 2002]

Silverman's first foray into the world of the visual-spatial learner had involved working with gifted visual-spatial students. Despite subsequently finding that the concept could be applied to the general population of learners, she noted that

advocates for students with dyslexia, for those with AD/HD and for gifted students identified most strongly with the ideas presented (Silverman, 2002). She concluded that while applicable to many mainstream students, the behaviours and characteristics described by the visual-spatial learner concept were particularly relevant for highly gifted children and for twice exceptional children. Silverman explained that while having visual-spatial ability may present as a preferred way of learning it can also be so pronounced as to make learning any other way very difficult. Her clinical experience had shown that "(m)any highly gifted people have superb visual-spatial abilities without the deficits. Only when these strengths are accompanied by serious weaknesses is the child considered learning disabled. It takes diagnostic testing to determine the extent of these weaknesses" (Silverman, 2002, pg 164).

2.3.4 Summary

As a 'hidden' group, gifted visual-spatial learners are difficult to identify when traditional methods such as standardised testing and teacher judgement are relied on too heavily. Standardised tests that evaluate children's achievement in verbal domains can overlook potential, particularly with skills such as spatial ability, which are rarely assessed in schools. Inclusion of a behavioural inventory such as Silverman's Visual-Spatial/Auditory Sequential Identifier within a multi-method approach to identification can be useful in increasing awareness and understanding of recognisable behavioural characteristics of this group. Beyond identification, such understanding is essential in order that educators are equipped to implement provision that is appropriately designed to meet the needs of their gifted visual-spatial students.

2.4 Research into how Visual-Spatial Learners Learn

A search for literature around the topic of how visual-spatial learners learn revealed support for the idea that many research studies have been designed with an underlying assumption that all individuals utilise essentially the same cognitive processes as they learn. This viewpoint has been brought into question by findings of recent neurological research that suggests distinct differences can be seen which may explain variances in visible learning behaviours.

2.4.1 A Different Way of Learning

In an article that discussed differences in neurology shown up by a functional magnetic imaging resonance (fMRI) brain imaging study of reading disabled college students with nonverbal IQs in the superior range when compared with gifted students without the learning disability, Gilger and Olulade (2013) posit that there are significant differences in gifted dyslexic or twice exceptional students (Eide & Eide, 2006; McClain and Pfeiffer, 2012; Pfeiffer, 2002). The results of fMRI testing suggests that gifted reading disabled students have approached problems through different neurological pathways to non disabled gifted students, supporting the idea that individual students utilise very different ways of learning. Gilger and Olulade draw attention to the tendency for research on twice exceptionality to draw on models of pathology that propose a disorder or deficit rather than drawing on a model of different variant of brain structuring. Gilger and Olulade also make the suggestion that these differences in neurology could mean that visual-spatial strengths that exist early in life can be adversely affected by lack of use as learners are forced instead to use their atypical right hemisphere brain functions to compensate for language deficiencies in a remedial environment. Expecting that remediation will 'cure' their difference places them under unwarranted emotional and cognitive stress. Because they learn differently they require different teaching methods that "revolve around thorough psychometric testing and educational plans that build upon and develop strengths, using these strengths to remediate deficits, and provide alternative testing methods best adapted to the student's cognitive-academic profile" (Gilger & Olulade, 2013, p. 243) in order to reach equitable outcomes.

Other research uncovered during the literature review phase of this study also supported that researchers based their work upon the assumption that all learners learn in the same way. Wang and Barrow (2010) explored how students' ability to generate and use a mental model affected their competence in analysing and solving problems. It is assumed in their research that development and mastery of the ability to construct and reason using mental models is something that requires a lot of practice and mental effort (Seel, Ifenthaler & Pirnay-Dummer, 2008). However Wang and Barrow's study used adult university students, therefore their subjects had successfully navigated the education system with its contingent necessity to be able to easily learn from verbal texts. Referencing the earlier description of VSL characteristics (Silverman, 1995, 2002; Maxwell in Silverman, 2002), VSLs are described as having visual and spatial strengths at the expense of the auditory sequential abilities required to easily manage traditional classroom learning. Consequently, it would seem likely that in terms of an auditory sequential and visual-spatial continuum of abilities, the learners used in Wang and Barrow's study were either well balanced, or favoured an auditory sequential processing style. Possibly, it could be said of VSLs that not only is development and mastery of the ability to construct and reason using mental models easy for them, for many it may in fact be their natural and preferred means of processing information.

As stated earlier, much of the research that has been carried out into the use of visual-spatial abilities has been done around the assumption that learning takes place in the same basic way for every individual, with variance in specific skill levels affecting a learner's success. Hindal, Reid and Badgaish (2009) suggest that we need to pay attention to the diversity of ways by which children learn or we risk never discovering many of their abilities. They refer to Leyden's (1990) suggestion that "while all learning requires the processing of information, the detailed variations in the way information is processed and stored are important" (Hindal et al., 2009, pg 187).

2.4.2 Changing Values

The Stanford-Binet Intelligence test, created in 1916 to measure scholastic intelligence, was designed around the valuing at that time of linguistic and logical-mathematical skills and this narrow view of intelligence has persisted in spite of

attempts by many to broaden it. Gardner, for example, included spatial intelligence in his Theory of Multiple Intelligences (Gardner, 1983) as one of seven original distinct "intelligences" that function independently of each other. While most children have an uneven profile of ability across these areas, the concept of intellectual asynchrony inherent in gifted children means they are likely to show even greater levels of uneven development. Multiple Intelligences theory proposes that educators should identify children's areas of strength and then seek to support and develop these. The rationale behind Multiple Intelligences theory is to provoke thought on the part of educators such that they provide a rich and diverse learning environment that is more responsive to the intellectual strengths and working styles of individual students, enabling them to explore and learn in ways that work best for them (von Karolyi, Ramos-Ford & Gardner, 2003).

2.4.3 Providing Practice Opportunities to Enhance Spatial Skills

Von Karolyi (2013) wrote about research into how mental rotation abilities might be improved. There was a wide variance in findings over how much benefit training and practice provided, and many studies involved participants with low or average spatial ability, or focused on the difference between males and females. However, participation in physical activity that involves spatial experiences was found to enhance spatial skills, for example certain sports (Moreau, Mansy-Dannay, Clerc & Guerrien, 2010) and also computer gaming (Newcombe, Uttal & Sauter, 2013). Von Karolyi notes the lack of development opportunities in traditional school curriculum for gifted visual-spatial learners (Wai et al., 2009; Web, Lubinski and Benbow, 2007) who she recognises as an underserved population. She recommends that educators, parents and programmes for the gifted should provide spatial experiences that develop mental rotation skills and also suggests spatially gifted students be encouraged into practice, training and experience opportunities in STEM-related activities in order that their spatial abilities can be recognised, valued and developed (von Karolyi, 2013).

2.5 Literature Review Summary

The underpinning foundation for defining students who are gifted and talented is that they have developmental capacity to perform in some way that is exceptional in relation to their peers. Beyond this, there is a dynamic web of sociological and psychological aspects that must be assimilated in order to fully understand and adequately describe the students whom definition as gifted and talented seeks to support. This literature review has examined some background to the terminology behind the concepts of giftedness and talent and discussed some of the barriers that hamper adequate understanding necessary for accurate identification and provision.

The importance of recognition and insight into the diversity of characteristics and learning behaviours displayed by gifted and talented students in order to respond appropriately to the learning needs that these create was highlighted. One key reason for this understanding is to help to address the issue of 'hidden groups' within the gifted and talented population who may not, for a variety of reasons, be displaying any evidence of exceptional talent within regular classroom settings. Evidence was discussed that places gifted visual-spatial learners as a group for whom such invisibility is a significant concern.

As the literature describing the characteristics of gifted visual-spatial learners was explored, further barriers to identification of and provision for these students were noted. Teacher judgement of ability based on academic performance assessed through class-work and standardised testing that is weighted towards literacy and numeracy strengths can lead to strengths in other domains being ignored. Ministry of Education guidelines are clear that identification of gifted and talented students should be multi-categorical and that effective identification processes will be designed around a multi-method approach. This review has critiqued a selection of tools and processes commonly employed in New Zealand and elsewhere with specific relevance to identification of gifted visual-spatial learners. The idea that highly gifted students can have exceptional visual-spatial ability that is well balanced with abilities in other areas was discussed, together with literature supporting that other students may have exceptional visual-spatial strengths with a marked deficit in their contrasting abilities such that they find learning any other way to be very difficult.

Recent research that has explored neurological differences in how individuals process information supports that gifted visual-spatial learners learn in a different way and calls into question the validity of studies that have been designed around the assumption that all students use the same cognitive processes as they learn. The concluding section of this literature review suggests that visual-spatial ability is a valuable skill set that is largely ignored in our schools and briefly visits a proposal that learning experiences that incorporate these skills in order that they are recognised, valued and developed are desirable.

Chapter Three

Methodology:

3.1 Case Study Methodology

This research uses an explanatory or instrumental case study approach to explore the lived realities of these children with a focus on their learning experiences. A detailed, in-depth picture has been created through collection of data from multiple sources of information (Creswell, 2007). Yin (2009) highlighted the importance of describing the contextual conditions that cases exist within, believing that the phenomenon being studied is likely to be affected by various environmental factors that surround it. He states "A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009, p. 18).

The type of case study used was chosen based around the intent of this study: to present descriptions of students who demonstrate and can provide added insight into the different ways that students who fit a gifted visual-spatial learner profile perceive, store and use information, together with an examination of how different learning contexts work for and against them. The study of multiple cases selected to illustrate different perspectives of the same issue is termed a "collective case study" by Stake (1995). This study examines cases of three students in the mid-primary to intermediate school area, within an age range of 9-12 years.

Case study research requires extensive 'lines of sight' from perspectives gathered through interviews, observations, documents and physical artefacts. The data gathering phase in this study involved collecting data from all of these sources. Within the format of semi structured interviews, a photo elicitation strategy was incorporated as the primary methodology because of the good fit this approach has for visual-spatial subjects. This was supplemented by semi-structured interviews with significant people in the participant's world, observations conducted of learning environments, evaluation of assessment material and reports and of other products of learning.

This triangulation of data sources and methods provides corroborating evidence to substantiate the building up of themes (Creswell, 2007). Berg (2009) asserts that each research methodology has weaknesses that can be acknowledged and then mediated by using alternative forms to improve the validity of the resulting picture. He gives as examples - the assumptions that data gained from interviews is representative of a stable reality and that data obtained through observations is flawed due to the inevitable changes that occur when subjects know they are being watched.

These data gathering tools were used to inform a description of experience from which issues were drawn and used as discussion points to illustrate the complexities apparent in each case. This "within-case analysis" was followed by a "cross-case analysis" that explores common themes that transcend the cases (Yin, 2009). This final phase includes researcher interpretations based on findings and how they align with previously conducted research as well as new insights and suggestions for future action.

3.2 Research Design

A research design is a logical plan for getting from here to there, where 'here' is the initial set of questions, and 'there' is reached with the conclusions or answers to these questions (Yin, 2009). The creation and maintaining of clear procedures that support future replication is acknowledged as important, particularly as it may be valuable that future investigations are carried out to account for differences in gender, socio-economic status, ethnicity or other variables, to those found in the subjects in this sample. This next section sets out the study aims, units of analysis and data gathering tools. Photo elicitation as a data gathering technique is described and the decision to include this is explained.

3.2.1 Research Aims

The aims of this study were to describe the nature of the differences demonstrated by gifted visual-spatial learners and to describe how these differences affect their experiences and in particular their learning, within a New Zealand context. A secondary objective was to ascertain the extent to which gifted visual-spatial learners were recognised, valued and empowered to develop their exceptional abilities through equitable access to differentiated provision (Ministry of Education, 2012). It was intended to determine how well the adults in their lives understand the potential these students have and how much appreciation there is of their need for a differentiated curriculum.

3.2.2 Units of Analysis

Three students who had been identified as having a gifted visual-spatial learner profile following the administration of a cognitive assessment process by a specialist assessor were sought. The decision to examine three cases acknowledged the reality that within any grouping, members will display diverse characteristics such that while common features will determine group membership, individuals will also differ from each other in various ways. By comparing three cases, it was anticipated that both commonalities and differences would be identified and overly prescriptive description to some extent avoided. Recruitment of participants from the pool of students who

had consulted professionals and undertaken standardised testing also enabled the collection and analysis of the results of this testing as a data source.

The first step in the recruitment process involved approaching two professionals who are each well recognized within the gifted education community as having expertise in the area of assessing gifted children. After discussing the intended study with me and giving their informed consent to participate, they each passed on requests to the parents of students they had assessed that fitted the criteria for participation, to meet with me to discuss participation (see Appendix A). Criteria included that the students were aged between 8 and 14 years of age and that the cognitive assessment profile resulting from testing carried out by the assessor indicated a gifted visual-spatial processing style. Upon reviewing assessments from the previous 12 months and ruling out any who lived too far away or were outside of the required age range, the first assessor identified four potential candidates. The second assessor supplied me with a list of six possible candidates. On request, each prioritised their list to reflect the degree of visual-spatial ability as determined by their assessment. I contacted participants from the top of each list as positive responses were received back from them, indicating interest in finding out more about the study. In this way my selection of participants remained a more objective process that relied on outside professional opinion and avoided any bias on my part.

An initial meeting with the parents and their child was then arranged, to answer any questions they had about participation. After receiving their informed consent, a meeting with the principal of the student's school was arranged to discuss the study and obtain their informed consent to participate. Upon receipt of their agreement, a similar approach was made to the student's teacher, and the informed consent process was again followed. In all cases, the relevant information sheet and consent forms (see Appendix B) were left for consideration and eventual return by post.

3.2.3 Data Gathering Tools

The case study approach demands a wide array of information be gathered in order to illustrate the case from multiple perspectives and to thereby gain an in-depth picture of it (Creswell, 2007). Data gathering tools used in this study involved individual

interviews with the students, their parents and their teachers. An interview was carried out with the assessor who had completed the assessment process and information provided in the cognitive assessment report completed by them was also drawn upon. This was supplemented by information from reports and results of standardised testing completed at school, from student work samples, and by observations of the student in different settings.

The initial data gathering approach was to conduct a semi-structured one on one interview with each student, as well as with their parents, their teachers and with the assessor who had completed a cognitive assessment with them. The information gained in this way was used to provide viewpoints of the same issues from different perspectives. Therefore similar questions based around identified concepts were asked of each participant, to elicit a range of views that were used to build up a thick description. However, room was deliberately left free within each interview for the unique experiences that individuals may have to tell about (Stake, 1995).

The need to collect comprehensive data about the individual experiences of each participant pointed to interviewing being the best fit method for data collection. It was considered that research questions around how the gifted visual-spatial learner experiences learning, what participants know and feel about the students' learning differences and how differences are responded to would be best answered through direct conversation. A semi-structured interview format, where questions are partly pre-planned but flexibility to follow fruitful tangents is retained, was therefore chosen.

Advantages of using semi-structured interviews as a data collection method include that much greater depth of detailed information can be attained. A more informal conversational approach that creates a relaxed atmosphere can help participants to feel comfortable with sharing experiences. On the other hand, the time required to plan, undertake, transcribe and analyse interviews is noted to be a shortcoming of interviewing as a data collection method. Further disadvantages include that not having a totally identical set of questions limits the extent to which the study can be replicated. Also, the risk of interviewer bias increases with more freedom to add spontaneous or leading questions (Woods, n.d.).

3.2.4 Photo-Elicitation Interview

In recent research on a similar 'How do we learn?' theme, Phelps, Nhung, Graham and Greeves (2012) chose to interview Vietnamese children using photo and drawing-elicitation interview methods as they recognised that doing so would moderate some of the problematic aspects of more traditional style interviews. Their rationale is equally valid for the visual-spatial learners within my study. Firstly, they note a reduction in reliance on verbal linguistic communication skills. Also, there is room for a style of dialogue that is more sympathetic to children's natural ways of exchanging ideas, as opposed to the 'question-and-answer' format of more formal discourse. In this way, the power ratio implicit in an adult-child interview situation can give the impression of being more balanced, leading to positive and more productive relationships (Epstein, Stevens, McKeever and Baruchel, 2006). Further to this, participants are empowered by being given choice over what to photograph, enabling them to capture the essence of what is important to them (Einarsdottir, 2007). This lessens the danger that ideas and values are imposed upon them and their own perspectives are missed. Phelps et al. (2012) also note from their experiences of this approach that the method of utilising photos within interviews "provides a concrete product and creates a 'show and tell' dynamic that can make interviews more fun and less like a test in school (p. 7)".

Luttrell and Chalfen (2010) found the process of participatory media to be seldom defined, but that it "often brings together an unfamiliar 'outside' person and an individual or group of 'inside' people who use cameras (still and video) to jointly explore a topic of shared concern" (p. 197). Harper (2002) defined photo-elicitation as simply "inserting a photograph into a research interview" (pg 13), however stated that the impact of this addition is quite profound, based upon the way that the human brain processes visual information separately to verbal information. Harper (p. 13) tells that

> the parts of the brain that process visual information are evolutionarily older than the parts that process verbal information. Thus images evoke deeper elements of human consciousness that (sic) do words; exchanges based on words alone utilize less of the brain's capacity than do exchanges in which the brain is processing images as well as words.

This is consistent with written accounts of VSLs' preferred processing mechanism (Baddeley, 2003) pointing to this method as being one that will evoke optimum information-sharing.

Loizos (2000) describes advantages to photo elicitation as being "restricted but powerful records of real-world, real-time actions and events" (p. 93). He also credits the method with providing concrete visual data that can provide positive support towards research questions that seek to illuminate complex, theoretical and/or abstract issues. Further, he places the visual element involved as being in keeping with the contemporary influences of today's communication media that have become such an integral part of our social, political and economic life.

Less favourable aspects of "the growing practice of 'giving kids cameras'" (p. 197) were highlighted by Luttrell and Chalfen (2010) including a lack of consensus from researchers who had utilised participatory visual methods in their work over what purposes the photographs were intended to fulfil. Other concerns were that they may influence responses, particularly if captioned or accompanied by other text. They also questioned the assumption that participatory visual research 'gives voice' to marginalised, less powerful people. Loizos wrote that visual records are limited in that they are only two dimensional representations of a three dimensional world and that therefore "they are inevitably secondary, derived, reduced-scale simplifications of the realities that gave birth to them" (Loizos, 2000 p. 94).

The decision to include this technique was based on its good fit with the characteristics of the participants. It was hoped the children would feel empowered through participating and making choices over what to photograph. Discussion around the photographs was considered useful in providing a scaffold for lower verbal ability that was anticipated as a possible feature. This discussion provided a context for informal dialogue that used a concrete visual product linked to personally meaningful experiences as a prompt for communication.

3.3 Data Collection

This section describes the process undertaken to collect data. Considerations that were reflected upon in relation to following a procedure that would account for the characteristic working style of the participants are discussed. Particular description is given of the photo elicitation technique that has played a central role in the structuring of the participant interviews carried out with the gifted visual-spatial learners.

3.3.1 Initial Meeting with Participants

Tailoring this process to work in sympathy with the strengths of visual-spatial learners suggested the importance that participants be afforded the opportunity to exercise their holistic approach to learning through the presentation of this study as a conceptual project based around the questions, 'What is learning?' and 'How do you learn?' In working with Vietnamese children in a similar study, Phelps et al (2012) found that differences in understanding of the concept of learning had important implications when trying to discuss experiences with them. Everyday learning episodes assumed a taken-for-granted guise that required explicit attention in order for subjects to be sufficiently prepared to undertake the task of searching out examples of learning in an effective way. Armed with the knowledge that gifted visual-spatial learners are conceptual learners who excel at grasping relationships between complex systems but have difficulty with isolated details (Silverman, 1989, 2002), the researcher's intention was to present the photo elicitation task to the visual-spatial subjects within a grounding conceptual discussion inquiring into exactly what learning is and how it occurs.

Golding (2002) suggests that when concepts are very abstract it is useful to first ask students to name some concrete examples. This also acts as a 'warm-up' encouraging students to become comfortable with contributing to discussion, while also making the concept personally meaningful to them. To begin discussion in our initial session together, students were asked to think about things they have learned and things they have been taught. Contributions were recorded on a mind map and then in order to move from 'warm up' mode to deeper thinking, more abstract questions were used to stimulate discussion. Examples of these questions include:

"What differences are there between learning something and being taught something? Does teaching automatically lead to learning?"

"Why do people not want to learn sometimes? Why do people sometimes feel confused when learning something new? Should they feel confused?"

"What, if anything, is the difference between learning at school and learning you do outside school?"

Again, the questions given above are examples that reflect the content of our discussion however subject matter was deliberately kept fluid in order to encourage an open and responsive relationship. The protocol used for this initial interview is attached as Appendix C.

3.3.2 Photo Elicitation Process

After this initial discussion around the concept of learning, students were instructed to photograph examples that demonstrate their understanding of learning, along with examples that explain *how* they learn, both in and outside of school (Phelps et al, 2012). The students were provided with a camera and advice on how to use it and provided with a 'Photography Tips' sheet to reinforce the verbal instructions on what was required (attached as Appendix D). It was explained that they would have several days to take photos of things that show learning taking place. In order to provide a "quality filter" they were asked to present up to 12 photos for discussion at our next meeting. Suggestions were provided of things they might like to photograph and discussion took place inviting them to share their initial ideas, e.g. things they do in a typical day; things they have learnt to do at home or at school that they are proud of. In preparation for the follow-up interview, cameras were collected in and photos printed off.

3.3.3 Follow-up Semi-structured Interview with Gifted Visual-spatial Learners

At the second meeting, students were provided with copies of their photographs and encouraged to talk freely about the images they had captured. Berg (2009) advises

that the style of language and questions used should match the profile of the respondents. This was particularly relevant when considering the visual-spatial subjects of this study. Knowledge about a visual-spatial learning style gleaned from the preceding literature review suggested that strictly following a sequenced, verbally conducted interview was not going to be the most appropriate way to work with these students. It appeared that a better approach was one that works the way that they do – in accord with their holistic style of processing. Thus it was the researcher's aim to work with them to build up a "big picture" view of their learning which could then be analysed together using questions that related to real-life experiences that their photographs represented.

While guided by pre-designed questions and prompts, much of the discussion was unstructured in order for students to feel at ease and willing to talk, while also yielding information about their lives at home and school (Phelps et al, 2012). The need for this process to be informal and unthreatening was seen to be particularly important for visual-spatial learners who have been noted for their heightened perception of and sensitivity to emotion such as anxiety in others. Visual-spatial learners pick up and respond to body language, intonation and setting – they 'read' these as much, or more, than the words used (Ornstein, 1997; Silverman, 2002). They may respond to environments and situations in which they feel uncomfortable by withdrawing or demonstrating reluctance to engage in activities (Yates, Berninger and Abbott, 1995). This could be expected to be exacerbated in situations where perceived pressure to reply to questioning about unfamiliar concepts places stress upon the participant in an interview situation.

It was therefore seen to be quite critical that phrasing and language use was very informal. A relaxed atmosphere in terms of dress, mood and venue were all seen as very important. Use of humour and heightened verbal animation were considered helpful too. Awareness that participants could very quickly become aware of the "power ratio" was considered and the researcher understood that for optimal results, the participants needed to be helped to feel comfortable and confident to speak freely. The need for translation time required for a 'picture thinker' to transfer, create and absorb new information out of and into verbal form (Mann, 2005) was also noted.

To begin the interview, students were asked to choose a photo of something they were proud of that they have learnt to do at home or in the community. They were prompted to describe and elaborate on this and then other things that they have found easy or hard to learn outside of school and what helped them to learn. The focus then moved to learning at school, again beginning with the stimulus of the photos and then moving to more structured questions around things they like, do not like, find hard, what helps them learn, and so on. Social, emotional, and physical well being issues were also kept in mind and discussed as these topics presented within conversation (acknowledgement to Phelps et al., 2012, for the structure of this process).

As discussion progressed, a list of 'prompts' designed to elicit information that might help to fulfil the objectives of the study was used to guide the progress of the interview (see Appendix E). In line with advice from Yin (2009), these questions/ topics were not considered literal questions to be asked but rather as guiding ideas, with further probing and digression expected and encouraged. The researcher sought to understand the perceptions of her subjects and how they had come to attach meaning to phenomena/events. Therefore, questions were ones that would elicit information on respondents' attitudes, behaviours, experiences and qualities/ characteristics they have that are relevant to learning.

Stake confirms the importance of consulting with interviewees to verify the reliability of reported conclusions, suggesting that often they may, on later reflection, suggest that wasn't quite what they had intended to say (Stake, 1995). This was seen to be of particular significance after interviewing the visual-spatial subjects in this study, as finding words to describe the pictures they have for thoughts can be one of their principal difficulties. This key characteristic also confirmed the need for a flexible style of interview, for example providing visual prompts or the opportunity to draw or mind-map their ideas, and also the value of pursuing photo-elicitation as an integral part of the data gathering process.

3.3.4 Interviews with Parents, Teachers and Assessors

A similar protocol was used for interviews held with parents and teachers (see Appendix F). Again, the interviews were guided by these pre-determined questions

along with content that had been highlighted in discussion with the previous participants. This fluid direction was important in order to elicit supplementary viewpoints that could be used to confirm or otherwise expand on the perceptions supplied in previous interviews, thereby creating the multiple 'lines of sight' that would improve the validity of findings.

3.3.5 Observations

Observations were conducted in classroom and in other learning contexts including the home environment. These observations were intended, among other things, to help create a good quality description of the physical environment and the nature of the learning tasks undertaken. Description of the context was seen as valuable to enable logical cause and effect inferences to be made.

The researcher followed Stake's (1995) suggestion that observations for a case study be organised through use of an Issue-based Observation Form designed with prompts that guided the collection of data relevant to issues of concern (see Appendix G). It was considered important that the format be seen as a guide only and use of it remained reflexive to evolving concerns that surfaced through the data gathering process, however having a well designed form was helpful in providing prompts of specific data required, together with reflective questions to focus attention on possible 'multiple realities', i.e. alternative viewpoints of individual stakeholders, or of different theoretical conceptualisations. The interview/observation combination also provided a useful contrast whereby the data gathered by the first was targeted and influenced by the interviewer however within the latter technique the researcher was a more detached observer and thereby witness to less circumspect, more objective data.

3.3.6 Document Analysis

Added richness was gained from collecting further sources of unobtrusive data, e.g. results of standardised testing completed at school, as well as the results of cognitive assessment profiling completed by the educational psychologist/assessor. Student work samples were looked for to provide further evidence of the visual-spatial learning profile.

3.4 Data Analysis

Following transcription of each interview, a coding procedure was carried out whereby similar data was drawn together within relevant categories. The first step involved 'data reduction'. In order to begin the transformation of the contextually laden and subjective information (Woods, n.d.) contained in each transcript into more objective findings that could be compared across all three cases, a written account was created that captured the major points uncovered within each interview. These were then sifted through and key ideas sorted into relevant themes that addressed the research aims, thereby providing material to describe the way that gifted visual-spatial learners perceive, store and use information. Data that described how much they and significant others in their lives recognised the aspects of their learning that set them apart and how these differences are responded to were also looked for.

Observational data was also used to support patterns of meaning upon analysing the content of teacher/student or parent/child conversations and interactions. Also, school reports and other relevant sources were analysed for assessment of skills. This document analysis provided an important dimension to the research base in providing more objective data to balance what may be viewed as perceptual self-reports gained through interviews and observations.

A description piece was then written for each case that highlighted the patterns that had emerged within the thematically organised information. This was followed by a discussion section that provided analytic comment and made links between findings and existing literature.

3.5 Ethical Considerations

The first phase of this research study involved submission of a proposal to the Massey University Human Ethics Committee and following a review of intended procedures by them, approval was granted. Approval for Application No. 12/48 is attached as Appendix H. In the course of this process, ethical concerns were considered in depth and a wide range of potential issues accounted for. General ethical principles addressed included affording respect towards all participants. Particular attention was given to accounting for the possibility of diverse cultural conventions. Any possible potential negative repercussions from participation needed to be accounted for and minimised. Assurance of privacy and confidentiality was paramount. There was an explicit expectation that participants would benefit from the resulting research. All participants were required to be given full information in order that they could give informed and voluntary consent and the young age of participants was considered carefully when designing appropriately-worded information and consent forms (Massey University, 2013).

Recruitment of participants through third party professionals provided a buffer whereby direct contact was made by the researcher only after participants had received written information explaining the proposed study and they had responded expressing their interest in finding out more. In this way their initial reply was entirely voluntary and the researcher was only given their contact details once they had responded. Ten potential participants were initially contacted by the assessors and of these nine responded, all indicating their interest. The assessors passed contact details for these participants on to the researcher, prioritising the positive respondents with those they felt best met the criteria for study participants listed first, in order that selection of participants by the researcher was as objective as possible. The researcher contacted respondents from the top of each list, proceeding until three participants had been finalised. Respondents who were subsequently not required were then thanked via e-mail and their offer to participate declined.

The initial meeting with participants involved more detailed description of the project and sought agreement to them taking part. Explanation was given that the aim of the project was for participants to think about and discuss aspects of how gifted visual-

spatial learners learn. Discussion covered that this research intended to ascertain how teaching and learning might be improved for these students and for learning to be something that they enjoy. Matters of confidentiality, anonymity, the use of pseudonyms in the report, voluntary participation, there being no 'right' or 'wrong' answers were covered. The research process was explained and participants were advised that findings would be shared with them. Participants were assured that they could ask any further questions and that they could withdraw from the study, at any time. In all cases, information sheets and consent forms were left for them to consider and return to give them time to think about whether they wished to proceed.

The recording of images raises particular ethical concerns. It was emphasised to students during explanation of the photo elicitation process that it was their responsibility to always verbally obtain permission before photographing someone, and that if people did not want their photo taken it was imperative to respect their right to privacy. As the aim of this study was to explore how the participants themselves experience learning, they were encouraged to either take photographs of some aspect of their own learning, or to have someone photograph them.

Care has been taken to ensure that the images that have been included in the following case descriptions do not identify any individuals. The third case does not have photos included in response to the wishes of one of the participants who expressed their concerns over the use of photographs in terms of privacy issues. While they were happy for the photographs to be taken and used within the interview, they withheld their consent for these being used in the report. Privacy and anonymity of participants have been carefully accounted for at all stages of this research study. However the validity of the concerns raised is acknowledged without reservation and the wishes of this participant that photos not be included has been respected in this case.

This methodology chapter has explained the rationale behind selecting the approach and methods used in this study. These have been described along with the process undertaken to create the data required to meet the research aims and how the resulting information was analysed. The ethical concerns that were considered have been discussed.

Chapter Four

Results (Case A)

4.1 Introduction to Case Descriptions

Each of the three case descriptions that follow begins with a section describing observed 'gifted characteristics' followed by observed 'visual-spatial characteristics'. As discussed earlier, lists of gifted traits are readily available in texts published by gifted advocacy groups through their web-sites as well as in academic text books on the gifted and talented topic. This may appear contradictory when viewed alongside the commonly upheld principle that the gifted are a diverse group. Including demonstrated behaviours and qualities at the beginning of each description supports the understanding that there are observable differences that underlie gifted children as a group regardless of context, for example, culture or specific areas of exceptional ability. As already stated, identification of gifted children is a complex business! For this very reason, looking for common gifted characteristics can and should be part of a multi-dimensional identification process. A review of the gifted definition being used for this research reminds us that the students under discussion *have exceptional abilities relative to their same age peers* and *learning characteristics* that, when all necessary supports are in place, will enable them *to achieve outstanding performance in one or more areas.* As specified in the second part of this definition, recognition and understanding of these abilities and learning characteristics, as well as the social, emotional and motivational needs created by them, is critical for gifted students to achieve success. This then is the reason for this first section – to isolate and draw attention to these exceptional characteristics at the outset - so that this important understanding is cultivated through the reading of the following descriptions.

The first two cases have a selection of the photographs that were taken by or of the participant visual-spatial learners as part of the photo elicitation technique interspersed within the report. They are included to add a further dimension to the description provided. Each section of quoted material is referenced to the transcript of the interview from which it was taken, for example *C3:14* denotes that it has been extracted from Case C, Interview 3, page 14. Participants' names have been changed or withheld to respect their right to anonymity and privacy.

4.2 Case A Description

Kyle is an 11 ½ year old boy. He is the youngest of three boys and has been exclusively homeschooled, taught by his mother who is a trained primary teacher. He was working at a Year 7 level at the time of data collection and had also attended a one day a week gifted withdrawal programme since the beginning of 2012.

Meeting criteria for enrolment in the gifted programme involved a comprehensive assessment process that included the administration of a standardised assessment tool (Woodcock Johnson III Tests of Cognitive Abilities Version 3.1 NU). This test placed Kyle above the 99th percentile for General Intellectual Ability. His lowest score was for phonemic awareness at the 72nd percentile (average range for age) and this relative weakness, together with his displaying many of the characteristics of a gifted visual-spatial learner, saw him classified as such by the testing assessor.

4.2.1 Gifted Characteristics

From a very young age, Kyle's mother felt there was something quite different about him. She noted that he was able to do 3D puzzles very easily, showing a natural facility where others struggled. Kyle has always been extremely curious, and likes to explore and find out how things work.

As a largely self-taught reader, Kyle read voraciously from a pre-school age, in spite of a significant vision disability. He has a preference for books about science and technology and from a young age often read quite technical manuals in his quest to discover how things work. He has continued to be a very self-directed learner, following up on his own interests and questions independently. His fascination with concepts such as electronics and electricity has fuelled the development of his interest and ability in the mechanics of technology.

He is an imaginative child who comes up with very original ideas. He is very creative and enjoys making three dimensional models, using both real materials, and working within computer simulation programmes. He also enjoys taking photographs and making videos.

The products of Kyle's creative endeavours demonstrate thinking that encompasses advanced and often very abstract ideas, including high levels of moral thought. These qualities feed a high level of idealism that is also apparent in his work. Kyle's parents noted that he is a very empathetic boy with a mature emotional development. He often shows care for younger or less able children. This empathy can also be seen through shrewd or perceptive comments he makes about people and their behaviour.

On occasion Kyle has voiced frustration at being asked to complete tasks for which he can see no personal relevance or need. His willingness to question authority is reflective of a high level of self-determination. Kyle shows a preference for having sufficient time to think through complex ideas and to plan reasoned responses. This can at times lead to him appearing averse to taking risks but may be more reflective of his capacity for advanced thought and abstract reasoning.

4.2.2 Visual-Spatial Characteristics

In a student who is a gifted visual-spatial learner there is inevitably some cross over in characteristics. Already covered above are some descriptors that demonstrate Kyle's visual-spatial ability. These include his exceptional ability with three dimensional puzzles and computer programs and his fascination with systems such as electronics. He enjoys pulling things apart to see how they work and spends many hours building with construction tools.

Kyle has demonstrated a preference for and exceptional facility with visual imagery. He uses visualisation of a whole word as a spelling strategy. His facility with visualising feeds an imaginational ability that can lead to distraction and off task behaviour.

Kyle showed that he naturally works towards creating an understanding of a whole concept and prefers to learn by synthesising information so that relationships are apparent. His self-directed learning involves exploring real-life aspects and creating solutions to problems that he finds. His capacity for fluid reasoning together with his

utilisation of three dimensional visual imagery lead to very creative solutions that he often becomes engrossed in over an extended time.

While he masters complex material easily, Kyle struggles with some simple, sequential activities, e.g. writing. He also has some difficulty with following verbal instructions and needs support with managing organisational tasks that involve too many verbally explained steps. At times he has had problems with losing or forgetting things.

4.2.3 Strengths

Kyle likes research work, particularly where it involves some form of active enquiry. An example of this is his interest in taking things apart to discover how they work. In the excerpt below, he talks about taking apart a television set (as shown in Figure 4 below). As it shows, Kyle is fascinated by the way that the components of this dynamic system interact and he has actively investigated to form his own understanding of how it works.

Figure 4, Taking apart a television set, photograph supplied by Kyle, 2013

Kyle: "*So I got to take apart the small one because it would be an interesting adventure.*

Researcher: *And the reason that you wanted to take it apart was?*

Kyle: *I really like technology and stuff. I have our old internet router that's permanently apart ... It's actually quite amazing.*

Researcher: *Tell me about it, tell me more …*

Kyle: *How a little "blip" of electricity, becomes 1's and 0's, which become words, which become letters, which can become colours and pixels, which make an image or words or text ... Like there's a setting on my web browser, and you press a button and it comes up with all the settings just in a little line of code up the top and you can just scroll through everything. Of course, you can't make any head or tail of it, but if you look at that, that simple line of code is all of that, broken down by the computer and it started out as little blips of electricity going together on a big circuit board that makes an image." (A2:5)*

Kyle likes to spend time designing and creating artefacts, ranging from models to creating his own language. His ideas are very detailed and purposeful. He particularly enjoys using and creating within the three dimensional computer programme, Minecraft.

[Figure 5, Lego model of man with camcorder, photograph supplied by Kyle, 2013]

Other interests include photography and video making. Kyle recently researched and then bought his own camcorder. He photographed a little Lego ™ man (see Figure 5 above) that he had made when he was thinking about buying the camcorder. His parents told me about the experience:

Kyle's Mum: "*He bought himself a video/camera the other day and then decided the video function wasn't quite as good as he was hoping. So we've returned the item and he's decided he'll save up more money to try and get something a bit better.*

Kyle's Dad: *But he loves videoing, he loves … that's one of the areas where you'll go into the shops and he knows more about the camera than the sales guy that's trying to sell the stuff"(A4:19).*

His parents recalled how the specialist that saw Kyle at age 6, when his visual disability was discovered, had commented on the exceptional concentration and focus that he must have, given that he had successfully learned to read in spite of the severity of his disability. Kyle recalled his process for me as he learned to read, saying that he mainly sounded out words and also that he would listen to people as they spoke and in that way he learned *"how to say the words in my head"* (A1:1) while also ascribing meaning to words heard in a particular context. Kyle also described his ability to visualise as part of his planning process. He told of lying in bed at night and coming up with ideas that he would then get up the next day and follow up on.

Often during our conversations, Kyle demonstrated his remarkable metacognitive ability. I gained the very clear impression that thinking about and discussing his experiences of "learning" as a concept, was something that he enjoyed and found stimulating. He offered well thought through and fascinating insights that demonstrated his exceptional facility in thinking about abstract and complex ideas.

He also showed that he has well developed critical thinking skills and that he makes connections as he classifies, analyses and evaluates ideas and solves problems. At one point in our interview, Kyle replied to a question that I had asked him twenty or so minutes earlier. His response just "popped out" after we had, in the ensuing time period, talked about a number of different ideas. His answer was comprehensive and well reasoned, evidence that this mental planning is an on-going, cumulative process and that he appears to hold, and continue to work with, information in his working memory for an extended time.

His gifted programme teacher also commented on this: *"He is very good at thinking about ideas and developing them in more depth and detail. He's good at bringing in other things, so if you've taught a topic, he can link it in and transfer it beautifully." (A3:1)*

She also laughingly told me how Kyle is one of those kids that, if involved in off-task behaviour that happens whilst the students are meant to be listening to her, can, when questioned, happily cite back to her exactly what she has just said.

Kyle described to me the typical format of learning that occurs within his gifted programme. One component of this is a research phase. He told of how, following a whole class discussion, students independently researched aspects of the topic and then presented their findings back to the whole group. His description included that he often buddies up with another student who has a complementary skill set to his own.

Kyle: *"It's usually half and half with me and my friend, but he writes everything down. I just remember key points that I look into, while he writes the stuff that he looks into. Like if it's a topic that I already know something about, I'll maybe show him a picture and explain what's in that picture and then he'll maybe come up with something as well, and then he'll write down both.*

Researcher: *O.k., so he … we call that scribing, he's the scribe, he does the writing.*

Kyle: *Yeah, he also looks into different stuff and I look into different stuff but if I can …I'll maybe teach him some things as well." (A2:8)*

He is described by his gifted programme teacher as being good at interpersonal relationships. His positive attitude and ability to work well with others place him naturally into a leadership role within the class. She credits him with an ability to use trial and error confidently and considers his ability to listen to be superior to most other children.

4.2.4 Challenges

Kyle has been reported by his parents as frequently finding school work to be boring and/or too easy. He actively dislikes repetition and can be stubborn in refusing to "re-do" on paper what he has already completed in his head. It was noted by his mother that he often demonstrates strong avoidance towards the task of writing. He isn't able to offer a reason for this beyond that he just really doesn't like to do it and that he finds it quite tedious.

Kyle's mother*: "…he refuses to engage in the learning if he sees no point in it, and if it is something he's already covered, he knows absolutely in his head if he knows it or if he doesn't and I might be insisting that he's got to reinforce his learning and he'll just say, no." (A4:7)*

In this next segment, Kyle talks about writing an explanation for his grandmother that put computer terminology into plain language for her. In this example, the writing assignment was a self-directed one that had occurred within a real life context as his grandmother needed to buy a new computer. With a clear purpose and audience it appears to have had the necessary level of challenge to motivate him to undertake the task. However a further difficulty is highlighted as he talks about struggling to verbalise his understanding.

Kyle: *"It also challenged me a lot as well, to try and explain something in her words, that she would understand … it's like when you hear and see a word and its just a simple thing that you know, but then to verbalise it would just, you just couldn't do it, because its very difficult to explain it.*

Researcher: *Difficult to… take it out of your head and put it into some words that someone is going to understand exactly what you mean by it, is that what you mean?*

Kyle: *Yeah, because there isn't really any words that would really explain it, but you hear the word and you just know what it means … Mostly other people know what I'm talking about, but if they don't have much knowledge on a subject then it's even more difficult." (A2:17)*

The ability to verbalise what he knows has been a learning focus with his writing as well this year with his mother also commenting: *"I am having to push him to explain it well. He understands it in his head, but I'm trying to say to him that you've got to be able to explain it so thoroughly and so logically so that the person who's reading it understands what's in your head." (A4:8)*

His parents told of times when his attention wanders away to a point where he completely "tunes out" his surroundings.

Kyle's Mum: *"I will often be speaking to Kyle, either in the context of learning at home, or just generally … and he is completely not tuned in to me at all, and sometimes I will be facing him, talking to him, and he is already not tuned in, I can just see it.*

Kyle's Dad: *His mind is working somewhere else …*

Kyle's Mum: *And he'll recognise it and he'll often say, "Sorry Mum I wasn't listening to you" (laughs). He actually is, of all our children, he's been the one who can shut everything out, he can sit in a little bubble, and World War II could be going on outside and its irrelevant, because he actually is distracted by his own mind, so there can be noises, there can be people asking him stuff, people mentioning his name several times, we can be standing right beside him saying his name, and he will be so absorbed in his own mind about what he is thinking about, or inventing, or discovering, or learning, that he can't focus on anything else. I have probably found that the most frustrating thing of all … He really does zone out." (A4:16)*

Kyle's father considers him to not be well organised. He has had problems in the past with losing belongings and forgetting items. His mother has worked at giving him opportunities to practise the development of routines and considers that he has improved somewhat. She finds his ability to follow verbal instructions is best when he is given adequate prior warning, and when instructions are very specific. Instructions sometimes need to be repeated and are best kept to one or two at a time. If given too many instructions she says it is likely he would become distracted after

the first one and absorbed by something else that has caught his attention. It was also noted by his mother that Kyle finds a major assignment involving many components to be overwhelming. He needs help to break the task down and someone to guide and motivate him through it step by step.

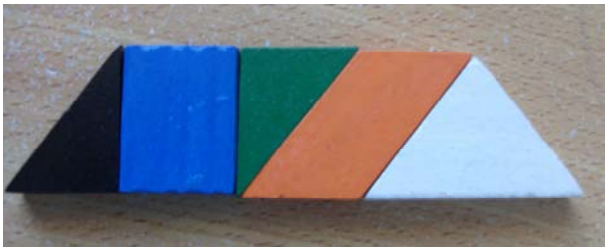
Conversely, the teacher at Kyle's one day a week gifted programme described him as well organised and very responsible. She also found him to be very adept at following a series of instructions.

Kyle was described by his parents in an assessment questionnaire as being risk averse and reluctant to try things that may result in failure. During his cognitive assessment, the assessor noted Kyle preferred the opportunity to think about his response. He liked to be assured of its correctness and was not comfortable with guessing. However the assessor also noted that when encouraged to "have a try" he correctly answered many of the questions to which he would have previously answered "I don't know". Kyle's gifted programme teacher however commented that he was comfortable with using trial and error in his learning.

4.2.5 Elements That Support Learning

Kyle is a very active learner. Once he has seen something working, he searches for evidence to explain the process behind its mechanics. He is motivated by open ended tasks and by flexible learning tasks that allow him to choose and follow his own interests.

Kyle has a vast collection of Lego™ and this has been a much-used tool in his learning to make models and experiment with. Lately he has also been enjoying manipulating tangram shapes and the patterns that he makes with these are another source of inspiration for creative design. His mother explained: *"…we have tangrams every day … and he's getting quicker and quicker and picking up on patterns … it's just his thing … I think it's pretty stimulating for him … he enjoys doing it and … he just happened to look at one of the figures, you know forms of shapes, and he began to think of something else, and he talked about it a lot, but he didn't draw it for many, many days, so it must have been going on in his head …" (A4:10)*



[Figure 6, 'Modular transport system' created from tangram pieces, photograph supplied by Kyle, 2013]

Figure 6 shows the example that Kyle's mother describes above. Kyle described his "modular transport" system for me, explaining that the act of manipulating the shapes in front of him had helped to spark ideas for what the different parts could be.

Kyle: *"Basically it's sort of like a car and a tram or train, put together … It runs on tracks, basically around the city, and it's sort of like your own personal train almost. But you can add bits, and take out bits and change that and change this, which is what I quite like about it… This is the front driver's module, where you get two people and they drive it just like any ordinary car. This bit here is actually the door, and it can slide up there, because of its diagonal shape, it just slides up. That's the rear passenger compartment, which is two seats again, and a little bit of foot space. This is an extra bit that you can add in, because it's a nice simple square, its really easy to add in and you can put what ever you like in there. It's got its own door. And that's just the engine at the back.*

Researcher: *Right, so this is a mode of transport that you've designed in your head.*

Kyle: *Well it was mainly when I was playing with tangrams, because it was an interesting shape, and so I just put it together like that, and then it just came to me... I really like coming up with future transport designs." (A2:12)*

We talked about mind maps (see example below, Figure 7). Kyle had been researching the atmosphere for a science lesson and laughed when he told me that his

mum had done all the writing on the mind map. He said that he didn't like doing mind maps because of the writing involved but agreed that they were helpful.

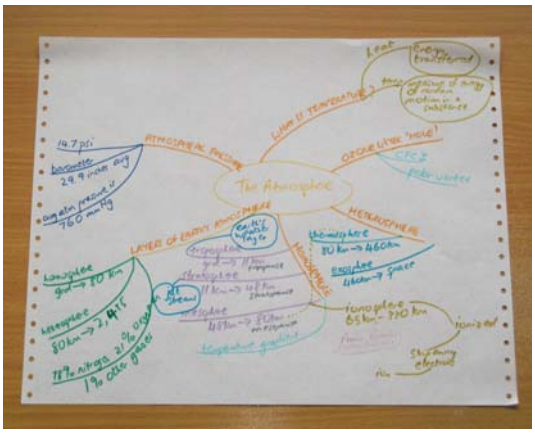


Figure 7, Mind map created for a science lesson,
Photograph supplied by Kyle, 2013

When I asked how they helped, he gave me an example:

Kyle: *"Like, if someone were to ask me how to spell a word, I'd first, instead of thinking back about how to spell it, I just imagine it typed on just blank whiteness, and then I'd spell it out. Like if I'd read it in a book, then I'd just imagine myself reading that in a book, and then I'd separate it and tell them how to spell.*

Researcher: *O.k., very good, so that's how you remember how to spell words, you've got a visual image of them that you can recall, and so this helps you in that way as well." (A2:11)*

I asked him if mind maps were a good tool to use for exam preparation and his answer suggested that they were helpful for mentally organising new concepts in a visual way, however he didn't seem to equate this with remembering the new knowledge that it represented.

Researcher: *"Does this help? Remembering facts and remembering …*

Kyle*: Mainly it helps because I usually spend about a week or two studying one module before I do an exam for it … It mainly just helps me remember the stuff that I've already learned, but …*

Researcher: *So you do use mind mapping, to help you remember for study?*

Kyle*: Not really, the only thing is it just helps me remember what I've learned and then it's just straight from memory. I just practically forget about it (laughs)." (A2:11)*

Kyle enjoys authentic problem-based learning that relates to his areas of interest. The student-directed learning experience where he helped his grandmother is an example of a rich task made meaningful by its real world application. It also provided an opportunity to incorporate the caring dimension of his emotional intelligence within an authentic context.

Kyle: *"Like my grandmother came earlier this year, and she was going to get a new computer because her old one had just phased out on her (laughs) … And she just didn't know what to look for, what to do, what all this meant, and so I was just kind of helping her choose and decide and then we got around to making a little dictionary, A-Z, with everything computer.*

Researcher: *And did that help her?*

Kyle: *We never got it finished, but yeah, quite a lot."(A2:17)*

Kyle has a very high need for novelty and for learning to be personally meaningful – in other words, for learning to take place within what he finds to be a stimulating environment.

Researcher: *"With new things that you are learning about, so new information, maybe a new skill in maths, how long does it take you to learn something new?*

Kyle: *Generally if it is something I enjoy or like doing, it'll be practically as soon as someone shows me how to do. If it's something I don't typically like doing, it's more just like doing it over and over again, and doing the same thing with different variations, over and over and over and over and over and over, until you just get it.*

Researcher: *So, sometimes, if you're not really interested in it, it may take lots of practice for you to get it.*

Kyle: *Yeah." (A2:10)*

His mother reflected on the difference that she sees in his behaviour between tasks that he is motivated to engage with and those that he finds pointless: *"the way that he works and he learns … there are certain things that are not stimulating to his mind that he's not prepared to necessarily retain … for what purpose?; I mean times tables are really dull, but other things that he's really curious about that he will master, and he will just research until he knows it so well and he can tell anyone about it, so it just made me realised that he has to be stimulated to learn and retain and if he isn't stimulated he's not going to retain it." (A4:5)*

Her observations confirm that Kyle works best when he is physically as well as mentally involved with whatever task he is undertaking. She explained: *"I think also he learns better when he interacts with the material somehow, so if he's handling something or if he's watching something or if he can actually see how it works, if he just had to read about it he would probably not be as engaged, and I think he learns best when he is in control of the learning, so if he's doing an experiment or if he's designing something or making something, he's got to be totally immersed in it, he's not the sort of child who would just look up some information and regurgitate it." (A4:6)*

It was noted by his father that *he does quite like getting his pencil out and his paper, and away he goes, he doodles … (A4:13)* Again, this shows as an example of the connection between a physical act and the mental work of thought processing.

Kyle's father also offered some insight into the rich inner world that fuels this student's creative process: *"I think he likes ideas too, ideas seem to be something that he really sort of cottons on, like he sort of … I've asked him what would you like to be, and he wants to be an inventor, you know, I think he'd love to be inventing things and he's got all these drawings that he kind of draws, and they're not um, they've got interesting things in them, they are detailed, they're not like you know, um, they're not like artistic drawings, they're detailed kind of drawings and so he likes to put the engine here and the compartments for living here, and you know, so its quite interesting the things that he is interested in and then the drawings have got a purpose, so you know, he's drawing this big kind of plane that was going to be a mobile theatre for third world countries, which is kind of like, when I was his age I wasn't thinking about … a mobile operating theatre, I was just thinking about one army smashing another one, or something like that, or building a plane with as many guns as possible, so they could blow up the enemy, but he was thinking about you know, a mobile theatre." (A4:6)*

Chapter Five

Results (Case B):

5.1 Case B Description

Danielle is a 9 year old girl. She is the youngest of four and was born in Brazil, moving to New Zealand at age 4. Danielle is bilingual; her family speak both Portuguese and English. She was in a Year 5 class at the time of data collection and also attended a one day a week gifted withdrawal programme as well as regular involvement in a GATE (Gifted and Talented Education) programme at her regular school that withdraws students for enrichment activities.

This student scored above the 98th percentile for General Intellectual Ability on the WJIII (Woodcock Johnson III Tests of Cognitive Abilities Version 3.1 NU). Her lowest score was 86th percentile for Verbal Ability. The assessor noted that her "very high scores for Concept Formation/reasoning (99%) and Spatial Relations (99%) together with her preferred activities would indicate a learning style of a gifted visual-spatial learner."

5.1.1 Gifted Characteristics

Danielle has a very vivid imagination. Her father described how when she reads, *"she goes to the stories, and you hear her reading in her room, and suddenly she goes 'ha ha ha ha', she's there, she's not here, you know … she's inside of that story" (B6:10).* She is very creative and loves art and creating models and music videos. Danielle taught herself how to use her computer and uses this for self-directed research and to create.

Danielle has a high level of intrinsic motivation. She displays notable leadership qualities, particularly in a sporting context. It is evident from her behaviours in this setting, along with other times at home that her parents described for me, that Danielle possesses a high level of self-determination. She is an independent thinker, capable of making decisions based on her own judgements and reasoning. Her father notes that

she is a very quick learner, that there is no need to go over and over new things, "*You can say once, and she is already doing it" (B6:9)*.

Danielle enjoys exploring abstract ideas. She demonstrates a depth of curiousity as she puzzles over how things work, as seen for example when she explained to me that she had figured out how a particular type of breakfast cereal was made.

5.2.2 Visual-Spatial Characteristics

Once again, many of the visual-spatial characteristics are covered already in the above list of gifted characteristics, including Danielle's vivid imagination, her creativity, and her enjoyment and ability with her computer.

Her capacity for visualising three dimensionally was readily evident in many of the discussions I had with Danielle and with her parents and teachers. When describing images that she was visualising, it was apparent that she could view these from many different perspectives. She talked to me about enjoying mazes, an example of a task with a spatial component.

It was also apparent that Danielle relishes a challenge and this is especially notable when the task is one that allows her to use her visual-spatial ability to manipulate an image as part of her problem solving process. She enjoys activities with a high level of novelty, and particularly when these include an opportunity for hands-on investigation. She demonstrated ability to develop her own methods of problem solving. She enjoys complex conceptual ideas and can see inter-relationships.

Silverman's (2002) contention that VSLs master complex material easily but struggle with simple, sequential tasks was evidenced, particularly in a maths context. Her teacher's comment that Danielle had on one occasion surprised her by taking unexpected path to a correct answer in a maths assessment shows that she utilises fluid reasoning to arrive at an intuitive solution. However, difficulty with computation strategies shows that understanding linear, sequential tasks can be challenging for her.

5.2.3 Strengths

Danielle told me that she likes art, particularly abstract art "*because it's different than other art." (B2:17)* She had enjoyed an art lesson at school where her teacher had shown the class a YouTube clip called 'The Dot' as a stimulus and the students had created a piece of art that started with a dot, and grew into an abstract piece.

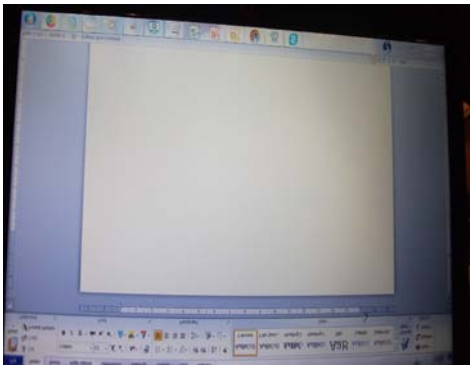
[Figure 8, Copy of Abstract Artwork Recreated at Home, photograph supplied by Danielle, 2013]

The image, seen above in Figure 8, is not her original drawing; rather it is a copy that she recreated at home … *"I just copied it when I was brushing my teeth, so it's not perfect" (B2:17).* She described the parts of her picture for me. She had included elements to represent the ocean, outer space, music and shape.

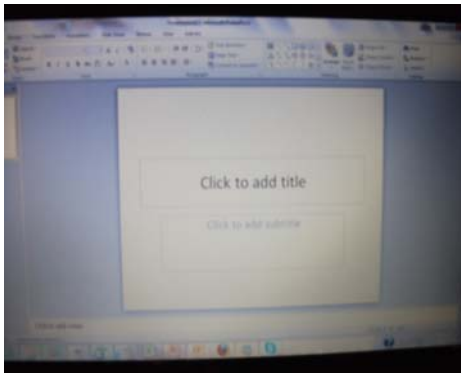
Danielle's teacher showed me another piece of art that Danielle had drawn at school that was displayed in the school hall. This was a head and shoulders self-portrait that had been created using a half of a photograph of her with the other half sketched in pencil. This piece showed that Danielle is a talented artist, with a natural ability to accurately depict shape, size and proportion.

Danielle enjoys and is very proficient at using a computer. At our first meeting she had her iPad™ out and during the course of a general conversation between herself, me and her mum, she used it to research topics that were referred to that interested her, for example, Siamese twins. She took control of her mum's laptop during our second session together, using it to show me the photos that she had taken.

Using her computer for self-directed learning, both researching topics and creating products, is something that Danielle enjoys and at which she has developed some excellent skills. Figures 9 and 10 below depict photographs that Danielle had taken as examples of things that she had learned by herself, rather than someone teaching her.

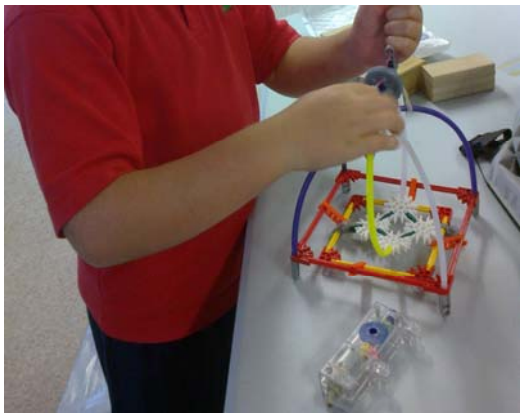


[Figure 9, Word Software Programme, photograph supplied by Danielle, 2013]



[Figure 10, Powerpoint Software Programme, photograph supplied by Danielle, 2013]

At school, Danielle is included in regular GATE (Gifted and Talented Education) activities. I was able to observe her taking part in a Robotics programme, and as noted by the Deputy Principal who organises the GATE activities, she very much enjoyed the hands-on problem-solving activity that this afternoon involved.



[Figure 11, Danielle's motorised K'NEX™ Cable Car, photograph supplied by Researcher, 2013]

The Deputy Principal described for me some other activities that Danielle has undertaken recently as part of their school GATE programme. She noted that Danielle had enjoyed taking part in a unit of science-based activities on the topic of plants, with a variety of activities that the students could choose between. It was of note that Danielle had selected hands-on activities over written ones.

Danielle's classroom teacher observed that Danielle can sometimes solve problems in unusual ways. This is a reported gifted visual-spatial learner characteristic (Silverman, 2002).

Classroom Teacher: *"…especially in her maths. I did maths testing with her, I can't think of the question, but she came to the answer and I was just like, "What?! How did you get that?!"*

Researcher: *And she could tell you?*

Classroom Teacher: *Yeah, she could tell me, she told me the whole way that she … got the right answer, went about it in an odd way as far as I was concerned at the time! … but it was … really interesting to see the way that she sequenced it and thought about it. (B3:5)*

Her classroom teacher also shared an anecdote with me that highlighted Danielle's ability to create systems, in this case to help with organising her desk at school. She had thought to glue little tabs with the name of the subject on to the front of each of her books, so that she could easily find the book she needed. The teacher noted that this was an original idea that no one else had thought of.

Her gifted education programme teacher also commented on Danielle's ability to think independently, reporting that she will look first thing in the morning at the options available in the day's programme and decide what she will do, and that her choices are made autonomously, based on her own interests and not influenced by others. Danielle's gifted education programme teacher observed that she "*often has something quite set in her mind as to what she's going to do" (B5:1)* and that on the day that I was there "*she'd chosen before the class had even started… and her whole day was working toward and wanting help to do that Make Do Create … " (B5:1).* This supports the impression that Danielle is actively developing her ideas over time and that this incubation period involves a mental planning process as she creates and refines.

Danielle had taken photographs of a couple of models that she had made at her gifted programme, as examples of her learning. She explained her process in planning the model pictured in Figure 12 below to me, saying that she hadn't decided before she started what it was going to look like but rather that she just kept adding on things as she went and also that others in the class had made suggestions that she had also followed. So her creative process seems to be a fluid and responsive one, in that she stays open to inspiration that occurs in the moment and to new ideas.

[Figure 12, 'Disco Skim' model, photograph supplied by Danielle, 2013]

The model depicts a new sport that she created for a civilisation that she had designed as part of a topic at her gifted education programme. Danielle named the sport 'Disco Skim' (*because it's a discus and you skim it like a rock on the ocean" (B2:22)*)

Another area of passion for Danielle is her involvement in team sports. Her parents told me that she enjoys playing touch rugby, rippa rugby and volleyball, and that she is very good and very competitive. They have noticed skills that make her stand out as a sports player, in particular her ability to understand what is needed and lead the direction of play in a team game. When I asked them to tell me about some things that Danielle was good at, they both agreed that she had natural leadership ability in this context:

Danielle's Mum: *"… it struck me again, when was it? Last Thursday … there was this rugby … touch … rippa rugby tournament … the way she commands everybody*

… It was like, you go there and you go there, and you do this! And then somebody did something wrong and then …

Danielle's Dad: *But she does it well you know, very well …*

Danielle's Mum: *No, she does it really well, and then so the boy threw the ball to somebody wrong and she said but that is the wrong person, come here and I tell you how to do that and so she just commanded the whole team actually and there are ten kids …*

Danielle's Dad: *She organises well, she really does it well.*

Danielle's Mum: *And actually these kids listen to her." (B6:1)*

A little later her Dad revisited this when he described how well Danielle was able to follow a series of instructions, saying that "*she is very spatial, so if you tell her 1, 2, 3 and 4, in her mind, the whole thing is ready, so she is going to go there and do it, you know … Rugby is a good example. She knows that she has to go like this, that guy has to be there, that guy has to be there, for that point to be done like that" (B6:12)*

5.1.4 Challenges

Danielle had difficulty responding to my initial questions around identifying different things she had learned, or been taught. During our first meeting, when I was verbally explaining to her what I wanted her to take photos of, she didn't immediately grasp my meaning. In the first instance, when I asked her if she could take photos of something that someone had taught her she incorrectly focused on the person rather than the content of the learning. Even when I rephrased my instruction long pauses showed she was still struggling to understand what I meant. Despite more prompting, and although she had identified that there were lots of things that her teacher had taught her, she found it difficult to name an example. This hesitance was quite a dominant feature of our first session together. She also appeared to settle on a quite narrow definition of what "learning something" entailed, i.e. that the "something" would be a concrete fact or piece of knowledge.

We had started our session by writing headings on a sheet of paper, in order to create a mind map.

Danielle: *"(Reading from poster in a stilted, mechanised voice) "What are some things you have learned?" "What is learning? and How do you learn?" (laughs)*

Researcher: *All right, how about we think of some things that go under these headings?*

Danielle: *(Nervous laugh)*

Researcher: *Think about some things that … Start with this one, might be easier … what are some things that you've been taught … that people have taught you?*

Danielle: *Umm …(long pause)*

Researcher: *Any ideas?...*

Danielle: *Um … Lots of things … (big sigh) … Wait, no I figured that out myself … Um … (B1:2)*

Eventually, Danielle shared a fact that she had read in a book, "*that rice is the main food for like, three quarters of the people in the world" (B1:2)* and we agreed that counted as something you had been taught, as it was like someone telling you. Looking back, I can see now too that she was puzzling over understanding the difference between being taught something and finding something out for yourself.

If it was nerves, these had certainly vanished by our second meeting, when Danielle was very self assured as she led me through her photos. However she frequently illustrated her reluctance to solely "talk about" things, preferring instead to "show about". In spite of having the photo in front of us, over and over again she would race away to find the object itself. Often her desire to produce the object under discussion came from wanting to give me more information than was apparent in the two

dimensional photo. For example, she wanted to show the size of a book, and what was inside it and she wanted me to see what some letters she had painted were made of. A large part of the challenge seems to come from communicating her "picture" to someone else, using words. However even when Danielle had drawn a picture for me to aid to her explanation, there remained barriers to our joint understanding in terms of my not sharing her quite unique perception.

Researcher: *"So that's the top … is that the top down view, and that's the side view?*

Danielle: *Yeah … Aw, wait… no, this is the bottom, so like I'm down here and I'm looking up at the machine.*

Researcher: *Ah, so that's looking up from underneath*

Danielle: *Yeah*

Researcher: *O.k. gotcha … I'll just write this here, in case I forget …and is that one there the top down view?*

Danielle: *Um no, this one is …(pause)*

Researcher: *Is the same thing, that's just smaller than that, yeah… is that right?*

Danielle: *No, it's … (laughs) it's pretty hard to explain." (B2:24)*

Math computation is a recognised weakness of Danielle's, as noted by her school. When I observed her in a maths lesson at school, the students were rotating around activities. She began on a computer-based activity that she enjoyed. It involved a game series embedded within a system that she had all mapped out and worked out. Other children next to her were doing the same activity but struggling a bit and she was simultaneously helping them while completing the activity herself and had it all completely under control.

Next Danielle moved to a worksheet activity involving a 3 x 3 grid with numbers to be filled in, in the form of a small Soduku-type puzzle. While she again knew what to do, I did notice her making some basic addition errors confirming that basic facts are not being easily retained in her memory and that this area does challenge her.

Her classroom teacher noted that Danielle becomes confused working with numbers: "*At times she struggles in her maths… that's an area that we're really trying to work on… I think because it's more of a … I'm not quite sure what it is … but I think just that you have to use so many strategies to work out that, and I think she stumbles across that in her thinking sometimes … and because it's not always right in front of you, I think that could be quite difficult for her sometimes" (B3:2).*

While difficulty with add/sub, mult/div and proportions and ratios knowledge has contributed to Danielle being one stage below overall where she should be in her maths, her teacher recognised that sequencing, figuring out patterns and strand-based mathematics were areas that Danielle has no problems with.

Danielle's parents have organised a tutor for her and have noticed an improvement in her understanding and enjoyment of maths now that she is having some success. Her Dad appeared to have a very empathetic understanding, commenting that for Danielle to grasp a concept depends on how the new material is presented.

Danielle's Dad: "… *how it is put to her. How is that laid down to her … But it was just … I think that math situation for her was the time tables, right? That was the only thing that was really bothering her. But it was a block, that she was struggling with, it was a block … she could not do it.*

Researcher: *It wasn't making sense to her.*

Danielle's Dad: *And you have other things that she was doing so well …with a very high level … and times tables is something, you know, people look and say well that's simple, right? But for her, it was a block … and she went to this friend of ours, and she unblocked it. And now she can do it." (B6:9)*

5.1.5 Elements that Support Learning

Danielle displays admirable perseverance even when faced with tasks she finds difficult, or when adverse circumstances hamper her efforts. She obviously enjoys positive reinforcement received when her persistence pays off and she achieves success in spite of initial difficulties. This characteristic was one of the first things her classroom teacher thought to describe when I asked if she could talk about things that Danielle was good at. She described her ability to understand and follow a series of instructions as effective, saying that Danielle is proactive in seeking clarification if needed "*because I think she's the type of girl, she doesn't like to get something wrong, so she'll just say 'Am I on the right track?'"(B3:3)* Her gifted education programme teacher shared this perception of Danielle's classroom behaviour, describing her as a very attentive student who follows instructions well.

Both teachers recognised that Danielle's understanding of, and engagement with, learning material is enhanced when it includes visual content. Her regular classroom teacher commented that she often uses power points to provide visual input for the students when presenting information and sees that Danielle benefits from this. Her gifted programme teacher also gave examples of visual stimuli that she employs in her teaching, and both teachers routinely have visual reminders of instructions available for re-checking if needed.

The gifted programme that Danielle attends one day each week includes as part of its curriculum a built-in focus on providing students with choice around products that they can create to demonstrate their thinking and reasoning. Danielle told me that she enjoys that the programme provides challenges for her, and pinpointed this element as being one aspect that does so. Her gifted programme teacher noted that in the "Make/Do/Create" section of the day, Danielle favours creating products that are very visually-oriented. She chooses projects that include a design element such as Power Point presentations and is very meticulous about her work.

Danielle's relationship with visual material goes even deeper than a preference for this style of input and for creating visually-oriented products in response to a stimulus. She demonstrated a preference for a visual medium as part of her

communication style also. Danielle's natural inclination for drawing an image to show her understanding of new material was illustrated as she recounted for me about her older brother teaching her about atoms. When asked how he had taught her, whether he had drawn a picture, or told her, or shown her in a book, she replied that he had told her and that she had drawn it *"to show him that I got it." (B2:10)*

As mentioned previously, when Danielle was telling me about something, and particularly when she needed to describe or explain some product or process, time after time she would begin only to pause, and typically say, "Hang on a minute!" … and then race off to retrieve some concrete object. Even when we had a photograph of the object in front of us she would do this, seeming to prefer the three dimensional reality over a two dimensional image as an aid to her verbalising. One time that she had no physical object to help her was when she wanted to describe for me how she thought she had figured out how a particular breakfast cereal was made.

Danielle: *"There was one, the cereal that I have, or that I had, I ate it all up because it was so yummy. It had chocolate inside and … then it's got this like this crunchy stuff on the outside. So I think I know how it's made … So, look … I'll just go and get … a sheet of paper quickly (runs to next room) and show you what it looks like … I'll show you how I think it's made, in the factory … So first it's got … I'll just move the table a bit closer … So, it looks like this." (B2:23)*

This time Danielle proceeded to draw her idea for me. First she drew a bowl with a spoon and with the cereal and milk in it. She was quite explicit in describing what each part was. Next, she drew what she thought the process would look like as the cereal was being made in the factory. It was of note that she seemed to be describing something she could actually see happening …

Danielle: *"So, I think they're made like this. So, they go on the conveyor belt, and the conveyor belt has a few lines, and here they come, they're here … pretend they're pretty small because they're everywhere and (pause to draw) and there. So there are lots of them right? … So there's … they're going to go to a place where there's going to be this like this chopping machine so it goes like that … this is the bottom of it … and it goes like this and then it keeps going on like that, so, that's the hole … it's*

going to be a hole, so this is a side view (pause), so it keeps going on like that, because they're sort of roundy, shaped like this." (B2:23)

Another feature that Danielle's gifted programme teacher pointed out as being helpful for her learning was that the structure of their day provides lots of opportunity for looking, thinking and planning. She noted that Danielle will frequently take advantage of the chance to check early and see what is scheduled for the day and that she will start to plan right from that first look.

Her teacher also told of using "visual language" to communicate ideas and develop more flexible thinking. This conversation is extending her in a way that would rarely take place within the regular school curriculum, particularly as she is perceived as being below her cohort in mathematics. The value of the teacher drawing her thinking, as well as explaining it in words is described:

Gifted Programme Teacher: *I think one example this afternoon was when she was trying to … her visual picture of the tent, she was thinking more of a tepee sort of a shape and she couldn't quite move beyond that in terms of attention, so actually sketching what *I* was envisaging as a tent, sort of "flipped her" to thinking oh, o.k. and from there … thinking about the shape of the net … And then when we drew the net it took her a few minutes to see … because I drew a long side for the net so that it could then fold over the base tent shape, and it took her a few minutes to visualise why we couldn't do the wings on either side to fold up to the tent shape and then, yeah, she could obviously picture it more that way, and it took her a few minutes to flip that thinking to think aw, o.k. it could be done that way too. So very much the sort of … I think the visualising and the puzzling out – how is it going to look and how is that going to work." (B5:2)*

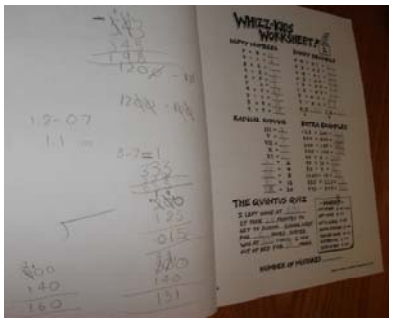
Another example of a learning experience that worked well for Danielle and drew on her visual-spatial strengths involved looking at 3D street art under the umbrella topic of 'Illusion'. Danielle's gifted programme teacher showed me examples of their "Holes in the Paper" work on the wall. The teaching approach used incorporated showing the end result first – this is what our finished product will look like – and then working backwards to figure out how to achieve it.

Gifted Programme Teacher: *"That was very much a(n)… experimenting case, she looked at how it was done and had a go…did a small one… that was o.k.… looked at a bigger one…a hole the size you could fall down and it was really quite a disaster and she knew it hadn't worked… she was actually canvassing other people to say… what do I need to do…how can I change it, how can I make it better, so that was really interesting to see and then actually listening to the responses (B5:3).*

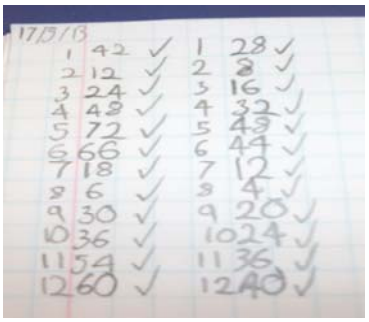
This last excerpt also demonstrates how Danielle benefits from a peer group of students of a similar level of cognitive ability to bounce ideas off. I observed that while remaining focused on what she was doing, she was aware of what everyone else in the room was doing also, occasionally throwing out the odd little comment to others. What was apparent though was that there was very much a sense of 'whole group learning' going on, and that Danielle was maintaining 'big picture' awareness even while she was focusing on individual details of her own work.

Danielle's gifted programme teacher couldn't easily name any situations where she struggled with learning, saying Danielle was always quick to signal if she hadn't understood an idea and that going back and re-explaining was usually enough for her to catch on. She suggested the extra time built into this re-stating and clarification was possibly the element that helped Danielle to process and make sense of new information. This fits alongside the earlier statement that the structure of her day when working in her gifted withdrawal setting provides her with ample time to reflect, plan and create. Working for a whole day on one topic, with each activity providing related information, gives Danielle the opportunity to really develop her understandings around the concept.

When I asked Danielle to show me a photograph depicting something she was proud of, she selected a photo showing her maths homework, with her methods for working out shown on the facing page, shown in Figure 13, along with a school times table test with a 100% correct result, shown here in Figure 14.



[Figure 13, Danielle's maths homework, photograph supplied by Danielle, 2013]



[Figure 14, Times Table Test, photograph supplied by Danielle, 2013]

As discussed in the last section, Danielle has been having one-on-one tutoring to help with her maths. I asked her to tell me about the strategies for working out multiplication and division. She said they could do any kind of strategy and then showed me her preferred method, which was to use an algorithm. She confirmed she had been having trouble with multiplication and division strategies at school and that these hadn't been making sense. Her tutor has shown her how to work them out using an algorithm and she agreed she felt good now she knew how to do them.

She has been working hard to memorise her times tables and is more confident now that she is meeting with some success in this area. Rehearsal on its own hadn't worked well and she had been really struggling until her tutor introduced the flash card method. Again this shows how her understanding and engagement with material is significantly enhanced when a visual element is included.

In discussion with her parents, I recounted to them how Danielle had indicated to me that she was recalling a very specific image of the particular card to memory. It was again apparent that her Dad clearly related to this.

Researcher: *"… she told me about the tutoring she was having, and we talked about her times tables, and she went and got the little box and showed me, and she showed me the flash cards that they were using …*

Danielle's Mum: *She loved those.*

Researcher: … *what was really interesting for me, and for my study, was that … I was trying to have her answer … what had made the difference? Why she was now able to start remembering these time tables, when she couldn't before? And so I said to her, "If I asked you what is 6 x 6?" She said, "Oh! 36!" She said, "I know that one", and she had her eyes closed and she said, "It's on a brown card … look I'll show you" … and she went through the bag and found it …*

Danielle's Mum: *She loves the cards.*

Researcher: *Yes, but it's like she has …*

Danielle's Dad: *It's visual*

Researcher: … *this visual image of the card, and that's why she's remembering it.*

Danielle's Dad: *Yeah, it's amazing eh?" (B6:9)*

Her Dad commented on her difficulty with maths facts, recognising that her different mental organisation requires that she be able to make a visual representation of what is happening to the numbers in order to make sense of the operation: *"Everybody ah, you know … 12 – 8 how do I do that in my mind? Since I was a little kid, I take 2 that is over 10 and 2 that is below 10. 4 – I know it is four because I put 2 here and 2 here, but you do it so automatically that you already know what it is, and she is trying to do that, but it is also … she's very spatial, you know, she's very … she has to see things and to look at things, and when it is not presented properly, like this to her, she … she struggles to understand." (B6:9)*

In describing his own strategising I noted his language whereby he specifically says he "takes" 2 that is over and 2 that is below 10, and "puts 2 here and 2 here". His reference to the spatial nature of this process suggests more than just a two dimensional visual representation is being made but one that exists in three dimensions.

Learning through observation is a strategy that Danielle frequently employs. Using her iPad™ to research how to do something and following visual prompts is a preferred learning method for her. When talking about the photo depicted in Figure 15 below, she told about making a balloon animal to give as a present for her friend, explaining that she had watched and copied the man demonstrating the procedure.

[Figure 15, Making a Balloon Animal, photograph supplied by Danielle, 2013.]

Danielle's self-teaching is largely based on use of observation, sometimes involving logic, prior knowledge and 'try it and see' exploration. When talking about how she taught herself to use Word ™ she suggested she had used visual cues, such as the underline function comprising an underlined U and the bold function **B** being "thicker than the other ones" to help her. She agreed she also learned by watching her Dad and her Mum and then trying out what she sees for herself. With her obvious enthusiasm and aptitude for using the computer, learning to touch type would be a very helpful skill for her to master.

Chapter Six

Results (Case C)

6.1 Case C Description

My third case study subject is a nine year old boy I have named William. William has an older sister and a younger brother and at the time of data collection was working in a Year 5 class.

The WISC-IV assessment for William shows statistically significant differences in his abilities with scores that range from a 99 percentile rank for perceptual reasoning to a 9 percentile rank for working memory. In analysing his results, the educational psychologist concluded that "his personal learning strength is his visual-spatial abilities. He can accurately be described as visually spatially gifted. Students who have significantly less well developed verbal abilities and significantly less well developed listening abilities relative to outstandingly excellent visual-spatial abilities usually find classroom learning problematic." She noted that understanding questions and instructions and giving explanations and expanding on his original answers were difficult for William, and that "he relies very much on what he sees and he is an intelligent observer". Following recommendation from the educational psychologist, William was assessed and diagnosed with an auditory processing disorder in April 2012 and has used a personal remote microphone hearing aid system in class for the past year.

As noted above, I very quickly came to see that William often struggled to respond to my verbal questions. William's parents had explained that he had delayed speech, not beginning to speak until he was nearly 5 years old. As an interview subject, his lower capability with language expression impacted on his capacity to interact with me and to explain his ideas and experiences.

6.1.1 Gifted Characteristics

William shows creativity at home in his enjoyment and adeptness with construction toys such as Duplo™, Lego™ and Meccano™. He is constantly re-constructing and

creating new models. William's imagination when constructing with Lego™ was described by his Mum as being "*pretty out there*" (C4:21). She said he would often lose track of time and both his parents agreed that he displayed an introverted style of imagination, so he would draw "*quirky little things*" (C4:21) and create rather than verbalise. Designing his dream home was another example given of his imagination and evidence of a rich inner world. His teacher also noted that he has original ideas.

William learns quickly and easily in his areas of ability. He enjoyed teaching himself to use a computer. He likes figuring out programmes and very quickly finds his way around strategy games, both computer-based and board games too.

6.1.2 Visual-spatial Characteristics

Once again, creative, imaginative and logical strengths described in the gifted characteristics section above cross over into the realm of the gifted visual-spatial learner. The traits described below expand on these and help to illustrate the level of ability and also the depth of effect that his visual-spatial characteristics have on his learning.

William has demonstrated exceptional capability on tasks with spatial components, e.g. computer games, jigsaws and puzzles. He is passionate about construction toys and spends hours building with Lego™. His parents spoke of his ability to turn a two dimensional diagram into a three dimensional model or product, for example putting pieces together using Meccano™ to create a system.

William's mother described the disorder his immersion in this pastime can cause as his enthusiasm leads him to "*run wild … not tidying up … leaving creations all over the place … getting a little bit out of hand."* (C4:3). His teacher also commented that he struggles with sequential organisation and that he can be disorganised.

William demonstrates many qualities of an introverted VSL, as described by Silverman (2002). He likes to rehearse mentally before trying anything new and does best when able to observe first so he can form an image-based plan of how something will proceed.

William's difficulty with listening skills has lead to an auditory processing disorder diagnosis. He is noted to have a poor memory for verbal instructions. In contrast, he has an exceptional visual and spatial memory and is noted to have a good recall of places and to often remember how to get to a place that he has visited previously.

William has some significant difficulties with language. He does however enjoy visual language, relating to the ideas presented in illustrations and photographs in books and in movies. He enjoys numbers more than words and his visual-spatial abilities are noted by his teacher to be useful to him in maths.

The prolonged frustration endured by William throughout his early life as he struggled to communicate has contributed to some motivational, self concept and behavioural issues. His mother described him as a 'late bloomer' and his father too, suggested he is just starting to 'grow into his own skin' with strengths becoming more apparent.

Both William's parents share his learning style. His father, who agreed that he also sees everything in pictures, spoke of going "*to a place once, even in the dark and I can get there… I always found that funny, you know*" (C4:24). William's mother added that his dad "*definitely can see things three dimensionally, from all different perspectives easily*" (C4:24). When talking about his strengths and weaknesses, his Mum interestingly chose the term "in my mind's eye" when describing her perception of his sporting ability. This term is often used within visual-spatial literature to denote the visualisation of a concept.

6.1.3 Strengths

William is good at and enjoys playing sport. As with Danielle, his visual-spatial skills are a real asset on the sports field. William talked about a photo of himself playing a 3-player game called Dribblers and Robbers. He told me how the game works and about the skills needed to be successful when playing it. His teacher described him as quite a sporty kid, a great runner and as very confident to try new things physically, most recently enjoying a rugby league coaching session at school.

William's teacher confirmed that math ability was a strength, that he is a logical thinker and a capable maths student. His most recent ICANZ math result showed him working at Stage 6. He hadn't shown up as being of concern in any strand however his strengths had come through in reading visual information, like statistics and reading graphs, with using number knowledge, as in basic facts and strategies, as a comparative weakness, along with part of measurement. His teacher noted that he had "*a logical way of thinking, and if you give him a rule, or a pattern to follow, then he's fine, and so I find that with the maths he's quite good" (C3:1).* She also noted an ability to visualise that she recognised as helpful to his maths: *"He doesn't always need like a visual prompt, like … you heard me saying to the other children, write it down if you need that visual prompt, and like I modelled it at the beginning before we played our game this morning … he doesn't always need that, so he's actually quite good at visualising it in his head." (C3:1)*

While William is not normally a keen independent reader, he very much enjoys some non-fiction books. He "devoured" a Guinness Book of World Records his parents bought for him and after reading it would bring into conversation facts he recalled from the book. William's Mum mentioned he enjoys watching movies and could talk about them. She also commented on his enjoyment of picture books and being read to, from a young age, saying that he was very alert to and would comment on small details within the images.

William's Mum: *"… he would pick up things, oh I can see some detail there – no one else was privy to it, but he would always want to point it out … his eye for seeing the big picture in one sense, but also the detail within the big picture was a big thing for William, and he was quite … good at that" (C4: 12).*

Further to her above remark that William shows exceptional attention for detail in visual images, William's Mum also described his interest in the world around him, saying he was very in tune with his surroundings, often now asking questions and making observations. She spoke of his visual memory for what he has observed:

William's Mum: *"…certainly just seems to pick up on … and its funny, got a very good memory for the visual but not the spoken, or if you've told him something he'll forget by the time he's gone down to the bedroom sort of thing, but the visual is really good … like he will remember … we went there the other day, or he'll know … like he could probably take you back to some (places)" (C4:13).*

I asked William's parents about his ability and interest in visual art. His Dad mentioned he had noticed William's physical dexterity had noticeably improved and he felt he was finally beginning to "grow into his skin". With increasing fine motor control, William's abilities in this area too, are becoming more apparent. At pre-school William was said by his Mum to have hated being put in front of a piece of paper but now *"can't get enough of it … he's designing his own birthday… sketching out you know, with lettering … so interesting how that's sort of developed and he's actually got a reasonably good eye for you know, laying things out and thinking things through." (C4:4)*

His Mum and Dad talked about William's facility with using the computer, saying they hadn't taught him how to use a computer but that it was something he had naturally picked up. They noted that the things he was good at and enjoyed, such as using a computer, watching and talking about movies, and creating three dimensional models from two dimensional diagrams contrasted with traditional academic domains and that William therefore didn't necessarily recognise his own strengths.

William's Mum felt the repercussions of his speech delay had over-shadowed any perception that he might be in any way talented. She reflected on how the journey they have been on to uncover the cause of his learning difficulty had been the real focus up until recently and that while his visual-spatial ability was always very visible it was not ever acknowledged as being of any consequence. Looking back now, with the information that they have since gleaned from the cognitive assessment that has been carried out, they can more easily recognise that he has some areas of exceptional ability, as well as the areas of difficulty.

6.1.4 Challenges

As already noted, William's delayed speech has been a core element underlying challenges with his learning. William's Dad reported he had been nearly five before he started to really articulate and that even then it was one word responses. Concern that William's speech was very muffled had prompted them to have his ears checked however his hearing had been found to be fine. Lacking the language to communicate his feelings at times lead William to express his frustration either through tantrums, or by withdrawing.

The cognitive assessment carried out by the educational psychologist who assessed William included a range of tests from the WISC-IV, Stanford-Binet, WIAT 2, the SPELD battery, a Neale Analysis of Reading Ability (4th ed), a Wallen, Bonney and Lennox handwriting speed test and a Carver word recognition test. The summary of test results noted that William tests approximately 3 years below his age for listening accuracy. William's ability at identifying sounds is weak, and sounding out unfamiliar words is difficult for him. Reading accuracy and understanding and remembering what he reads are also difficulties for him. I found I was frequently repeating back William's responses to him; this was often necessary to confirm that I had heard him correctly as his speech was at times a little muffled and also sometimes hesitantly delivered. It was apparent that he continues to have difficulty with producing all of the sounds in words.

Verbalising his thoughts is a difficulty for William that came through strongly in my conversations with him. In our first session, we talked about the concept of learning, and I recorded William's ideas on a mind map. He listened attentively to my questions and responded with mostly one word answers. His first responses to my asking what some of the thoughts in his head were when I said the word 'learning' were the obvious and predictable. He suggested reading, writing and maths and school. At this "prompting" stage of our discussions, I tried to lead him a little towards some hopefully fruitful thinking topics and we recorded them on our mind map.

In this first session, there were very few instances where William was willing to elaborate on his initial response. Generally he would begin and then withdraw, not willing to commit without more time to think the idea through.

Researcher: *"Are there any things (writing on mind map) you have learned all by yourself, with no one teaching you?*

William: *Um, to build things.*

Researcher: *Awesome … building things …So, … building things (writing on mind map), what kinds of things do you learn when you build things?*

William: *Like, um … I'm not sure …*

Researcher: *That's o.k. You don't always have to have the answers straight away, sometimes it's quite good to have a question … and just let it sit in your head for a little while, and you might think about the question and you might think … aw, actually … and an idea might come to you later." (C1:3)*

The one time that William did begin to share his thoughts on a topic was when we talked about learning to walk. We had been looking at the graphics on the "Photography Tips Sheet" I had prepared to leave with him, one of which shows a baby learning to walk. In answer to my question as to whether a baby learns to walk by themselves, or whether it is something they are taught, William initially responded that he thought they got taught but then qualified that by saying it was both. He differentiated that "*you can learn it off someone, and you can … and you start to crawl on your own …(C1:5).* We agreed that crawling was something a baby figures out all by itself. At that point William's Mum joined in our conversation …

William's Mum: *"Walking's probably different though, I sort of can see what he's saying, because you sort of see other people walking…" (C1:5)*

However, once his Mum had joined in our discussion, William once again became quite content to let her take over and the rest of our session involved me going over the procedure for taking photos and his Mum responding to any further questions, with William passively observing.

In our second session, with the photos, William was more responsive however he still took a lot of encouragement to engage with a topic enough to feel comfortable suggesting his own ideas. He was happy to answer factual questions related to his experience quickly enough but seemed reluctant to engage with any questions that required him to analyse or apply judgments to what he had observed.

When I asked William to nominate a photo showing something he found difficult, he selected a photograph showing him holding a worm. Our ensuing conversation showed that the way William's thinking can approach a topic does not always conform to the expected path. His interpretation of what the photo showed was that "getting … finding things" was difficult. When I asked "What was hard about finding the worms?" he began by saying "You had to search a lot" but then contradicted this when I asked him if he were actually searching for a worm, replying "No, I just found one". He went on to tell me in response to further questions that he wasn't really interested in it and that he just picked it up because he felt like it. What is really interesting to contemplate here though, is my assumption that because the photo showed William with the worms, his comment that "getting … finding things" was difficult should be applied to his experience of finding the worms. Maybe he in fact connected the experience of finding the worm with the idea that finding things in general could be hard.

This was also one of the few times he offered me some insight into the picture he was holding in his mind, and was notable for the way that he used his hands while talking, to help to describe the image. He drew me a picture to show what the worm looked like - a very simple, elongated oval shape with a vertical line from end to end. I had anticipated that he might have observed horizontal lines going around the worm's body and the worm using its anatomical structure to move. However this is not what he had seen and so his responses were delivered in recognition of a very different

picture to the one I was envisaging. His explanation of the worm "tangling up" was a good description of its behaviour.

William talked about a photo of him playing a musical instrument at school, again illustrating his hesitance with expressive language. I went on to ask William more about his music as he has also been learning piano outside of school for a few years. He seems in this next excerpt to equate mastery with being "good at something" and to recognise that when learning involves incremental steps, each new step begins at a place of "not knowing" – another example of what could be perceived as an unexpected answer, but when you think about it, is really an intelligent distinction to make.

Researcher: *"I know you said you learn piano, don't you? Is music something you're quite good at?*

William: *No, not all the time.*

Researcher: *You're not? Not all the time? O.k., tell me why you think you're not good at it.*

William: *Um…(pause)*

Researcher: *What's hard about it?*

William: *It's just getting used to it.*

Researcher: *O.k., so when it's new, it takes … you feel like it's quite hard when it's new and you don't know how to do it (C2:12).*

William recognised that to progress from the initial stages when something new felt difficult involved learning from his teacher and that this process involved time and practice. He described how his teacher would demonstrate a new piece to him and they would play it together first, reading from the musical notation.

Researcher: *You read the notes, and you play it together. And then do you have to try it by yourself after that?*

William: *Yes*

Researcher: *O.k., so you understand the notes, and you're able to read the note and play it on the piano at the same time. But it's quite hard because you can't remember? Is that why it's hard?*

William: *No, I think it's pretty easy instead of hard." (C2:12)*

Looking back to the beginning of this conversation, William had said that he thought he wasn't always good at music, but hadn't actually said that it was hard. He clarifies this here. Interesting distinction – so he is saying, quite correctly, that he isn't good at playing a new piece but that remembering the new notes is easy and that he gets better and faster with practice.

William's Mum had spoken earlier about his exceptional visual memory contrasting with his being likely to quickly forget a verbal instruction. William's teacher commented that he could be a bit forgetful and was inconsistent with remembering to bring his homework to school, in spite of an incentive system she had in place to encourage the students to form a reliable habit around remembering homework. In my interview with William I asked him about his homework. He told me it was going well and that the reading, spelling words and maths that he had for homework weren't difficult to do. Remembering to do it and put it into his bag for school was more challenging however. William's Mum explained that 'taking responsibility for ourselves' was a focus at school this year, however William's memory for this kind of routine was not strong. She said that they had actively tried together to think of ways to help with remembering but suggested their busy mornings could be a little 'topsy-turvy' and that the competing demands of getting everyone ready created some pressures.

William's teacher noted that he has some problems with organisation: *"he can be disorganised … he often puts things in the wrong places, so he like misses a page, or he's not methodical … so that can be an issue with him … he doesn't get things in the right place, or in the right order." (C3:2)*

And his Dad commented that they had adjusted some of their home organisation to work around the tendency for a non-standard way of functioning, in William's bedroom for example, *"like clothes are no longer in drawers, they're in a bucket, like a box … It's the same as putting it in a drawer, but it's in … you know, thrown in there (laughs)." (C4:23)*

His Mum also described how William's passion for creating with Lego™ lead to some chaos at home: *"…honestly we went through phases where you'd walk into William's room and his whole desk would be just covered in creations and then he'd leave little bits everywhere so there wasn't anything … no sort of order." (C4:2)*

Reviewing the information I had gathered about William, the big picture that had begun to emerge showed that, within the bounds of the world that he lives, his combination of strengths and weaknesses create some real challenges. I mentioned to his Mum that I had hoped I could have prompted William to talk a little more about some of the things he was really good at. She responded that one of his greatest challenges is that even things he is good at become muted when the demands placed upon him as he is constantly asked to use his weaknesses to perform, result in fatigue.

William's Mum: *"Yeah, and you know why? … like this, he says he enjoys it but he … he's a bit like, … practice? No, I don't want to practice piano today … but the thing is I think … if you get him to do any task, unless it's watching something, but I think his attention even with watching something is going to be the same, it's his attention with piano or anything, but it's because he gets given so many activities that are written and verbal, which are not his strength, he comes home really knackered, so it's that auditory processing thing working against him …*

Researcher: *It's like having one perfect vision eye and one that's not very good, and being made to look out of that one that's not very good all day!*

William's Mum: *You're going to come home and that eye's going to be sore, and you have to keep working it. Yeah, exactly." (C2:27)*

William's parents talked about his tendency to resist trying out a new activity until he has had the opportunity to observe and build up knowledge of what is involved. They described how he had refused to ride his bike without trainer wheels as a six year old, for a prolonged period, however once he finally "took the plunge", he showed himself as a very competent cyclist.

William's Mum: *"…and came second in a duathlon where it's cycling and running, and it's interesting with William though from that perspective and whether that's a little bit psychological in and around achieving … and being a little bit a perfectionist, has to absolutely know it inside out before he will actually tackle it … but then the glory is that when he does master something … yeah, it's … it's been really good for him." (C4:17)*

These observations suggest that William is developing an image of an activity or event in advance of its occurrence. William's Mum and I had talked about an incident where he had become agitated when changes were imposed on what he had expected to happen. She commented that sometimes he could cope fine and that his becoming upset by a change in plan wasn't predictable. William's Dad also saw that the chances of William reacting negatively to an imposed change were fluid and dependent upon a number of variables: *"Or he understands what's going on ... like say a birthday, where he's planning and he's got an idea, he's like opened his plan, so it's not … fixated on. Like … he's listed down food, but … he hasn't really, he's just like gone ballistic with what he's … going to get… but he knows that, whereas if … he was on the computer and you said right, you're going to go down the road to do this … he'll go no, and he won't like it." (C4:4)*

The phrase above "*he's like opened his plan*" struck me as an evocative choice of words, suggesting that William has here switched into a creative mode, where openness to ambiguity holds sway, and change or alternatives will be well tolerated.

William's Dad proposes that the situations that cause a negative response are likely to be more such as when William is asked to interrupt an activity that he is in the middle of, and maybe to perform an activity that he is mentally unprepared for.

William's Mum and Dad spoke about what they called "habits", however as our conversation progressed it was plain that they could see these behaviours are better described as ways of responding to stressful situations when he maybe feels overwhelmed, or particularly anxious. His Dad described how his habit of sucking his thumb acted like an "on/off switch" whereby he would put his thumb in his mouth and go into a "comfort zone". William's Mum continued: *" it was like that with soccer, it was like that with everything, but funnily enough, it's just something … a little blockage, and once you've got … whatever's going on for him removed, and it might take just that push, so with soccer it was turning up to the practices and … all he'll do is suck his thumb and pick at the grass, for the first part … sort of gaining momentum just through being there, by just observing, osmosis, whatever you want to call it, because all of a sudden you look back, two years down the track, three years down the track and you can slowly see him change and then to now, wow. He's come a long way and doing really well." (C4:19)*

His response to being asked to talk about something that he's feeling uncomfortable about is another situation where he will often resort to coping strategies through which he intends to escape, or protect himself from stress.

William's Mum: *"…giving some examples would be … angry that he has wear the ear pieces at school … "How's it going?" "No, I don't want to wear them, no good." So he'll get a little negativity around it, and you'll try and ask him why … he basically just puts up his hands and says," I don't want to talk about it" … he'll either give you the answer he thinks you want to hear … (or) he'll just close you off and say no, I'm not talking about it. He'll have a complete melt down because it hasn't gone the way he thought it should, so if you ask him to do something, that would be a classic example, so it's almost diverting what needs to happen, but he won't communicate why." (C4:19)*

William's Mum considered that his behaviour while I was interviewing him was a further example, whereby he had opted out of conversation … *because he didn't want to have to use new words, so we have little defence mechanisms to try and please … it's almost like the easy way out… it's the idea of as soon as he gets … where he feels a bit uncomfortable …" (C2:24)*

I got a sense of this myself when I was talking with William, with regard to his answering of my questions. While at times he was quite chatty, there were instances where I felt he deferred from attempting to explain something further, basically opting out of the conversation. There were other instances too, where he did indeed seem to give an answer because he thought it was what I was expecting to hear, as if thinking to do so would earn approval and negate any further questions.

6.1.5 Elements that Support Learning

While characteristically brief in his descriptions, William provided many examples of a kinaesthetic mode being integral to his method of gathering and processing information. These include many already discussed, such as the photo of him playing 'Dribblers and Robbers' and his talent for sports, his musical ability, his preference for interactive computer activities, his enjoyment of using construction toys such as Meccano ™ and Lego ™, and his general interest in the world around him, mentioned by his mother and illustrated for me in his description of finding the worms. A further example was offered when, in a conversation with his mother, he himself had suggested that playing games was a context for learning.

He had also provided a photograph of building a 'hut' outdoors as an example of learning. William chose the photo of his hut for me to represent something he was proud of learning. He and some other children had made the hut at home out of timber and other supplies left over from a home renovation project the family are currently involved in.

While William had abdicated any responsibility for the planning involved in the hut building exercise, his parents told me he was actively enjoying planning his upcoming birthday. Again, William's interest in this type of undertaking is a new development

but it is a great example of him creating a graphical representation of his thinking. It also again illustrates his engagement with developing an idea that he is personally connected to.

William's Mum: *"… he's designing his own birthday, and he's … sketching out you know, with lettering and … so interesting how that's sort of developed and he's actually got a reasonably good eye for … laying things out and thinking things through … and he's even … not that his language is his strength but he's thinking about how he wants his birthday to evolve, so he's written up on there exactly what … that he's going to have a sleepover and then we get up in the morning and he's even detailed that everyone has to brush their teeth…"(C4:4)*

More evidence that William enjoys working visually with hands-on tasks came in our second session together, when he nominated a photo taken of him using the class interactive whiteboard in a small group maths activity as an example of something at school that he was good at. When I asked he was confident in stating that maths was something he was good at and he agreed working with the interactive visual display was something he found helpful when learning.

The importance of good experiences and the therapeutic value of praise and recognition, when due, has obviously helped William to be more open to trying new and initially challenging things. His Mum recognises the effect on William's self efficacy of years of not being successful: *"… they sort of say these kids are late bloomers, and so it's like now that he's having good experiences and that's huge … that's actually more what has bumped him up than anything else … that's why all of a sudden, these sorts of things are doing o.k. because he will get up in front of people and play the piano at a concert, possibly through pressure, but also each time he does it, it's like well actually I did do that, and that was really cool, so we pump him up for those things, and so … and the same with maths, you know, he'll have a good experience with maths and so he'll feel really good … so it's all those sorts of things." (C2:27)*

When I asked William's teacher if she could think about some times when he has successfully learned something new, and what aspects of that learning experience seem to help him with being successful, she also recognised the value for William of having his feelings of success reinforced: *"… the repetition, so not doing it once … he likes being able to do something and then practice it … so he's not just doing it once and saying oh yeah, I've got it, but having that success of being able to do it over and over again." (C3:1)*

In response to my question as to things that seem to make a difference for him, William's teacher responded: *"Him specifically? Um… (pause) I think getting him to pay attention to the details of things …if he's trying to work out a new word, so he might be trying to work out … 'scientific' … what can you see inside there that you already know … so getting him to actually break it up and look for the visual clues inside something… and referring him to look at the picture and thinking about what he can see in there … I think that is quite important, but it's across the board … for all of them in this age group as well" (C3:4).*

Although she is clear that this learning focus is a more general one rather than for William specifically, she has in fact highlighted something that his mother had noted to be a particular strength of his, in that he is very quick and perceptive in noticing visual detail.

Knowing that he struggles with language-based activities and needs extra support with homework in this area, William's Mum talked about working with him on a homework task. She began by saying that he works best when able to watch someone else and see how it's done and then follow a demonstrated process. She explained that working on an exercise involving letter sounds was something that took him some time to grasp. On top of having to work out the difference in sound between short and long vowel sounds, he was also watching as his Mum organised the information into a table, an activity that requires a sequential approach. She comments that he needs repetition and that with many opportunities to practice he can master new language ideas.

Researcher: *"So if he's learning something new, what kinds of things seem to help him, when he's got a new skill to learn?*

William's Mum: *Aw, definitely more with demonstration, so there's no point in verbalising it so much, and repetition, so like he was doing some words tonight … he was slowly getting it, but he doesn't get it straight away, so it's more just a practice thing for him … so he was getting his head around which column to put which words in and how it all fitted together, but again it's just through demonstration, and that's why he adores the one on one, because obviously it can be shown at a pace that he can manage and process, and the verbal and the practical, so I was almost doing the first couple for him, opening a dictionary, checking the spelling …"*

William's Dad joined the conversation to agree that William likes to have a "system" to follow: *"He loves process …*

William's Mum: *Yeah, and I guess I was showing him, if it was me doing it, how I would do it …*

William's Dad: *that would be the process." (C4:6)*

In another photo, William had captured a computer software programme he was using to help remediate a difficulty with spelling. The programme called STEPS™ is a New Zealand-designed programme available from The Learning Staircase that supports learners with literacy difficulties. William described for me what was involved with using the programme and told me that he was getting better at his spelling through using this programme. He enjoys using the computer but said he wasn't sure what it was about computer use that made it better than other ways of learning.

Key features of the STEPS™ programme include that it is multi-sensory with word banks that can be personalised and cover sight vocabulary, spelling rules/patterns, word families and topic lists. There is a range of reinforcing resources and activities available and anecdotal evidence from users, supported in some cases by school data, suggests the programme is highly effective (The Learning Staircase, n.d.). William's

teacher was the first to mention the programme to me, telling me that it was "*devised by a lady whose son had dyslexia, so her son wrote the programme … and it's designed with lots of repetitive … kinds of games that he plays and the activities that he does … basically he has the activities and goes through the activities …" (C3:8).* She emphasised that the rationale for learning is making the aural to visual connection through looking for patterns in words and through repetition. Again the value of following a set process is also a visible feature of the learning. When I asked William if he could tell me about the STEPS programme, while characteristically short, his description demonstrated that the focus for William is on using his strong visual memory to be able to recall what the word looks like. He told of typing a word in and that you have the word and then it goes away, and you have to try and remember and write it.

When William's Dad spoke of his facility with the computer, he pointed out the eagerness with which William engages with new material when it is set out visually within an interactive computer environment: *"That's why he likes those computer programmes, cos they do give you an example, and then you basically work on problems, based on that example … he did that yesterday when he was on the computer with the maths one … so he was going and doing that himself … it was quite self-directed, and it was good cos I thought he'd play … just some random game, but he was on there, and doing the maths one that he'd learnt at school, he was interested in it". (C4:7)*

In the course of my observation of William at school, one thing I took note of was his classroom environment. During my follow up interview with his teacher, I asked her about some aspects that I had observed, particularly the student chairs which were of a design that could pivot or tip forwards and backwards slightly, allowing a little movement rather than being a rigid seat. I had noticed that William was a very active learner in that he was constantly moving, to a much greater degree than the other boys he was working with. His teacher agreed that if William was standing, he was invariably "jiggling" and that the chairs could be a very helpful feature in that they allow the students to move a little.

William has found using a remote microphone hearing aid system in class helpful in understanding verbal information. He said that *"things now 'stick in my brain' (C5:1).* However, he has also said that he doesn't like that the ear phones hurt his ears and appears to be avoiding wearing them more as time goes on. His teacher from the previous year, when he first began using the system, had noticed an improvement in his ability to maintain focussed attention. She commented that he was *"able to retain information from days past whereas before he would have forgotten the information. William's ability to recall and retell has dramatically improved." (C5:1)* She also noted improved participation and growth in confidence saying that he was *"sharing his ideas more readily in both class and small group settings. William rarely needs clarification of what to do now and if he occasionally does seek clarification it is just to check and reassure him that he is right. He doesn't seem to be relying on his peers but is now actually helping others know what to do" (C5:1)*

Chapter Seven

Discussion:

The Discussion that follows begins with a section describing the different way that these learners process information. The strengths that characterise gifted visual-spatial learners were apparent in each case as the students talked about their learning. Evidence demonstrating how the act of visualising forms a fundamental component in the way they process information is discussed and some implications of this are outlined.

The natural gift these students have for creating images that represent ideas sets them apart from most other students not only through the superior level of their ability to do so; the three dimensional form that these representations take also gives rise to significant differences that can impact on classroom learning. Many behavioural implications of their different style of information processing were observed and discussion of these continues in the second section, 'Aspects that are Challenging for VSLs'.

The third Discussion section, 'What Has Helped?' explores how the learning differences identified in this research were responded to. Examples of teaching approaches and learning experiences that met needs outlined earlier are discussed. This section also confirms the need for teachers and parents to have an understanding of these differences in order to provide positive support for gifted visual-spatial learners.

The final Discussion section addresses the second stated research aim which was to establish how well the observed differences are understood by these students and the significant others in their lives and the learning needs that these create.

7.1 Visual-Spatial Information Processing

Kyle is obviously adept at imaging complex and abstract ideas, and making connections within and between concepts and visualising images is integral to his learning. It was apparent that these images are stored in memory as readily available resources for future learning. Kyle's indifferent response to my question asking

whether mind mapping helps him to remember content suggests that for him, in common with accounts of other gifted visual-spatial learners, "learning" involves the development of a mental image that is permanent. Therefore, once this picture is formed repetition is not required (Silverman 2002) and the physical mind map becomes redundant. Danielle's experience with using flash cards supported that she too was recalling an image having successfully "learned" her times tables.

The piece of art I viewed at her school showed Danielle to be a skilful artist. It was of note that she said she prefers abstract art and that she both understood and enjoyed the notion of shape and form representing concepts and ideas. Danielle's abstract art provided an interesting illustration of the way that the visual images she creates in memory stay with her. When at home she had wanted to redraw the piece of art she had created at school, the image had been readily available to her when, in her own words, she "*copied it"*.

Danielle's Dad's interpretation of her ability to follow a series of instructions in the context of playing rugby suggests that upon listening to a series of instructions she formulates these into an image. In her visualisation she sees what needs to be done and what it will look like as it is being done. She therefore knows ahead of time what needs to happen for a successful outcome and how this process will look as it unfolds. This also explains William's need to observe first, often for an extended period of time, before he will attempt a new physical activity.

Another element of my interactions with Danielle that supported her visualisation being three dimensional was her need to have the object we were discussing in front of her to talk about, even when we had a photo of it. The assessor who had evaluated Danielle for entry into her gifted education withdrawal programme explained this for me in terms of the photo being a two dimensional, flat on a page image, however Danielle wanted to get that third dimension to really show me what she could see (Assessor, personal communication, 2013).

Further, the assessor confirmed my experience with Danielle whereby at times trying to follow her explanation of her visual representation could be confusing. The ability to visualise in three dimensions feeds the characteristic divergent thinking processes

of the visual-spatial learner; however it can create communication difficulties when the other party cannot follow the child's train of thought as they leap from one aspect or perspective to another. Also she explained how drawing ideas can help them to "mark their place" with thoughts as they zoom in and out from the "big picture view" to explore different tangents (Assessor, personal communication, 2013).

Danielle's Dad was able to articulate his understanding of the spatial component of the double-banger term 'visual-spatial' because he shares this way of processing information with her. Others (for whom the term isn't implicitly understandable) seem to attach meaning to the visual part more readily as they too utilise this sense, but struggle with adequately assigning significance to the spatial part of this concept. Danielle's Dad shares her facility to process and organise all perceived information (visual, aural, tactile, or olfactory) in some quite different way that facilitates the visualisation of a consequent reality as a three dimensional structure.

7.1.1 A Different Way of Organising Information

The mental organising schema of gifted visual-spatial thinkers seems quite distinct from that of their auditory sequential counterparts. Stored information is not bound by time or space in the same way. Jeffrey Freed (1996, pg 16) wrote

> Because one of the attributes of right brained thinking is a non-sequential divergent form of thinking, their minds often veer into unusual and different territory. This can result in illogical or often unsubstantiated conclusions. On the other hand, they may view a problem from an entirely different angle, leading to new breakthroughs and discoveries.

My experience of working with students like William is that they often give unexpected responses. Our conversation about the worms is an example where there was a definite misalignment in our thinking. On selecting this photo, William had commented that finding things is difficult but then did not relate this difficulty to his experience of finding the worms. While this might seem illogical, this kind of dissonance is quite common in discussions with gifted visual-spatial learners.

The above statement that the organising schema of visual-spatial students does not utilise the same parameters of time and space as their school-savvy auditory

sequential classmates is central to a useful insight into how they perceive the world. The visual-spatial student's organisation of space whereby all knowledge is interconnected is what sees them described by some as a holistic learner, who sees ideas conceptually. This 'all at once' overview can be viewed to contrast with an auditory sequential student's manner of aligning pieces of information sequentially, in an expected order (Silverman, 2002; Sword, 2000; Porter, 2009).

Teachers reading this will undoubtedly have met with students who routinely make entries in their exercise books in quite a random fashion, skipping pages, writing with their book upside down, and even at times maybe writing from right to left. The report written by William's educational psychologist states that he, even at age 8, did not have a strongly established left to right progression. While he may work from left to right, she stated that he was equally likely to work from right to left. William's teacher also commented on his difficulty with being methodical, saying that he would miss a page, or put things in the wrong place, or the wrong order.

While easy to dismiss such behaviour as resulting from inadequate early exposure to literature to facilitate the learning of literacy conventions, especially because it commonly occurs within populations of students who tend to struggle with reading and avoid independent reading books, my own experience suggests that this is simply not the case. William's mother stressed that he loves picture books and has eagerly engaged with her in reading and talking about them, and this has definitely been the case with other gifted visual-spatial learners I have known.

Time is one of the most sequential systems we know. Cues within William's dialogue suggested his view of an idea exists in one time frame that spans the past, the present and the future. A report from a speech language therapist who worked with William when he was 5 years old showed that at that age too, he used the present tense in most instances to answer questions, regardless of the tense of the question. This starts to make more sense if we consider that he is drawing upon an image when responding and that an image can be interpreted as a present tense event – if you are looking at it, it is happening now. This is reinforced by Danielle's description of her cereal manufacturing process where she too used present tense verbs as she described how the cereal was made, "*Here they come – they're here*" (B2:24).

7.1.2 Creativity

Kyle talked about his own perception that his learning style was different to the peer that he often chooses to work with at his gifted education programme. He commented that he would "just remember key points that he 'looked into' *(A2:8)*" while researching whereas his friend would write down what he found. As well as supporting Kyle's ability to create a visual representation that he can easily recall, this difference also illustrates the ideas discussed in the Literature Review, whereby Horn (1976), Cattell (1971), Seeley (2003) and Silverman (1998) explored the distinction between crystallised and fluid intelligences. To recap, crystallised intelligence is that which is most often developed in schools as students learn the content as taught and can recall it in the form that it was presented to them. Fluid intelligence involves higher level skills used to think critically and apply knowledge flexibly in novel situations, and relates strongly with creative giftedness. A consequent mismatch can occur when students who have exceptional fluid abilities are faced with educational experiences that are more strongly aligned with learning where crystallised intelligence is utilised (Gohm et al., 1998).

This division encapsulates one of the primary conceptual differences between Silverman's gifted visual-spatial learners and those she terms auditory-sequential learners. Gifted learners who have gained their knowledge in the prescribed and expected way are most readily recognised as being gifted as they easily achieve academic success. The knowledge that visual-spatial learners bring to tasks is not primarily amassed through any approved system of passing on facts and predetermined knowledge. Rather they use their own keen sensory capacities and observational skills, adapting their responses and behaviours as they build up a global web of knowledge. Horn (1976) described their knowledge as being "incidental" to that taught in schools.

Students who have exceptional ability to solve problems in unique ways following idiosyncratic pathways that they have formulated themselves can also have difficulty understanding the expected steps in a sequence or following the rules as taught to them and this too can contribute to them appearing as average or below in academic

assessments. When discussing the difference between convergent and divergent thought Silverman (2002) states that auditory sequential learners work comfortably in environments that use routine and sequence to lead to predictable answers. In this way they build up all the pieces of knowledge they need to gradually progress their understandings. Silverman (2002) describes this convergent process as "instruction that leads to one right answer" (p. 102).

Visual-spatial learners however find this restrictive. The ability to extract cohesion from seemingly dissonant elements seems to grow out of a very different mental structure that needs the widest view possible to make meaning. When provided with this amplified oversight, they can explore alternative angles and find patterns that remain obscured to others. Thus they thrive on the kind of original and complex material found through the exploration of open-ended questions, a very divergent process (Silverman, 2002). This description of visual-spatial learners as divergent-thinking "big picture" learners also ties in with Porter's work wherein she renames Silverman's visual-spatial learner as holistic (conceptual) learners (Porter, 2009).

William does not overtly demonstrate many of the most commonly recognised gifted traits as listed by the Ministry of Education (2012) such as advanced language and thought, curiosity, early abstract thinking, or intrinsic motivation. He is however, a very good example of a student who demonstrates diverse ways of learning and creative thinking (as advanced by the Education Review Office, 2008), as well as some less positive behaviours, e.g. frustration, being risk averse (Betts & Neihart 2010) and sensitivity (Webb et al, 2004). Some of these behaviours show in some settings much more than in others. This is why such behaviours, in context, need to be included in the identification process (MOE, 2012).

7.1.3 Introversion

Silverman (2002) and others (Dixon, 1983, Kerr and McKay, 2013) note introversion to be a frequent attribute of those with significant visual-spatial abilities. Silverman describes an introvert as an individual who is energised by time alone to reflect on inner thoughts and feelings. They need opportunities for private contemplation. An Introversion/Extraversion Continuum developed by Silverman lists a significant number of descriptors that fit William's personality, including: being reserved,

focused on inner world, learning by observation, needing time to think and mentally rehearse, hating being interrupted, being cautious, uncomfortable with change, slow to respond, needing time to adjust, possibly appearing different at home and in public, being tantrum-prone, and holding negative feelings in public and venting them in a safe environment. Silverman points out that both introverts and visual-spatial thinkers need extra thinking time before entering into verbal tasks. She cautions against believing that all visual-spatial learners are strongly introverted or that all introverts are strongly visual-spatial. However as she suggests, it makes sense that this essentially non-verbal style of thinking would lend itself less to the social world of verbal communication that an extraverted personality would enjoy and be more aligned to imagistic thinking that is internal, private and difficult to communicate to others (Silverman, 2002).

A further link is made by Silverman between the perception that introverts are shy (not true says Silverman, rather they are just easily over-stimulated and have very powerful emotions that can overwhelm them) and Dabrowski's "emotional overexcitability" (Silverman, 2002). Dabrowski's concept of overexcitabilities is discussed in the Literature Review section of this thesis as an explanation of how gifted individuals perceive the world more intensely and of how problems associated with this can manifest. The degree of tiredness demonstrated by William at the end of the day or week could also indicate a "sensual overexcitability" and signal his inability to cope with any further sensory input (Lind, 2001).

7.1.4 Summary

The gifted visual-spatial learners in the three cases showed that learning for them involves the creation of a permanent three dimensional image. The exceptional capacity they have to utilise this ability was visible as they described using visualisation in contexts such as planning how to carry out a task. Sometimes, this involved using their excellent observational skills to learn by watching and formulating an internal model. At other times, they imaged complex and abstract ideas as they created novel products. The learners all demonstrated an introverted, reflective approach to learning that supports the way they gather in and process information in a holistic fashion, in order to create their own 'web' of knowledge.

7.2 Aspects that are Challenging for VSLs

As discussed in the Literature Review, asynchrony, or unevenness in abilities, is commonly encountered in gifted children. In gifted visual-spatial learners contrasting levels of ability in different areas can be explained as a consequence of their different style of processing information. Logic dictates the importance of not expecting that a gifted child be able to effortlessly achieve success in every area. Implications of academic struggles that can result from a visual-spatial learning style are discussed below.

7.2.1 Barriers to Writing

Kyle described writing as a tedious and pointless task. Silverman points out how difficult and time consuming it can be for those who think in pictures to have to find the right words to describe their image (Silverman 2002). Stopping to write interrupts the flow of thought processing – forcing what is naturally a rapid, fluid process to break down as it continuously grinds to a halt in order to mechanically record the facts so far in words. Enforcing the need to stop and record in writing hampers the learner's ability to make connections and to expand the detail within his picture. Requiring Kyle to write his ideas is therefore restricting his ability to create and may understandably create feelings of frustration. Conversely, when his excellent visual memory is enabled he can formulate his ideas more fully and thereby more easily produce to his potential.

The above example illustrates what is meant when Silverman and others describe a visual-spatial learner's more holistic and intuitive reasoning process as being in opposition to an auditory sequential learner's step by step processing style (Freed, 1996; Golon, 2004, 2008, Silverman, 2002, Sword, 2002). Intuitive understandings are being reached as connections are illuminated by their harmonious placement within the overall "bigger picture". When knowledge has been amassed intuitively it can be hard for the student to explain – as Kyle said, "*you just know what it means*" *(A2:17).* When others haven't shared his cognitive processing journey explaining his understandings whether orally or in writing, becomes a very complex task. He can be literally bombarded with a web of connected ideas and thoughts stemming from

experiences stored in an image-based format along with the emotional and the ethical dimensions that accompany them. The multi-dimensional form of these ideas can make it understandably difficult to know where to begin and which path to follow.

7.2.2 Barriers to Verbal Communication

Probably the most noted feature of my first session with Danielle was her difficulty answering my early questions asking her to name things she had learned or been taught. In discussion with the gifted education assessor who had worked with Danielle, she suggested this case paints the picture of her being exceptionally perceptive to evaluation, especially in the early stages of building rapport, evidenced by her initial reluctance to sharing her thoughts. The "I don't knows" and dead ends could imply a sensitivity to feedback as to whether her ideas were going to be received well, or appreciated, or wrong. She observed that Danielle has had the experience of relating to those who don't share her learning style, as well as some that very strongly do, for example her father, and so she has experienced people who "don't see what I see". The assessor also shared her experience that, once children like this have had time to evaluate you and figure out what level they will communicate on, often they will then start pouring out their ideas and this was certainly true of my interaction with Danielle (Assessor, personal communication, 2013).

Characteristics highlighted in these cases include that gifted visual-spatial learners will reflect on information they have perceived through observation and physical interaction to a very deep level. They incorporate their understandings into a complex, visually-oriented, interconnected web of knowledge (Sword, 2000). Several times William's Mum mentioned his difficulty with finding words to describe what he knows. This has been a cause of frustration for him his whole life. His Mum also suggests he needs to have a practical event to recall as a starting point in his image-based thinking to "hang" his words on.

7.2.3 When English is an Additional Language

"Meaning making" is even more complex for students who, like Danielle, are bilingual, as they are working even harder to assign meaning to new vocabulary and to juggle between two languages. It is important to acknowledge the impact that having a home language other than English may have on vocabulary learning. In Danielle's case there appeared to be little readily discernible difference between her English language proficiency and that of a native English speaker. Her parents shared that she has in fact always been bilingual as her mother (who herself speaks four languages) spoke in English to Danielle from the time she was born, while the rest of the family spoke mostly Portuguese. Also, she attended a bilingual school in Brazil from before the age of two. Her enjoyment of and fluency with reading shows her to have a well developed language knowledge base and that she has learned language quickly and easily.

The Ministry of Education acknowledges that it commonly takes an average intelligence English Language Learner between five and seven years to reach the same level of proficiency as a native speaker of the same age, particularly with the academic language that they need for classroom learning (Ministry of Education, 2008). Danielle has benefitted from an extremely rich and well supported language learning background and her language learning experiences have no doubt helped to develop her cognitive abilities in a very valuable way. However some of the English Language Learner students in our classrooms will not have had the same level of positive prior experiences and for those who share a visual-spatial learning style, the implications of this way of processing impact greatly on their progress. Gifted English Language Learners are recognised as an under-identified group (Ministry of Education, 2012) and gifted English Language Learners who are visual-spatial learners would be even more at risk.

7.2.4 Difficulty with Rote Memorisation vs. Excelling at Math Concepts

The concept of asynchrony is visible too in Danielle's comparative difficulty with math computation. While Danielle was having difficulty with basic computation and number knowledge, her teacher acknowledged that in areas such as patterns and

strand-based knowledge, she was doing much better. Danielle's Dad also commented on the anomaly apparent whereby she was struggling with her maths and yet there were "*other things that she was doing so well … with a very high level" (B6:9).* Excelling at math concepts with an accompanying difficulty verbalising the steps and slow processing of computation is a commonly observed characteristic of gifted visual-spatial learners (Silverman, 2002; Golon 2004, 2008; Rapp 2009; Mann, 2001, 2005). Silverman and others note the unfortunate consequence that undue focus on timed tests, drill and repetition can cause these students to believe they are not good at maths.

Danielle's classroom teacher acknowledged she seems to have difficulty and "stumbles in her thinking" with understanding and using different math strategies. Her Dad understood the difficulty she met in trying to learn basic math computation facts and strategies as a kind of "block". He articulated that she needs to have things explained to her in a certain way that works for her.

While teaching strategies noted to disadvantage visual-spatial learners, such as memorising math facts and following steps to complete computation (Silverman 2002, Golon 2004, 2008) may work for auditory-sequential learners, Rapp (2009) points out that they can at times do a disservice to both. She notes that while ASLs may be able to produce correct answers they often do so without real comprehension of underlying mathematical concepts. Methods that are critical to understanding for VSLs, such as placing them into the context of real life experiences with which they are familiar so they can access their conceptual web of related ideas (Silverman 2002, Golon 2004, 2008) can also be valuable for ASLs to gain a deeper understanding. Rapp also points out that the disadvantage to VSLs goes much deeper, stating that where their auditory sequential counterparts at least gain the positive feedback of successfully answering correctly – the negative academic and emotional impact of failing at basic skills hits VSLs hard. They suffer lowered self esteem and come to believe themselves as incapable, never realising their true mathematical ability (Rapp, 2009).

7.2.5 When Learning Difference Equals Learning Disability

William demonstrates the concept of extreme asynchronous development very well. The unbalanced development of his abilities has caused significantly uneven achievement in school subjects. Silverman described gifted VSL students who have such a marked discrepancy when she wrote that they

> often acquire block-building skills earlier than children their age, while speech may be delayed. They are considered "late developers". Math skills may be way ahead of reading proficiency. A child may understand concepts very well, but not be able to express those concepts in writing. There are usually marked inconsistencies between strengths and weaknesses in VSL's. When these discrepancies are severe enough to cause the child to be frustrated, he or she needs to be referred for comprehensive evaluation to determine if there are learning disabilities.
>
> Silverman, 2002, pg 104

Silverman (2002) points out that whereas long term memory is a strength for visual-spatial learners, auditory short term memory is a weakness. This was confirmed as a difficulty for William, who returned a low average score of 9th percentile for working memory (attention, concentration, short term auditory memory) in the WISC-IV Australian testing carried out by the testing educational psychologist. This low score suggested the possibility of an Auditory Processing Disorder, for which he was subsequently tested and this diagnosis confirmed.

William's Mum referred to him fitting the profile of a late bloomer and commented on the effect of his uneven development. She said that he is beginning now to experience the benefits of increased success in areas that he had initially struggled with. However, there had been a tendency for school to adopt a 'let's wait and see' approach. She described for me the long path travelled to finally end up in the office of the educational psychologist who held answers to questions they had been asking since before William had started school.

While not being a competent reader is a significant barrier to school success for William, an important difference comes into play when extreme visual-spatial students like him access their prior knowledge. Such students are "sponge-like" in their ability to soak up new knowledge; however this knowledge comes solely from

experiences; what they do, and what they observe. It's critical that William's teachers realise that he is not lacking in cognitive ability or knowledge. Rather, he lacks fluency in finding the words he needs to verbalise his thoughts. Also, like Danielle, he may often feel his ideas are out of step with what is expected (Silverman, 2002).

7.2.6 Challenges with Organisation

William's Mum commented on the contrast between his excellent visual memory and his less than optimal ability to remember a verbal instruction. It was noted at school and at home that organisation is an area that creates challenges for him. William's Mum notes that with juggling the demands of a busy family, the household routine is prone to being a little 'topsy-turvy'. With parents who both self-identify as visual-spatial learners themselves, achieving successful organisation for this family is likely to be even more of a challenge.

Organising homework is a new demand for William this year. However the belief that his ability at this will improve with some simple positive/negative reinforcement, as can be the case when younger students are introduced to exercising higher levels of self management skills, is again likely to create stress if improvement fails to eventuate. While such behavioural reinforcement often works for students with well developed auditory sequential abilities, students like William need extra support with developing organisational skills, in a form that works in sympathy with their strengths and doesn't rely on their weaknesses (Silverman, 2002, Golon, 2004, 2008).

7.2.7 Over-excitabilities

Golon noted that visual-spatial learners are invariably also kinaesthetic learners. She pointed out that they are highly aware of their environment and that they synthesise information from all their senses as they formulate their understandings and knowledge. Sometimes this hyper-awareness can impact negatively on their ability to focus on what is required by the classroom teacher. Too much stimulus from visual, auditory, tactile and/or olfactory sources can create an overload of information from which they struggle to filter out what is superfluous in order to follow an instruction or key expectation (Golon, 2004, 2008).

These features were in my mind when I checked with William's teacher about elements of his classroom environment such as the value of the ergonomically designed chairs in light of his tendency to "jiggle" and about possible distractions from him being seated right next to a window. While his teacher hadn't observed any problems, William's Mum had commented that he often comes home very tired, particularly towards the end of the week. She said that he copes with the ordered structure of school routines but then just often doesn't have anything left in the tank at the end of his day or week. There are clear links with behaviours described and with earlier discussion of Dabrowski's overexcitabilities (Lind, 2001).

William's auditory processing disorder diagnosis confirms that he does have difficulty filtering out distracting background noise and his ability to process speech is compromised by this. When asked about his capability with following a series of instructions, William's teacher noted that he didn't stand out as one who would query a verbal instruction through not managing to effectively follow the series, for whatever reason. She considered he was generally "*pretty good at that" (C3:4).* My own observations of William in class however revealed that he quite often referred to what the student next to him was doing and took cues from others. In light of his auditory processing disorder this is likely to be a strategy he has developed to compensate for his difficulty in following verbal information.

7.2.8 The Gifted Female Visual-Spatial Leaner

Much has been written about the nature and behaviour of gifted girls and while it is not something specifically addressed in this study, it would be remiss not to acknowledge that special concerns have been identified in research, including sociological factors such as gender bias and self image issues. Of particular note is that the under representation of girls in the gifted population is an area of concern explored by Silverman (1986). Thus, as her interest in gifted visual-spatial learners grew, Silverman looked at the concept and questioned the common perception that visual-spatial ability was an area where males were invariably superior to females. In opposition to the belief that males performed better at visual-spatial tasks, Silverman found evidence to suggest that tools used to measure these abilities may be gender-

biased. She wondered too if males and females are programmed, whether biologically or culturally, to use the abilities for different purposes and therefore maybe the same concept could look quite different in males and females (Silverman, 2002). Whatever the case may be, this further reinforces the assertion that along with commonalities, individual variation is to be expected within the visual-spatial learner population.

One of the antecedents of gifted girls being an under represented group is that they often hide their abilities in order to conform to social expectations (Reis, 1987). The issue of fitting in to please others is an example of the social and emotional needs that gifted students can require support with. This is an especially pertinent issue for gifted female gifted visual-spatial learners because being a visual-spatial learner has been traditionally viewed as a male domain.

7.2.9 Frustration Equals Stress

Kyle's resistance to writing has been explained as a consequence of the fact that writing is a task that works in opposition to his visual thought processing. The negative effect of this difficulty is compounded for Kyle because not only is the act of writing impeding his creative output, reproducing an idea in written form when he has already completed the task mentally is an act that holds no intrinsic reward for him.

This example of conflict between academic expectations and the way the visual-spatial mind functions can be a common dilemma for gifted students. Depending on their personality they may simply refuse to play the game, thereby frustrating their parents and teachers. Or, if they are more compliant, they conform with expectation but at a cost (Rimm, 1997). Either way, the struggle to maintain interest and motivation within what quickly becomes an unsatisfying learning environment for them leads to tension and stress, both for them and those around them. Lind (2001) points out that gifted individuals are more prone to stress reactions because they take in more external input and respond more intensely to it. Hours of boredom can lead to sub-optimal behaviours as the student strives to cope. These may take an overt form such as refusing to complete work assigned and negative outbursts in response to any consequences imposed. Or they may impact internally, resulting in depression and other negative psychological outcomes such as withdrawal.

The above are examples of some of the less positive behaviours that can present in gifted students as advanced by Betts and Neihart (2010), Heacox (1991), Porter (1992), Webb et al (2004) and discussed in the Literature Review section. In working to resolve such issues it is important to acknowledge the part played by exceptional abilities as an underlying cause of the behaviour if responses are to be effective. Part of this includes acknowledging that although ostensibly negative in nature, the way the student responds can be a sign of advanced ability to think critically and act independently (Dabrowski, 1970). Self determination is a feature of giftedness advanced by the Ministry of Education (2012). As with other traits it is important not to only consider the positive aspects of these as gifted behaviours.

7.2.10 Summary

Learners who have exceptional visual-spatial abilities can face learning challenges. While tasks that utilise their spatial abilities can be performed to a high level, these same abilities do not lend themselves so well to the performance of other tasks that require sequential or step by step processing. This asynchrony was observed with the first case whereby the learner found the act of writing irksome as it interrupted his flow of thought-processing, and with the second case as a difficulty in rote memorisation and understanding of basic maths facts when this learning was not presented in a way that made sense to her. The third case was an example of where the disparity was so large as to be symptomatic of a learning disability. Difficulties with verbal communication and auditory short term memory were noted together with organisational challenges. In each case the problems discussed can be related to the different way that the learner incorporates information they perceive through observation and other experience-based actions into a globally-connected, visually-oriented web of knowledge (Sword, 2000).

Issues related to the sensitivity and intensity of gifted learners reported within the Literature Review were observed and some significant social and emotional issues identified. These included feelings of frustration and the potential for a lack of self-belief when difficulties with “easy” work are evident. Feeling “out-of-step” with others was in evidence, along with implications from over-excitabilities, such as tiredness and stress.

7.3 What Has Helped?

While variations demonstrated across the three cases make it impossible to present one 'recipe' for designing appropriate provision, common threads that run through each case are highlighted in the following section. Differences stemming from the individuality of each participant are also noted and discussed.

7.3.1 Differentiation that is Responsive to Demonstrated Needs

Provision of curriculum that addresses the diverse needs, strengths and identities of gifted and talented students may seem a daunting task. To support provision of appropriate learning experiences, the Ministry of Education have guidelines for meeting the needs of gifted and talented students in New Zealand schools (Ministry of Education, 2012). Passow (1996) reminds us that the basic tenet of differentiation for gifted students is that the resulting content, process, product and learning environment must be sufficiently different to that provided for other children in the class in terms of their learning needs, preferences and abilities, to be appropriate for the individual. Reference is made within the Ministry guidelines to Bell's (2010) suggested list of criteria for a suitable curriculum model. Among other worthwhile evaluative considerations Bell includes that curriculum be flexible enough to allow for differentiated content, process, product and learning environment suited to individual learning needs within different areas of giftedness.

For gifted visual-spatial learners differentiation of these four elements that meets their need for a curriculum that is appropriate to their very different way of processing must form the basic blueprint for creating a successful learning experience. Bell (2010) also notes the importance of meeting social and emotional needs and in reviewing the fundamental place that these take in relation to the holistic learning style described here, this forms a very important aspect that must be considered when designing appropriate provision for gifted visual-spatial learners. Acknowledging the over-sensitivities that gifted learners can often be affected by is another important element of differentiating the learning environment to meet the needs of these students.

7.3.2 A Student-Centred Learning Environment

Having never been educated in a regular classroom setting was a real point of difference with Kyle. Kyle's home school environment has provided him with an individually designed education that allows him to utilise his strengths and work around his weaker areas in ways that keep him motivated and positive about learning. This case provided valuable illustration of many positive features contained within a responsive student-centred learning environment where learning experiences have been tailored to his individual learning preferences. An example of the type of autonomous skills this kind of learning environment can encourage can be seen in Kyle's gifted programme teacher's observation that he will adapt a situation that presents him with some difficulty in order to move around it. While he doesn't like to write, he can, and when presented with options will chose to record his ideas in a format that meets his purpose and utilises his strengths. His teacher noted that this ability is likely to have been developed through being supported by his mother in the role of mentor or guide talking through his ideas and then being given the time and whatever resources he needs to achieve his objectives.

Student-directed learning provides an ideal vehicle for meeting the needs of gifted students overall. When students are engaged and motivated, reflexive teaching can take place that responds to individual students by mediating their learning as needs arise. Teachers can help with focus, assist with planning, provide feedback that prompts further meaningful learning, make the processes they are employing explicit and help them to use metacognitive skills to self monitor their progress. The higher order thinking that these learning conversations promote provides the ideal foundation for fostering the mastery orientation (Dweck, 1999) that motivated gifted learners exhibit. Such learning environments therefore create a satisfactory cycle whereby effort is motivated by a desire to become more competent and the kinds of skills and learning dispositions that students need to develop can be the focus of learning.

Kyle's case demonstrates how this pedagogical style meshes with his style of thinking and learning. His curiosity to find out how things work and to then design and create solutions to real world problems often incorporates empathetic and ethical dimensions. The example of him creating a mobile operating theatre was a great

example of this. His parents' comments about the concern he shows for younger or less able children, together with his willingness to help his grandmother with her computer knowledge and to help teach his classmate when they are learning about a topic in his gifted education class, are all further examples of him engaging in self-directed learning that demonstrates the kind of holistic processing that is under discussion here. Also, because it relates to the learner's experience and involves solving a problem about which they care, the learner will own the learning and retain it for transfer to future applications (Silverman 2002).

7.3.3 Utilising Visual-Spatial Strengths to Maintain Motivation

In discussion around what it is like for students who struggle with some aspects of school but have other areas where they have a very natural, intuitive ability, William's parents agreed on the importance of using topics of high interest to the visual-spatial student and allowing them scope to work from their strengths rather than focusing too much on remediating perceived weaknesses, for maintaining motivation. Care needs to be taken to see that students who are disadvantaged by weaknesses in language are not further disadvantaged by too much emphasis being placed on working through those areas of weakness. William's Mum talked about him coming home from school so mentally tired that it is a struggle for him to find the resources necessary to complete piano practice or homework or anything that requires him to dip into his reserves – after a day of working at school in ways that do not work in sympathy with his natural style of processing, the tank is empty.

Sword (2002) wrote of the relief she observed when children finally understood that rather than there being something wrong with them, the problem was due to them thinking and learning in a different style to the way our school system teaches. She explained the damage that occurs when educators focus on remediation and concentrate too much on trying to fix problems:

> What happens with that approach is two things: one is that these children, who have magic in their heads, who can see the most beautiful pictures and have great creative thinking, have vivid imaginations, can create wonderful stories, solve problems, be the inventors of the world, the artistic souls of the world; these children don't learn how to use their

> strengths. They don't learn how to use what they're really good at (visual thinking) and, in fact, they are often not aware that they are good at it.
>
> What happens to these kids is that they themselves concentrate or are made to concentrate all the time on their area of weakness. What that does to you inside of course is what really does the damage, because if you struggle away, struggle, struggle, struggle, and you don't really improve all that much, after a while you can only think of yourself as dumb. We reinforce that; our system reinforces that for years and years and years. That's what does the damage.
>
> Sword, 2002, p. 2-3

Kyle's gifted programme teacher suggested that one of the important benefits for gifted children of attending a programme such as theirs comes from the student being given the flexibility to work to their strengths and thereby create and present work that showcases their abilities and through this, experience success. If instead, creatively gifted students are restricted by insistence that they utilise what for them may be a weakness, their consequent failure to realise a positive outcome provides a negative message about their abilities.

Golon (2008) supports this viewpoint, pointing out ways to utilise aspects such as visuals, music, colour, humour – all features that allow visual-spatial learners to demonstrate their understandings through incorporating their strengths - into a language exercise. Presenting ideas in more graphic form, e.g. a storyboard, or a cartoon, at least initially, could enable visual-spatial students to experience more positive feedback on their abilities. Also, if the context of the language exercise is within their realm of experience and expertise, rewarding and therefore more motivating outcomes should result.

William's teacher suggested that looking for familiar chunks or other details that provide visual cues to help with working out unknown words was something that would help him. What she describes is, in essence, an approach called analytic phonics. Phonics is a way of teaching reading that correlates letters, or groups of letters, with sounds and as phonological awareness is a recognised weakness for William, this is an area where it is important that the approach used accounts for his different way of learning. For students like William who have difficulty hearing and distinguishing letter sounds, it is suggested by Maxwell (2003) that analytic phonics is

a more useful approach than synthetic phonics which is often the preferred method for new entrant learners (Wyse and Goswami, 2008). Using already familiar words to teach sounds rather than teaching sounds out of context of an understandable unit of meaning, enables students to apply prior knowledge that they have amassed from words that they know. And rather than relying on an area of weakness, they can use visual cues and meaning cues to help them too (Golon, 2004, 2008; Maxwell, 2003; Silverman, 2002).

That an approach that works backwards from the whole, analysing its parts, might work better for a visual-spatial learner than one that sequentially builds up step by step towards a whole, is supported by literature on the way that a visual-spatial learner learns. As well as utilising the visual-spatial learner's strength in their ability to visualise a whole word rather than their weakness in listening for sounds, they are enabled to employ a further strength in finding visual patterns and they are applying these strategies within the context of a word that has meaning attached (Golon, 2004, 2008; Maxwell, 2003; Silverman, 2002).

Maxwell discussed the importance of cultivating visualisation and imagination to aid the visual-spatial learner's acquisition of reading. She recognised their love for fantasy books with strong themes of adventure and struggles between good and evil; their fascination with unusual story lines that include unexpected, quirky happenings. She also noted that "visual-spatial learners learn best through teaching to their strengths, and Whole Word reading, with its use of visual memory, pattern recognition, valuing the emotional impact of words, and utilizing playfulness and humour, uses those strengths well" (Maxwell, 2003, p. 5). Struggling visual-spatial learners may not read every word but using these building blocks to build supports can help them to gain the enjoyment and motivation needed to persist with the challenging task of reading (Maxwell, 2003).

7.3.4 Time to Process and Conceptualise

While she had got off to a slow start comprehending my verbal explanation of the planned process for our interviews, after time for reflection Danielle had found her way and by our second session together she demonstrated that she was linking the

taking of photographs with the recorded information on our mind map and had formulated a very cohesive understanding. Key aspects are that Danielle struggled to comprehend solely verbal information and that she needed time and support to make links between what she heard and other supplementary information such as visual cues and her image-based prior experience. It has been observed that Danielle behaved in a rather self conscious way during our first session, when she was unsure of what was required of her. Again, it follows that to begin with Danielle had no "picture" of what was to happen and therefore no sense of certainty as to what she needed to know. Even though the process had been explained, she had yet to assign meaning to the words. For example, the explanation of what a mind map was only began to make sense as she observed her words being written on to the map as she said them. Only then was she able to make meaning as she could "see" what was meant.

This further illustrates the overarching understanding that is required to fully comprehend and to remediate the difficulty Danielle sometimes has in making sense of new information. She needs to be helped to create an image first so she has an 'answer key' as she then subsequently meets up with pieces of the puzzle. In other words, in isolation, each piece has no meaning and she has no "hook" to hang them on as she progressively formulates her own understandings (Silverman 2002). The example given in this case where Danielle's teacher provided models of the 'Hole in the Wall' art work and then supported Danielle as she worked backwards to figure out how to achieve the end result is a strategy that worked well for her and could be generalised to other learning experiences.

Maths teaching is largely language-based; teachers adopt 'think alouds' to make their thinking visible as they step through a process. When this is done well, use is made of manipulatives, or a diagram may be drawn so that the teacher is "showing" while talking and adding visual elements to the verbal information. Reinforcing verbal information with visual is a valuable strategy for all; however for learners like Danielle the visual is more than an added extra. Being able to make her own visual image that fits with her prior knowledge is integral to her successful processing of information.

It is therefore important to ensure that sufficient time and opportunity is provided for her to assimilate the new ideas into her existing knowledge. The translation time required for a "picture thinker" to transfer, create and absorb is addressed by Mann (2001, 2005) who suggests frequent pauses in lectures/instructions and encourages the drawing of diagrams, the use of graphic organisers and note taking in pictorial form to aid recall. Also important is being very explicit about assigning shared meaning to maths vocabulary thereby avoiding making implicit assumptions about shared understanding of the terms that are used in verbal explanations (Khisty & Chval, 2002; Walkerdine, 1988; Christensen, 2004; Sullivan, Mousley & Zevenbergen, 2003).

Alton-Lee (2003) advocates that teachers should provide multiple opportunities for students to create non-linguistic representations of their understandings. Danielle demonstrated more than once when working with me that she liked to draw her understanding, and that it helps her to verbalise her thinking to be able to do so. Communicating graphically as part of everyday teaching is likely to help all of the students in the class. However beyond that, for Danielle and others like her, providing opportunities for them to draw a picture or build a model to represent their thoughts may really help them to be able to present and share their ideas and thereby enable truly effective teaching and learning to take place (Hatano and Inagaki, 1998).

Kyle indicated a preference for seeing an example in action and then setting about figuring out exactly how it worked - an inductive approach. My method for explaining the study requirements to Danielle was in contrast with her similarly preferred learning method of observing and then following the image that she creates herself once she recognises the 'complete idea'. In other words, she forms a picture of what it will look like as it is being done, before she starts. Danielle's Dad referred more than once to her spatial organisation, saying "*she's very spatial, you know, she's very … she has to see things and to look at things, and when it is not presented properly, like this to her, she … she struggles to understand" (B6:9)* and "*because as I said, she is very spatial, so if you tell her 1, 2, 3 and 4, in her mind, the whole thing is ready, so she is going to go there and do it, you know*" *(B6:12).* William's parents also described how he needed this extended time to observe and mentally rehearse

before he would attempt something new; however he often proved very capable when he finally did so.

7.3.5 Experiential Contexts that Support Deep Learning

When Kyle's gifted education programme teacher talked about the kind of inputs she employs, she indicated that in many respects his needs in this area are typical of all of her gifted students. She tries as much as possible to provide visuals, using a lot of You Tube ™ clips and similar visual stimuli, to emulate as closely as possible, real experience. On top of the manner of presenting new material, his gifted programme teacher emphasised the need for giving the students sufficient time to physically try things out. So again, her experience illustrates the need for content to be challenging and for it to be meaningful, which happens best for visual-spatial students when they encounter experiential learning.

Kyle's mum had also commented that he works better in hands-on learning situations when he is physically as well as mentally involved in an experiential way. His father's comment that he likes to get out his pencil and paper and "doodle" is another example of the helpful connection between a physical act, in this case drawing and the mental work of thought processing. In a research study to ascertain how effective doodling was in improving attention to a listening task, Andrade (2009) showed that participants who doodled while listening recalled 29% more information. Possibly, a similar study that isolated gifted visual-spatial learners would show a greater effect. While Andrade considers doodling to be simply a way of filling in time when bored and asked whether it might assist cognitive performance by reducing daydreaming, this perspective is very much at odds with the idea that doodling may in fact help to activate the visualisation process that visual-spatial learners employ as they perform cognitive tasks.

7.3.6 Direct Instruction in Organisational Strategies that Utilise Visual Strengths

The excerpt where William's Mum describes her process in helping him with a language skills homework task is interesting because it supports common advice that

visual-spatial learners struggle with step by step learning (Golon, 2004, 2008; Maxwell, 2003; Silverman, 2002). Of importance is the fact that William is being shown this step by step process through one on one demonstration, physically modelled for him to see, at a pace that he can control. The process itself would be likely to break down and become incomprehensible to him if it was being verbally explained without that physical one on one interaction happening. William's Mum questioned whether it links in with memory, and indeed, actually seeing someone doing the process that he needs to then follow is the critical aspect that allows him to make a visual mental image that he can then commit to long term memory and call on as he follows the process himself. It also allows him the opportunity to find and then follow patterns that help him to make sense of this and future tasks (Maxwell, 2003).

Silverman (2002) writes that those for whom such organisation comes naturally will often not understand the problem because they assume everyone else should be able to do it as easily as they can. As illustrated in the example of demonstration above, she also points out that VSLs need direct instruction and gives examples of strategies to try. One suggested solution is to take a photograph of what the finished product should look like, for example how a bedroom appears just after it has been tidied. Again this is helping them to reinforce their visual image, and when they need to recreate it, they have a picture stored away to reference.

7.3.7 Working with Like-Minded Peers

A further valuable feature of Kyle and Danielle's gifted programme is that it provides the students with intellectual peers. Working with students that have strengths or knowledge in topics other than their own areas of expertise can stretch students in new directions but more importantly they are given the opportunity to work with others who share their capabilities for learning quickly and easily. This aspect is important for gifted students in that it helps to normalise their educational experiences somewhat, supporting the development of their self image in a positive way. The learner also benefits from opportunities to have others open up what they think they know and introduce new ideas, or ways of looking. This is relevant to all gifted learners in that it underlines the need they have for working with others of similar ability, rather than always being the one who has the most knowledge (Cathcart,

2005). Gifted visual-spatial students particularly can benefit as their divergent thinking and working style often sees them out of step with others (Silverman, 2002). When these aspects are a constant feature of one's day to day experience, motivation can be depleted and repercussions in the form of negative coping strategies result.

There have been some good examples shown of the case study students employing a community of learners approach in their self-directed learning (Gabelnick, MacGregor, Matthews and Smith, 1990). A notable part of her process involved Danielle in consulting with others to canvas their opinions. This aspect of "group think" highlights one of the qualitative differences that start to occur when you have a group of gifted students working together. I've often been privy to exchanges where a gifted student has been asked what they like about their gifted programme and heard them reply "It's just fun," however this answer doesn't always reflect well the true meaning that they are trying to impart.

In the snippets of teacher reflection where Danielle's gifted programme teacher described the teaching and learning process that takes place can be seen some of the essence of that "fun" for the students. Firstly, they are able to use areas of exceptional ability within challenging tasks such that positive feedback on it is received (and often this can be an intrinsic sense of satisfaction as much as anything else). Secondly, to take risks in an environment where such risk taking is encouraged and supported along with the opportunity to "network knowledge" with a group of like-minded peers – these activities contribute to a rewarding feeling that, in the mind of the student, equates with "fun".

7.3.8 Learning Environment Sympathetic to Overexcitabilities

Kyle's gifted programme teacher observed that the material being presented to him in his home school programme is individualised for his learning level, whereas in a regular classroom, even if fortunate enough to be receiving appropriately levelled work in some areas, he would still often need to sit through a lot of instruction that is pitched at a lower level, along with all the other 'clutter' that he would have to shut out in a classroom. His teacher spoke of this as she made comparisons between him and the other gifted learners in her class in terms of the learning environments that

they each experience, saying that she considered that he listened better than a lot of the other students, who had spent years "bombarded" by an overload of extraneous sensory information. In his homeschooling environment, Kyle has to a large extent avoided any adverse consequences that over stimulation can cause for gifted students who have difficulty coping with too much sensory input.

The idea that gifted students can have difficulty coping with over-stimulation from an excess of sensory information in a busy classroom is one that has been explored in the Literature Review. The downside of being exceptionally sensitive includes limitations imposed through needing to almost protect oneself from too much input by way of noise, light, smells, as well as physical and emotional sensations (Lind, 2001). William's Auditory Processing Disorder diagnosis along with comments made by his mother suggests he does find this problematic. There were no obvious suggestions to indicate that Danielle experienced difficulties in this area.

7.3.9 Positive Personality Traits

A review of the criteria discussed in the Literature Review section under Behavioural Characteristics suggests that Danielle doesn't display any of the negative behavioural aspects that can sometimes occur. It is encouraging to note also that she has many positive character attributes such as perseverance and resilience and these enable her to maintain a positive self image in the face of any initial struggle/failure. She demonstrates an attitude that is also helpful to maintaining a positive frame of reference within her ability to follow instructions and complete work as required. These are qualities that are critical to school success, and indeed success in life in general. It is important however that the qualities students such as Danielle possess in terms of having a high level of self determination (such as being an independent thinker, capable of making decisions based on their own judgements and reasoning) continue to be viewed positively and not 'squashed out'. This is particularly true for those students who demonstrate levels of these characteristics that appear excessive when compared with norms (Piechowski, 2003).

7.3.10 Summary

Differentiation for gifted visual-spatial learners must provide content, processes, products and learning environments that are appropriate for their different way of processing information. Provision of a responsive student-centred learning environment can help to address social and emotional issues including maintaining motivation. Allowing them to utilise their strengths is important in order that they experience success. Too much focus on remediation of weaknesses on the other hand can reinforce negative messages about their abilities.

An appropriately differentiated curriculum for gifted visual-spatial learners will incorporate features to support their development of a visual image. The need for extended time to process language-based input and conceptualise information forms a significant element of this process. Provision of student-directed learning in experiential contexts where the learners can physically interact and incorporate these experiences as they create their representational image-based knowledge will create an important foundation for successful learning. Physical modelling of processes that allows for visualisation of an overview of what it looks like as the process unfolds is helpful; particularly where these require step-by-step progression.

Further social/emotional needs discussed include the value to be gained through working alongside others who share their different style of learning. Also, awareness of potential difficulties that can result from oversensitivity to sensory stimulation is a dimension that can help when providing an optimum learning environment for gifted visual-spatial learners. Knowledge of common gifted traits such as self determination can also help educators and parents to provide positive support for gifted visual spatial learners, especially as these can, in combination with typical gifted intensity, be viewed as less constructive behaviours.

7.4 Awareness of Difference

7.4.1 Acknowledgement of Difference from Others

Kyle's Mum observed that they had noticed there was something very different about him from a young age. As the youngest of her three boys, she noticed for example that he was able to do three dimensional puzzles very easily where others struggled. He was noted by his Dad to have a natural empathy and caring nature towards others, to the extent that others would comment on this, again from a very young age. His reading was also very advanced for his age in both complexity of text and content. Kyle's Mum recognised that he was an obviously bright child who could converse very intelligently on technical topics however concerns with remembering simple times tables, writing difficulties and occasional spelling confusions had prompted Kyle's parents to seek a cognitive assessment to pinpoint the cause of this disparity in his abilities. The report provided has helped them to understand Kyle's giftedness and how his abilities relate to his learning style. While Kyle's Mum felt that her understanding of visual-spatial learners was not great, she voiced her recognition that his weak areas such as his poor handwriting, not so great spelling and reluctance to write would mean that in a regular classroom he may not be top of the class in tests. She felt teachers may not see beyond these behaviours to recognise the gifts that show up when he is able to follow his curiosity in self-directed learning experiences.

In her dual role as his mother and teacher, Kyle's Mum has in-depth knowledge of what works well for him. She has created a responsive learning environment and shows she has an excellent understanding of his learning preferences. He has frequent opportunities to participate in activities that aid the development of his visual-spatial skills. Enabling Kyle to work using his strengths has assisted development in all areas and provided a real advantage in keeping him motivated.

Kyle and Danielle both attend the same gifted withdrawal programme although they are in different classes and each has a different teacher too. Within the lessons that were observed it was evident that as experienced specialist educators, their teachers also understand the importance of a responsive learning environment for gifted learners. The expert knowledge they each demonstrated of common gifted

characteristics and behaviours that are a daily part of life in their classrooms is utilised to create a programme that allows their students to build on their strengths and to take part in learning that is in tune with their needs. Kyle's teacher recognises the importance for him and for the other gifted students in the class also, of providing hands-on visually stimulating experiences where the children can participate actively in their learning.

Danielle's mainstream classroom teacher mentioned that she hadn't learned about visual-spatial learners beyond a brief introduction during her teacher training. In class she herself didn't see too many differences between Danielle and the other students. She acknowledged that the work she had seen Danielle produce at her gifted programme showed up her strengths and that the work they did in class wasn't often in areas that fit with those visual-spatial aptitudes. She hadn't heard of Silverman or her work, and found reading through a list of visual-spatial characteristics written by her very interesting.

Danielle's parents both recognise the exceptional facility she demonstrates in her capacity to lead others in a sporting context and her Dad was able to explain the way that her visual-spatial ability plays a part in this. Her father readily identified with the way that she processes information and provided examples from his own experiences that showed he too shares a visual-spatial orientation to the world.

There was an interesting disparity of views between teachers and parents over things like how organised the students are. Also with William, awareness of how well the student copes in classroom was viewed differently by home and school. While William's Mum was very aware of his tiredness at the end of a school day and particularly at the end of the week, his teacher didn't see this as a difficulty she had herself observed. These different perceptions may occur because students behave differently in different settings. Other reasons could include the way the students respond to different levels of expectation, for example, parents and teachers may offer a higher or lower level of support and assistance with tasks.

William's parents both expressed empathetic understanding of his visual-spatial learning style. Each of them connected through similar experiences of their own, offering anecdotes that illustrated their own visual-spatial strengths. William's Dad

showed his insight into and familiarity with the descriptions of being a visual-spatial learner, for example when he talked of having a very good visual memory for places. He often used descriptive gestures to help describe the idea he was explaining. He also identified with having difficulty reading large amounts of text and described his strong preference for reading text on a computer page.

William's Mum understands him very well; she empathises having gone through some difficulties similar to William as a child herself. While searching through a file of papers that she has collected in the process of exploring the reasons for William's speech and hearing problems to find me a copy of the educational psychologist's report, William's Mum shared with me that they were feeling more relaxed having learned more about the concept of visual-spatial learners and understanding William better in light of this.

William's Mum noted that because his exceptional abilities aren't used in areas where strengths translate into academic success she considers they are not generally recognised or particularly valued at school. Drawing on her own experiences, William's Mum voiced her awareness that teachers tend to derive from a language-based world and to take their values from this same framework. She also talked about how others have responded to William in terms of seeing him as a child who is less capable, because of his speech delay, and that because his strengths are in areas that don't correlate with the fields that ability is traditionally rewarded in school, such as maths, reading, etc., suggesting him to have exceptional ability in any area becomes difficult.

This insight highlights a real barrier to these students being identified, and having their needs catered for in schools. Firstly, there is a common perception, from both within and outside of schools, that allies giftedness with being academically talented (Education Review Office, 2008). The question "What exactly is he gifted *in*?" is asked, with the obvious implication that achievement in some academic endeavour should be significantly visible. Even when that first hurdle can be crossed, there remains a real gap in knowledge over exactly how to go about meeting the needs of students who have abilities that do not align with academic success.

7.4.2 Extent of Self Knowledge

Kyle commented on his awareness that he approached learning tasks in a very different way to that of the friend that he often chose to work with in his gifted programme. He is aware of his capacity to remember "key points" through his visual memory and that whereas his friend chooses to write down the information he finds, Kyle doesn't need to do this.

In conversation with Danielle, I asked whether the thinking in her head was in English or in Portuguese and when she answered, I asked if the thoughts were ever in pictures. She exclaimed, "*Yeah, it's always in pictures!"* as if that should have been obvious to me. She explained, *"If I've seen it, then it's always in pictures" (B2:14).* Danielle's gifted programme assessor shared with me that gifted visual-spatial learners are exceptionally perceptive to evaluation and that they have often experienced others who don't share their unique perception (Assessor, personal communication, 2013). This feeling of being out of step with others (Silverman, 2002) but not being quite sure why can create a barrier to communication.

William's lack of ability to verbalise his thoughts made it difficult to draw conclusions about the extent to which he is aware of his different way of learning. It would be fair to say however that his parents have an in-depth understanding and the ability to provide support to William and an excellent resource for his teachers.

7.4.3 Summary

There was a variance of ease with which the adults that contributed data for this study related to the gifted visual-spatial learner concept. Clearly, some identified closely with the way visual-spatial learners perceive and organise information. These individuals related to descriptions of visual-spatial strengths and also readily appreciated the difficulties that can present for a visual-spatial learner in an educational setting. Silverman's (2002) observation that those to whom skills such as organisation come naturally struggle to understand why others cannot easily do what they can, supports that there is a general underlying assumption that we all use the same cognitive processes and that others do things in the same way that we do.

Chapter Eight

Conclusions:

The principal aims for this research were to describe the nature of the differences demonstrated by gifted visual-spatial learners and to describe how these differences affect their experiences and in particular their learning, within a New Zealand context. A further aim was to ascertain the extent to which this group of learners are recognised, valued and empowered to develop their exceptional abilities through equitable access to differentiated provision. In order to meet these aims, research questions (see page 5) were constructed to elicit information that would provide insight into how gifted visual-spatial learners perceive, store and use information. It was also intended to generate data to describe how much they and significant others in their lives recognised aspects of their learning that set them apart and how these differences were responded to. This chapter describes the conclusions that have been reached.

8.1 Description of Difference

Visual-spatial ability exists on a continuum from non existent to exceptional. Gifted visual-spatial learners may or may not have exceptional abilities in other areas as well. Sometimes they have identifiable learning difficulties. Their learning difficulties can be caused by their exceptional visual-spatial ability. This can occur when teaching methods are geared towards use of auditory sequential abilities - the abilities that teachers and academically successful students possess and use.

There were individual differences visible in the profiles of the three case study students. Case A (Kyle) has strengths across the range of abilities assessed. This case was a good example of a student who has a good balance of abilities. He has exceptional visual-spatial abilities that he utilises to the full. He also has strengths in the auditory sequential sphere that he can call on when needed, for example, Kyle processes verbal information quickly and efficiently. However it is apparent that he uses his visual-spatial abilities as a preferred way of learning and there are many

obvious implications that can be noted as a consequence of this, for example his strong preference for not recording his thinking in writing.

Silverman (2002) describes learners who fit this profile as 'high spatial high sequential' and clarifies that the most successful learners are those who can integrate information well from both hemispheres. The assessor who referred Kyle to me suggested that if visual-spatial ability is well balanced with abilities in other areas and there is no other complicating learning disability, visual-spatial students can usually figure out what is required and although it is not their preferred way of working they are able to deliver what is required (Assessor, 2013, personal communication).

Case C (William) sits at the other end of the visual-spatial ability continuum and would be described by Silverman as high spatial, low sequential. Case B (Danielle) sits somewhere between these two. In spite of the variations that could be seen across the cases, it was readily apparent that each of these three learners fit both the gifted and talented and the visual-spatial learner definitions proposed earlier in this thesis.

8.1.1 How do these Learners Experience Learning?

All three students demonstrated that they were adept at imaging complex and abstract ideas. They showed that learning for them involves the development of a three dimensional mental image that is permanently stored in long term memory and readily available as a resource for future learning. Visualising and making connections within and between image-based representations of concepts is an integral part of their learning process. Kyle's case described the way that he formulates and manipulates images as part of his creative process. Danielle's case demonstrated that she formulated verbal instructions into an image of how something will look as it happens as part of her planning process. William's learning process also involved an internalised non-verbal style of thinking. It was observed that he needs time as he too formulates an image-based plan of how something will look and that this often requires extensive observation and mental rehearsal before he is comfortable to attempt something new.

These students all showed that they work better in hands-on experiential learning situations where they are physically as well as mentally involved. They reflect deeply on sensory input perceived through observation and physical interaction. This information is then integrated into a global, visually-oriented, interrelated network of knowledge.

The students all demonstrated divergent thinking processes that fed a high level of creativity. They are able to use their exceptional visual-spatial ability to solve problems in unique ways. Using the amplified three-dimensional overview that they have created allows them to explore alternative angles and find patterns that others do not see. Sometimes this creates difficulty for them when they attempt to communicate their ideas.

8.1.2 Learning Challenges

All of the case study students demonstrated learning difficulties in some form. Their areas of challenge differed in type and degree however all have been associated with a visual-spatial learning style in the literature and can be explained as being a consequence of their visual-spatial ability.

The writing difficulty experienced by Kyle was described more in terms of being an activity that he avoids as being an irksome task rather than one that he is not capable at. It is suggested that writing is a task that works in opposition to his visual thought processing and as such interrupts his flow and impedes his creative process. However he demonstrated a superior ability to verbalise his thinking in discussion.

Being what is described as a non verbal strength, students who favour a visual-spatial processing style can find it difficult and time consuming to have to find the right words to describe their image. This was a challenge for all three students to some degree. While for Kyle it seemed to be more of an inconvenience whereby having to translate his thoughts into a written format slowed down his fluid processing, the difficulty was more noticeable for Danielle. She happily engaged in conversation once she had formulated her understanding of a new idea, but seemed to take some

time to make sense of verbal explanations and found it difficult to explain her initial thoughts.

For William, the absence of words was even more pronounced. Tasks that utilise verbal ability require him to depart from his natural mode of visual-spatial processing and use skills that are significantly weaker. For the first years of his life, he relied almost totally on his visual-spatial mode of processing and this style dominates the way that he perceives the world. This is demonstrated by his early ability and fascination with using construction toys to create, his capability for understanding math concepts and that he likes an extended time to observe and reflect internally on how something is done and then shows that he has utilised this in mastery of new skills. These abilities contrast with his delayed speech, his struggle to master reading and spelling and the effort needed to express his thinking, all of which require verbal skills.

8.2 How Were Their Differences Recognised and Responded to?

Students who have exceptional visual-spatial ability can be easily identified by their learning behaviours however the nature of their skill set often means that their giftedness is overlooked in regular school settings. Over reliance on traditional standardised testing to assess academic abilities, together with a lack of educator knowledge of giftedness in general and of visual-spatial ability in particular, can see both the exceptional abilities and the consequent needs of these students ignored.

All three students have had their exceptional visual-spatial ability identified through a cognitive assessment process. The assessors who administered these tests both have significant expertise and knowledge of the gifted visual-spatial learning concept and the implications for learning of this profile and have provided supporting information to parents and schools. Danielle's regular school have included her in their internal gifted and talented programme on the strength of her assessment and encourage her attendance at the one day a week gifted withdrawal programme. William's school have focused on remediating his learning difficulties with some good results. However there was no corresponding attention given to development of either student's exceptional visual-spatial ability, or to the consequences this processing style has for their learning.

Little evidence of educator knowledge about this particular form of giftedness was found in either of the two mainstream school settings in spite of information that had been passed on by parents and specialists. There was however a significant pool of expertise and knowledge held by parents, some of whom shared aspects of their child's ability set. All had invested a lot of time investigating and responding to their child's needs. Teachers in the student's gifted education settings were also knowledgeable about the gifted visual-spatial learner concept and confidently described examples of responsive teaching and learning strategies that they had found to be effective.

8.3 Implications of Findings

It is commonly accepted that children are individuals, each with their own combination of traits and abilities; each situated within a unique set of circumstances. However our education system dictates that students are processed through a standardised system that supports the belief encountered often in research literature that all children learn in the same way. Teachers who actively subscribe to the view that learning doesn't happen in quite the same way for all children can make a real difference. Teaching methods that account for the differences outlined above are necessary for these learners to thrive. Gifted visual-spatial learners need acknowledgement of the incredible strengths that they possess and an education that is built around preserving and building up their strengths so that they can develop their talents and achieve their potential.

8.3.1 Recommendations for Practice

Desired outcomes from this study include a raised awareness of the valuable strengths that gifted visual-spatial learners have, together with recognition of their extra ordinary educational needs. It is hoped that this growth in understanding will prompt a consequent search for ways to meet these needs thereby enabling equitable access to differentiated provision that will value the strengths that these learners possess and empower them to develop their exceptional abilities. To differentiate for gifted visual-spatial learners requires an in-depth understanding of both the characteristics and behaviours that are found within the concept of giftedness generally and of the different way that visual-spatial learners perceive, organise and interact with information. Also necessary is a willingness to be flexible and to adjust processes and materials responsively in the knowledge that something different may be required for these learners to make sense and respond.

There are many suggested teaching and learning approaches discussed within each case as being helpful in assisting these learners to access and make sense of new learning. The summary of what has helped these three case study learners suggests a responsive student-centred learning environment to be a key aspect. This is recognised generally as being a positive pedagogical element desirable in teaching

and learning for all students. For gifted visual-spatial learners this means being responsive to their differences and affording them opportunities to utilise and develop their areas of strength.

Gifted visual-spatial learners need opportunities to engage in learning experiences that allow them to exercise their ability to create solutions to problems that are dependent on the visualisation and understanding of complex three dimensional systems and/or the recognition of visual patterns. They need to engage in self-directed learning that recognises their intrinsic curiousity about the world around them and facilitates their ability to see relationships and detect inconsistencies as they seek to explain what they observe.

The parents in this study all showed that they have an in-depth knowledge of their child's abilities and areas of challenge. Often their knowledge is based on empathy for the child's way of learning and understanding. In each case, they present as a substantial resource available for teachers. Also, these students have all undergone an extensive assessment procedure carried out by professionals who have worked with many similar children and again have a comprehensive knowledge of the needs of these learners and ways to meet them. The students who are attending a specialist gifted education programme are also working with knowledgeable practitioners who have a wealth of information available for sharing. This pool of expertise should be valued and actively sought out.

8.3.2 Professional Learning Needs

Understanding of the complex nature of the concept of giftedness by educators in New Zealand has been found to be improving; however there are still areas where professional knowledge is lacking. These gaps underlie the recognised deficiency in identification of "hidden groups" within the gifted learner population (Riley et al, 2004, Education Review Office, 2008, Ministry of Education, 2012). Professional development for educators around the concept of giftedness in general is critical to successful identification and provision for all gifted learners. Specialised knowledge is necessary in order to build a platform from which to design effective provision that meets the individual needs of each gifted learner. For gifted visual-spatial learners,

this must include recognition, valuing and development of exceptional abilities that are not based on verbal/sequential reasoning. Increased awareness of the behavioural characteristics of gifted visual-spatial learners is crucial in order for educators meet the needs of these students. These needs include recognition of the importance of allowing these students to use their strengths in their day to day learning experiences as well as equitable access to educational provision that includes opportunities to develop their visual-spatial talents.

An element for which understanding needs to be fostered is that of intensity as a characteristic of giftedness in general. This has important implications in providing support for the social and emotional well-being needs of the student, areas that have been recognised as being not well understood by educators (Ministry of Education, 2012). Case study participants demonstrated that they reflect on information that they have perceived through observation and physical interaction to a very deep level. The intensity with which they strive to make sense from experiences can come at a cost. The provision of an environment that is sympathetic to the effects of over excitabilities is a necessary part of differentiation for gifted and talented students. Also, gifted visual-spatial learners often demonstrate exceptional abilities in areas that utilise their strengths while appearing average or even struggling in others. Therefore an appreciation of the normalcy within the gifted population of asynchronously developed abilities helps to respond with appropriate support and provision.

8.3.3 Strengths and Limitations of the Research:

Limitations of a study are the characteristics of design or methodology that influence the interpretation of results, thereby potentially compromising the validity of the study. Elements that could have possibly impacted the ability of the researcher to effectively draw good quality conclusions in this study included the small sample size used, a lack of prior research studies on the topic**,** together with potential bias derived from self reports that created the majority of the data presented.

Although a small sample such as this could be seen to present limitations on the validity of generalising to other cases, this should not take away from the value and insights to be gained. Stake (1995) suggests that whereas a quantitative approach demands many repeats of identical data gathering exercises to validate the representativeness of a study, qualitative research is concerned with in-depth, quality data that includes "good moments to reveal the unique complexity of the case" (pg 63). Creswell (2007) points out the value to be gained from prolonged engagement with subjects that can mitigate distortions that may be less avoidable following briefer encounters.

Research cited in the literature review section acknowledges the diversity that exists within the gifted population. Specific prior research into the gifted visual-spatial population was limited in scope and what was found was almost without exception sourced from the United States of America. Understandings that have been presented as background to this study have therefore been drawn from a culture distinct from that of New Zealand. Also, in common with much of the literature reviewed, the findings drawn from this study relied largely on self-reported data, the value of which is limited. Self reports are prone to issues of subjectivity such as selective or faulty memories, and unintentional distortion based on personal values and perception. The researcher's personal experiences that lead to the identification of the issue as a topic for research also indicate a personal bias that would have influenced both decisions and interpretations made throughout the study.

Finding individual differences between cases was anticipated at the outset of designing this research study and was the driving reason behind the decision to investigate three cases rather than just one. The finding of patterns of behaviour

within the variations presented in each case was central to illustrating the commonalities that can be found despite these differences. Failure to find significant relationships was always a possibility. The methods utilised in recruiting participants were deliberately designed to ensure the selection of cases was kept as free from researcher-bias as possible so that such an outcome was not unduly prohibited.

8.3.4 Recommendations for Future Research

Limitations discussed above could be addressed through further research. The small sample size explored in this study limits the extent to which the conclusions reached can be generalised to the total population of gifted visual-spatial learners. Significant individual differences were found across the three cases explored in this study and it is acknowledged that the small sample size means that many other differences that were not found could be encountered and explored in further studies. For example, the lack of New Zealand-based research indicates that future research here could account for specific cultural differences.

On the whole, the photo elicitation process utilised within this study worked exceptionally well and achieved the aims that were intended. It facilitated the student's thinking so that when they came back with their photos they had very substantive and well thought through contributions to make. This was especially true of the first two cases and also of the third case, to a proportionate degree, in relation to his verbal ability. The discussion that was generated had a firm basis in reality, was directly created of the students' experience and was therefore very meaningful.

One refinement for any future study would be to make more use of graphics instead of, or as well as, words, in explaining the proposed structure of the process to participants, bearing in mind the importance of tailoring any research to mesh well with the preferences and norms of the participant. The realm of visual research as a whole is an exciting and relatively new field. The photo elicitation technique could have been expanded on to tap into the creative visual talents of the subjects of this study with even greater effect.

While limited in scope, the data generated that describe the knowledge that teachers, parents and significant other adults in the participants' lives have of the aspects of

their learning that set them apart, suggest a divide exists in appreciation of the differences between those who share this information processing style and those for whom it is an unknown concept. This finding suggests a significant need exists for the development of further research into the needs of gifted visual-spatial learners, to inform National Education Guidelines, Ministry of Education policies and to provide grounding for both special educator and teacher education programmes and for on-going professional learning. This is particularly needed to provide guidance and support for cases where the degree of separation between visual-spatial ability and auditory sequential ability moves into the realm of diagnosable learning disorders and twice exceptional learners.

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Appendix A

Dear

We have been approached by a Master of Education student from Massey University, Sharon Mansfield. Sharon is carrying out a case study research project looking at describing how gifted visual spatial learners learn. She has asked us to contact the parents of any students who have been assessed through the Gifted Education Centre who fit this profile. If you are interested in this research project, Sharon would like to meet with you to discuss participation in her study.

The aim of the investigation is to describe the nature of the differences experienced by gifted visual spatial learners. The intended outcome is to raise awareness of these differences; specifically, by describing these and explaining how they affect their learning, and to thereby contribute to the collective understanding necessary for these learners to be identified, valued and empowered to develop their exceptional abilities.

Briefly, participation would involve both yourself as parents, and your child taking part in interviews that will be focused around a photo elicitation technique. This technique involves your child taking photographs over 2-3 days of things that represent examples of learning for them. These photos will then be used to provide stimulus for discussion.

Further data will be gathered though interviews with your child's teacher, through observations that will be carried out of a relevant learning environment, and from other examples of work and assessments.

If you are interested in finding out more about this study, please respond by signing and returning the attached copy of this letter, giving your consent for us to pass on your contact details to Sharon. She will then be in touch to arrange a meeting with you.

Yours sincerely,

Appendix B i.

A Case Study of Gifted Visual-Spatial Learners

Information Sheet for Education Psychologists

This Information Sheet introduces Sharon Mansfield, a student at Massey University, who is intending to undertake a Case Study research project that describes how gifted visual-spatial learners learn. This research will fulfil part of the study requirements towards gaining a Master of Education qualification. You are invited to take part in this research, and this Information Sheet is provided to you to help in making an informed decision about whether you would like to agree to participate.

Project Description

This investigation seeks to describe the nature of the differences experienced by gifted visual-spatial learners, a sub-group of the students in our schools known as gifted and talented. The intended outcome of the study is to raise awareness of these differences; specifically, by describing these and explaining how they affect their learning, and to thereby contribute to the collective increased understanding necessary for these learners to be identified, valued and empowered to develop their exceptional abilities.

What you will be asked to do

Participants are being sought via educational psychologists who have employed the diagnostic assessment process necessary to identify a student with a gifted visual-spatial learner profile. In the first instance, you would be asked to approach the parents of any students aged in the 8-14 year age group you have assessed who fit the gifted visual spatial learner profile, and pass on a request to meet with me to discuss participation in the study.

Participating visual spatial learners and their parents will be invited to take part in an initial meeting, at which time the investigation process will be explained to them. The learner will be asked to take photographs that represent examples of learning for them, over 2-3 days, and will then participate in a second interview. Follow up interviews with the learner's parents, their teacher, and with you will also be carried out. These interviews are expected to take no more than 30 minutes each.

What happens to the information

Data gathered from these interviews will be transcribed from a sound recording, and then summarised to contribute to developing themes. This will be supplemented by observational data gained from observation of the visual-spatial learner engaged in relevant learning environments. Further data will be gathered from unobtrusive sources such as school reports, assessment results and work samples.

While it is impossible to absolutely guarantee the anonymity of information, every effort will be made to treat information gathered with the strictest confidence. Participants involved in this study, including you, will not be referred to by name in the research report. All data collected that identifies participants will be rendered anonymous by removal of names. Any photographs taken by participants that contain identifiable images of the participant or any other person will be used for interview purposes only and then returned to the student, as owner of the image, or destroyed. All other data will be stored securely and will be disposed of at the end of the study.

Participants' Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- ask for the recorder to be turned off at any time during the interview;
- be given access to a summary of the project findings when it is concluded.

If you have any concerns or questions, please feel free to contact either myself,

Sharon Mansfield
027 XXX XXXX;
email s.mansfield@slingshot.co.nz

or my supervisor:

Professor Tracy Riley
(06) 356 9099 x 8625;
email T.L.Riley@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 12/48. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 80877, email humanethicsouthb@massey.ac.nz

Appendix B ii.

A Case Study of Gifted Visual-Spatial Learners

Information Sheet for Parents

This Information Sheet introduces Sharon Mansfield, a student at Massey University, who is intending to undertake a Case Study research project that describes how gifted visual-spatial learners learn. This research will fulfil part of the study requirements towards gaining a Master of Education qualification. You are invited to take part in this research, and this Information Sheet is provided to you to help in making an informed decision about whether you would like to agree to participate.

Project Description

This investigation seeks to describe the nature of the differences experienced by gifted visual-spatial learners, a sub-group of the students in our schools known as gifted and talented. The intended outcome of the study is to raise awareness of these differences; specifically, by describing these and explaining how they affect their learning, and to thereby contribute to the collective increased understanding necessary for these learners to be identified, valued and empowered to develop their exceptional abilities.

Consent Process

Participants are being sought via educational psychologists who have employed the diagnostic assessment process necessary to identify a student with a gifted visual-spatial learner profile. An educational psychologist has approached you as the parents of a student aged in the 8-14 year age group who fits the gifted visual-spatial learner profile, passing on a request to meet with me to discuss participation in the study. At this initial meeting, which is expected to take around 15 minutes, the investigation process will be explained to you and your child, and any questions you may have will be answered. A printed information sheet together with consent forms, will be given to you and to your child for you to take away and discuss, and then return by mail if you decide that you are happy to proceed. When these consents have been received from you, similar meetings will take place between the researcher and your child's school to gain informed consent from the school and from your child's teacher, in order for the study to proceed.

What your child will be asked to do

Your child will be asked to take photos that represent examples of learning for them, over 2-3 days. The photographs may be taken both in and outside of school. Your child will then participate in a second interview where the photographs will be used to provide stimulus for discussion. They will be asked to talk about how they learned; what they found easy and what they found hard; and about what has helped them to learn. They will be asked to talk about their feelings about the learning and about the skills that they have. This interview is expected to take between 30-45 minutes.

What you will be asked to do

Follow up interviews with yourselves, your child's teacher, and educational psychologist will also be carried out, and these are expected to take no more than 30 minutes each. Interviews with yourself and with your child can be arranged either at school or at your home, and can be conducted at a time that suits you, outside of school hours.

What happens to the information

Data gathered from these interviews will be transcribed from a sound recording, and then summarised to contribute to developing themes. This will be supplemented by observational data gained from observation of your child engaged in relevant learning environments. Further data will be gathered from unobtrusive sources such as school reports, assessment results and work samples.

While it is impossible to absolutely guarantee the anonymity of information, every effort will be made to treat information gathered with the strictest confidence. Participants involved in this study will not be referred to by name in the research report. All data collected that identifies participants will be rendered anonymous by removal of names. Any photographs taken that contain identifiable images of your child or any other person will be used for interview purposes only and then returned to your child, as owner of the image, or destroyed. All other data will be stored securely and will be disposed of at the end of the study.

Participants' Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- ask for the recorder to be turned off at any time during the interview;
- be given access to a summary of the project findings when it is concluded.

If you have any concerns or questions, please feel free to contact either myself,

Sharon Mansfield
027 XXX XXXX;
email s.mansfield@slingshot.co.nz

or my supervisor:

Professor Tracy Riley
(06) 356 9099 x 8625;
email T.L.Riley@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 12/48. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 80877, email humanethicsouthb@massey.ac.nz

Appendix B iii.

Information Sheet for Students

Study Title: A Case Study of Gifted Visual-Spatial Learners
Researcher: Sharon Mansfield

You are being invited to be in a research study. Studies are done to understand things better. This form will tell you about the study to help you decide whether or not you want to take part.

You should ask any questions you have before making up your mind. You can think about it and talk it over with your family or friends before you decide.

What this study is about

I want to describe how gifted visual spatial learners have differences in the way that they learn best. The reason this study is being done is to help teachers to understand the way that gifted visual spatial learners like you learn things. I hope that this will help visual spatial learners to be more successful at school.

What you will need to do if you are in this study

At our first meeting, which will take about 15 minutes, we will talk about the concept of 'learning'.

You will then be provided with a camera and asked to take photos of things to do with learning, both in and out of school, over 2 to 3 days.

At a second meeting, the photos will be printed off and we will talk about the things you have chosen to photograph. This meeting is expected to take between 30 and 45 minutes.

I will also spend some time talking with your parents, your teacher and with the educational psychologist who has done an assessment on your learning abilities. I will look at information contained in school assessment results and reports, in examples of work you have done, and in the report that the educational psychologist has written.

I will also ask to observe you working in a learning environment (this may be a classroom, or it may be somewhere else that you suggest).

What will happen to the information

I cannot say for sure that anyone reading written reports from this research will not know that it is about you. However, I will keep your information private. I will not pass on anything you say or write without asking you first.

- No one involved in this study will be referred to by name in the research report.
- All of the information collected about you will have your name removed.
- Any photographs taken will be used for interview purposes only and then returned to you, or destroyed.
- At the end of the study you will be given a summary of the research report to read.

Your Rights

Some other important things for you to know include that:

- At the meetings, a sound recorder will be used to record our conversation. You can ask for this to be turned off at any time.
- It is also o.k. for you to say that you don't want to answer any question.
- You can change your mind about being part of the study at any time.

You do not have to say yes to this invitation. If you don't want to take part, that is o.k. If there is anything you are worried about, or if you have any questions at all, you can either ask me,

Sharon Mansfield
027 XXX XXXX
e-mail s.mansfield@slingshot.co.nz

or you can talk with my supervisor:

Professor Tracy Riley
(06) 356 9099 x 8625;
email T.L.Riley@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 12/48. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 80877, email humanethicsouthb@massey.ac.nz

Appendix B iv.

13 May 2013

The Principal,
Xxxxxxxxxxxxx School
X Xxxxx Street
Auckland

Dear Xxxxxxxxxx

Study Title: A Case Study of Gifted Visual Spatial Learners
Researcher: Sharon Mansfield
Student: Xxxxxxxx Xxxxxxx

This letter is to request your permission to undertake a Case Study research project in your school.

Project Description

This investigation seeks to describe the nature of the differences experienced by gifted visual spatial learners, a sub-group of the students in our schools known as gifted and talented. The intended outcome of the study is to raise awareness of these differences; specifically, by describing these and explaining how they affect their learning, and to thereby contribute to the collective increased understanding necessary for these learners to be identified, valued and empowered to develop their exceptional abilities.

Recruitment Process

Participants for this study have been sought via educational psychologists who have employed the diagnostic assessment process necessary to identify a student with a gifted visual-spatial learner profile. Upon request, the educational psychologist has approached the parents of students aged in the 8-14 year age group assessed by them who fit the gifted visual-spatial learner profile, passing on a request to meet with me to discuss participation in the study.

A student who attends your school has been identified as a suitable participant for this study. The student's parents have been approached and their permission has been gained to include this student in the study.

Your permission is sought to now approach the student's teacher with a request for their consent to the following procedures to be undertaken as part of the study. The proposed research method is described fully below.

Research Process

The initial data gathering approach will be to conduct semi-structured interviews with the student, utilising a photo-elicitation technique to help with scaffolding them to articulate what learning is and how it happens for them. The student will be asked to take 10-12 photographs over 2-3 days, representing a range of learning activities to be used in discussions with the interviewer. Your permission is sought for the student to take photographs for this study in school. Photo-elicitation involves using visual media to explore a topic of shared interest and in this study, participants will be asked to photograph examples that show how learning happens for them. The photographs

will create concrete visual images to lend support to research questions based on the complex, theoretical and abstract concept of learning.

Further semi-structured interviews will be held with both the parents and the teacher of the student, and with the educational psychologist who has assessed them, in order to provide information and views from different perspectives and to build up a richer picture from which to examine themes and issues. To this end, permission is sought to observe the student in learning environments, including extra curricular settings where the student may excel outside of the classroom. Added depth will be gained from analysing sources of unobtrusive data, e.g. results of standardised testing completed at school, as well as the results of cognitive assessment profiles completed by the educational psychologist. Student work samples will be looked for to provide further evidence of their visual spatial learning style. Your consent is therefore also sought to allow access to school records that pertain to the student, within the following contingent conditions.

Participants' Rights

Participants involved in this study, including the school, will not be referred to by name in the research report. While it is impossible to absolutely guarantee the anonymity of information, every effort will be made to treat information gathered with the strictest confidence. In the case of photographs taken by the student in the school context, any photographs that contain identifiable images of the student or any other person will be used for interview purposes only and then returned to the student, as owner of the image, or destroyed. Also, participant students will be advised that as part of the research process, it is their responsibility to always verbally obtain permission before photographing someone. This will include informing that person of the intended use for the photo, and gaining their verbal consent to this. Ultimately however, the subject of this study is to explore how the participants themselves experience learning and therefore they will be encouraged in most cases to either take photographs of some aspect of their own learning, or to have someone photograph them. All data, including photographs, will be stored securely and will be disposed of following the study.

A consent form is attached. Please read and consider the information carefully, and sign and return to the researcher if you decide to participate. If you have any questions or concerns relating to this research study, please feel free to contact either the researcher,

Sharon Mansfield
027 XXX XXXX
s.mansfield@slingshot.co.nz

or her supervisor:
Professor Tracy Riley
(06) 356 9099 x 8625;
email T.L.Riley@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 12/48. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 80877, email humanethicsouthb@massey.ac.nz

Appendix B v.

A Case Study of Gifted Visual-Spatial Learners

Information Sheet for Teachers

This Information Sheet introduces Sharon Mansfield, a student at Massey University, who is intending to undertake a case study research project that describes how gifted visual-spatial learners learn. This research will fulfil part of the study requirements towards gaining a Master of Education qualification. An invitation has been issued to a student in your class and, together with their parents, they have consented to take part in this research. This Information Sheet is provided to you to help in making an informed decision about whether you would like to agree to participate.

Project Description

This investigation seeks to describe the nature of the differences experienced by gifted visual-spatial learners, a sub-group of the students in our schools known as gifted and talented. The intended outcome of the study is to raise awareness of these differences; specifically, by describing these and explaining how they affect their learning, and to thereby contribute to the collective increased understanding necessary for these learners to be identified, valued and empowered to develop their exceptional abilities.

Participants for this study have been sought via educational psychologists who have employed the diagnostic assessment process necessary to identify a student with a gifted visual-spatial learner profile. Upon request, the educational psychologist has approached the parents of students aged in the 8-14 year age group assessed by them who fit the gifted visual-spatial learner profile, passing on a request to meet with me to discuss participation in the study.

What you will be asked to do

The student will be asked to take part in an initial meeting, at which time the investigation process will be explained to them. This initial meeting is expected to take around 15 minutes, and will take place outside of school hours. They will be asked to take photographs that represent examples of learning for them, over 2-3 days. Your permission is requested for some photographs to be taken during class time. The student will be asked to take no more than 10-12 photographs (and some or even all of these may be taken outside of class) to help limit any disruption to regular class work.

Also, participant students will be advised that as part of the research process, it is their responsibility to always verbally obtain permission before photographing someone. This will include informing that person of the intended use for the photo, and gaining their verbal consent to this. Ultimately however, the subject of this study is to explore how the participants themselves experience learning and therefore they will be encouraged in most cases to either take photographs of some aspect of their own learning, or to have someone photograph them.

The student will then participate in a second interview where the photos will be used to stimulate discussion about how they learned; what they found easy and what they found hard; and about what has helped them to learn. They will be asked to talk about their feelings about the learning and about the skills that they have. This interview is expected to take between 30-45 minutes and will also take place outside of school hours.

An interview is also requested with yourself, as the student's teacher. Discussion will be around the student's skills and learning characteristics and their experiences with learning. This interview is expected to take no more than 30 minutes, and will be conducted at a time and place that suits you.

Your permission is sought for the researcher to undertake observations of the student involved in learning. Observations may be conducted in the classroom or in other learning contexts, including the home environment, dependant upon contexts that are nominated by the student. Observations are expected to be for around a 45 minute time period, depending on the activity being observed. The rationale behind making learning context observations is to have the opportunity to collect first hand data from authentic situations, rather than relying on the accounts of others. Observational data will be used to create a good quality description of the physical environment and the nature of the learning tasks undertaken. In order to minimise any anxiety or other negative impact on the part of participants, the researcher undertakes to maintain a low key presence within the classroom and would suggest that the class is told that she is there to observe the particular lesson and not any specific student.

What happens to the information

Data gathered from interviews with the visual-spatial learners, their parents, their teachers and educational psychologists will be transcribed from a sound recording, and then summarised to contribute to developing themes. This will be supplemented by data gained from observation of the visual-spatial learner engaged in relevant learning environments. Further data will be gathered from unobtrusive sources such as school reports, assessment results and work samples.

While it is impossible to absolutely guarantee the anonymity of information, every effort will be made to treat information gathered with the strictest confidence. Participants involved in this study will not be referred to by name in the research report. All data collected that identifies participants will be rendered anonymous by removal of names. Any photographs taken that contain identifiable images of the student or any other person will be used for interview purposes only and then returned to the student, as owner of the image, or destroyed. All other data will be stored securely and will be disposed of following the study.

Participants' Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission;
- ask for the recorder to be turned off at any time during the interview;
- be given access to a summary of the project findings when it is concluded.

If you have any concerns or questions, please feel free to contact either myself,

Sharon Mansfield
027 XXX XXXX;
email s.mansfield@slingshot.co.nz

or my supervisor:

Professor Tracy Riley
(06) 356 9099 x 8625;
email T.L.Riley@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 12/48. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 80877, email humanethicsoutha@massey.ac.nz

Appendix B vi.

A Case Study of Gifted Visual-Spatial Learners

Participant Consent Form
(For Students, Teachers & Educational Psychologists)

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the interview being sound recorded.

I wish/do not wish to have my recordings returned to me.

I agree to participate in this study under the conditions set out in the Information Sheet.

Signature _____ Date: _____

Full Name – printed _____

Appendix B vii.

A Case Study of Gifted Visual-Spatial Learners

Parent Consent Form

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to my child, _____(full name) participating in this study under the conditions set out in the Information Sheet.

I agree to provide copies of assessment records, including the educational psychologist report completed on my child.

Signature _____ Date: _____

Full Name – printed _____

Relationship to child _____

Appendix B viii.

A Case Study of Gifted Visual-Spatial Learners

Participant Student: _____

School Consent Form

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

Under the conditions set out in the Information Sheet:

Consent is given for an approach being made to the participant student's teacher, requesting a 30 minute interview with them.

Consent is given for the participant student to take photographs that represent examples of learning for them, at school.

Consent is given for the researcher carrying out a 45 minute learning context observation of the participant student.

I agree to provide copies of school assessment records for the participant student, for research purposes.

Signature _____ Date: _____

Full Name – printed _____

Principal of _____ School

Appendix C

Initial Meeting with Visual-Spatial Learner

This initial discussion is intended as grounding conceptual discussion around the participant's existing understandings of what learning is and how it occurs. The objective is to activate the participant's prior knowledge, and to 'warm up' their thinking about what is a very abstract concept (What is learning and how do you learn?)

This discussion is designed to move from reflecting on some concrete examples towards the deeper metacognitive thinking required to grapple with thinking about one's own learning processes.

What are some things you have learned?

What are some things you have been taught?

Contributions to these initial questions are listed and then used to stimulate further discussion:

What differences are there between learning something and being taught something?
Does teaching automatically lead to learning?
Why might people not want to learn sometimes?
Why might people sometimes feel confused when learning something new? Should they feel confused?
What, if anything, is the difference between learning at school and learning you do outside school?

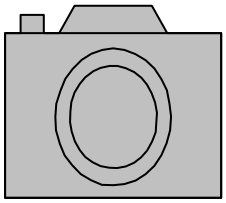
At the end of discussing these ideas, the participant will be asked to draw a picture of the concept of learning that represents what we have discussed. This visual will be used to summarise current thinking and to draw on further, as discussion continues in the next session.

Then the participant will be provided with a camera and advice on how to use it. It will be explained that they have 2-3 days to take photos of things that show learning taking place to bring back with them to the next session. In order to provide a "quality filter" they will be told they can present up to 12 photos. Suggestions will be provided of things they might like to photograph and a discussion will take place inviting them to share their initial ideas (e.g. how they get to school; things they do in a typical day; things that they have learnt to do at home or at school that they are proud of). Guidance will be provided of the need for gaining consent from others if they wish to take photographs that will include other people.

They will be provided with a printed 'Photography Tips Sheet' as a reminder of what is discussed.

Appendix D

Photography Tips Sheet



Task

Over the next 2-3 days, take photographs of things that represent skills or things that you have learned. Think about things you have learned at school, at home, and other places too.

Try to include a range of different skills – maybe things that …

- you are proud of learning,
- you have had to work hard at,
- have been easy for you,
- you learned when you were little,
- you have learned more recently,
- someone else taught you,
- or that you learned by yourself.

May be even something that you want to learn when you are older…

Remember

If you want to take a photo that includes someone else, you must always ask for their permission before photographing them. You need to tell them the photo will be talked about in an interview for the research study that you are part of. They need to agree that this is o.k. If you want to avoid this, it may be best to take photographs of the process/result of the learning, or have someone else photograph you.

At our next meeting, have 10-12 photos ready for us to talk about.

Appendix E

Follow-up Semi-Structured Interview with Visual-Spatial Learner

Initial discussion will be unstructured; the participant will be provided with copies of the photographs they have taken, and encouraged to talk freely about the images they captured. The student will be reminded at the beginning of the interview that they do not have to answer any question if they do not want to.

The participant will be asked to choose one or two photos of something they are proud of that they have learnt to do at home or in the community. They will be prompted to describe and elaborate on this and then other things that they have found easy or hard to learn outside of school and what helped them to learn.

Then focus will move to learning at school, again beginning with the stimulus of the photos and then moving to more structured questions around things they like, do not like, find hard, what helps them learn, and so on. Social, emotional and physical well-being issues will also be covered, including how they feel generally about going to school, parental involvement in school and their relationships with teachers. Discussion will be prompted over their future visions, including things they would like to change about school and what they would like to do after leaving school.

As discussion progresses, the following list of 'prompts', designed to elicit information that will help to fulfil the objectives of this study, will be used to guide the interview. In line with advice from Yin (2009), these questions/topics are not to be viewed as literal questions to be asked, but rather as guiding ideas, with further probing and digression expected and encouraged. The aim is to understand the perceptions of the subjects, and how they have come to attach meaning to phenomena/ events. Therefore, the questions will be ones that will elicit information on the attitudes, behaviours, experiences and qualities/characteristics they have that are relevant to learning.

Discussion Prompts

Look for a photograph that shows something they are proud to have learnt to do outside of school.
Can you describe/tell me more about this?
Where/When/Why/How did you learn this?
Who or what helped you? How did they/it help you?
What did you find easy about learning this? and/or *What did you find hard about learning this?*
How did you feel when you learned to do this?"

What else have you enjoyed learning outside of school?
What have you found hard to learn outside of school?
What has helped you to learn outside of school?

While talking about something they are good at:

Why do you think you are good at this – what skills do you have that help you to do this well? (If possible, try to draw out 2/3 strengths)
What made you want to learn this?
How long did it take you to learn this? Was it one try, or several?
How did you know when you had learned it?

Repeat the above questions, focusing on something they have learned at school.
Look for a photograph that shows something they are proud of learning at school.
Can you describe/tell me more about this?
Where/When/Why/How did you learn this?
Who or what helped you? How did they/it help you?
What did you find easy about learning this? and/or *What did you find hard about learning this?*
How did you feel when you learned to do this?"

What do you like most at school?
What do you like least at school?
What have you found easy to learn at school?
What have you found difficult to learn at school?

While talking about something they are good at:
Why do you think you are good at this – what skills do you have that help you to do this well? (If possible, try to draw out 2/3 strengths)
What made you want to learn this?
How long did it take you to learn this? Was it one try, or several?
How did you know when you had learned it?

Knowledge:
In respect to the content of classroom learning, e.g. Maths, Reading, Writing … how much do you think you know, in relation to others in your class?
Have you ever felt like you understood something, until others start talking about it?
Can you describe when this has happened?
How did you feel?"

If you were a teacher, what type of teacher would you be?
How would you teach Maths? Reading? Writing?"
Could you describe one or two of the best teachers you have had?
What did they do differently that you enjoyed or that helped you to learn?"
What most helps you to learn at school?"

Social/Emotional/Physical Wellbeing aspect of learning

How do you feel about going to school?
How well organised are you? If not well, how do you feel about this?
What would you like to change about school?

Do you get on well with teachers at school?
Do you have good relationships with your friends?
Can you tell me about times when your parents are involved with school?
What is your vision for the future? What would you like to do when you leave school?

Appendix F

Protocol for Semi-Structured Interview with Parent/Teacher/Other

1. Can you tell me about some things that Xxxxxx is good at? Why do you think she/he is good at these, i.e. what skills or characteristics does she/he have that help her/him to do these things well?

2. Can you describe for me times when Xxxxxx has successfully learned something new? What aspects of the learning experience seemed to help with this success?

3. Can you describe times when Xxxxxx has struggled with learning? What aspects of learning do they find difficult to manage?

4. How well organised is Xxxxxx? How do you think this impacts on her/his learning?

5. How well do they do following a series of instructions? Are there times when this works better for them than others?

6. How well can xxxxxxxx focus their attention? Are there times when this is better or worse for them?

7. Can you suggest things that seem to make a difference for them?

Appendix G

Date: **Time:** **Length of Observation:**

Space:
Describe/sketch a "context map"
of where the activity takes place

The Human/Social Environment:
Who is in the group/scene/activity – who is taking part?
Describe the identities/characteristics of those present?
How do the participants arrange themselves in the physical setting?

Action:
What is taking place?
How routine, regular, patterned, irregular, or repetitive are the behaviours observed?
What resources are being used?
How are activities being described, justified, explained, organized, labelled?

Nonverbal communication:
Who is talking? Who is listening?
How do different participants behave towards each other?
Who is making the decisions, and for whom?
What are people feeling and how are they expressing this?

Notable non-occurrences:
What is not occurring, although the expectation is that it should be?

Appendix H

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

22 January 2013

Sharon Mansfield
10A Mahoney Drive
Albany
AUCKLAND

Dear Sharon

Re: HEC: Southern B Application – 12/48
A case study on gifted visual spatial learners

Thank you for your letter dated 16 January 2013.

On behalf of the Massey University Human Ethics Committee: Southern B I am pleased to advise you that the ethics of your application are now approved. Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Dr Nathan Matthews, Chair
Massey University Human Ethics Committee: Southern B

cc A/Prof Tracy Riley
School of Curriculum & Pedagogy
PN900

Dr Brian Finch
School of Educational Studies
PN900

Dr Alison Kearney, HoS
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