A CASE STUDY OF THE LEARNING DISABILITIES ASSOCIATION OF SASKATCHEWAN (LDAS) ARROWSMITH PROGRAM

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I dedicate this dissertation to the many individuals with learning disabilities I have worked with through the years, who despite the challenges they have faced, maintain their humanity and hope.

Abstract

Case Study research was conducted to investigate how participation in the Learning Disabilities Association of Saskatchewan (LDAS) Arrowsmith program affected the cognitive, academic, emotional, and interpersonal functioning of five students who attended this program for two to three years. Learning disabilities involve consistent cognitive processing and academic difficulties that are present in individuals who have average or higher functioning in other cognitive processing areas. The average adult with a learning disability has less education, lower employment success, and higher rates of emotional and interpersonal difficulties. The Arrowsmith program is a cognitive training program based on neuroplasticity that claims to reduce or remove cognitive functioning deficits in persons with learning disabilities. Semi-structured interviews were conducted with five students and one or both of their parents. Standardized test results and information from the school cumulative folders of the students were also reviewed. Four of the five students experienced large and significant increases in cognitive, academic, emotional, and/or interpersonal functioning following their participation in the LDAS Arrowsmith program. One of the five students had much smaller gains in cognitive and academic functioning and experienced difficulties with emotional and interpersonal functioning following participation in the program. Several themes related to participation in the LDAS Arrowsmith program are identified for the student, parent, school record perspectives and themes common to these perspectives are also identified. Possible reasons why the students had different outcomes following their participation in the LDAS Arrowsmith program are discussed. Recommendations for parents, school psychologists, teachers, schools/school divisions, the Arrowsmith program, and future research are given.

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Chapter 1: Introduction

Academic achievement has always come easily to me. I think it is important to express that my understanding of what individuals with learning disabilities go through has developed over time and not through direct experience. To say that I have always achieved at a high academic level though, would not be a true statement. My elementary school scribblers are filled with doodles and I had several broken bones when I was a child as the result of my daring escapades. Despite my strong memory ability, I was very forgetful. My mother often said to me, "You'd forget your head if it wasn't attached to your shoulders." My high school marks were a roller coaster of underachievement related to poor attendance and punctuality, poor attitude, and assignments that were either slapped together at the last minute or not handed in at all; mixed with flashes of true effort and creativity. Fortunately, I chose my graduating year to make a reasonable effort and entered university with a scholarship from my high school and big dreams. I was the first person in my extended family to go to university and one of the few to graduate from high school.

I entered the College of Arts and Science at the University of Saskatchewan in 1977. My plan was to get a Ph.D. in Clinical Psychology and practice as both a professor and therapist. Given that I am completing this dissertation in 2013, it is apparent that I got a little off track. My marks improved overall at university but they continued to be widely varied, depending on my level of focus at the time, the number of hours I worked to make money to live on and pay for university, and my tendency to cram for exams and do assignments at the last minute. I did well enough to get scholarships every year and gained acceptance into the Clinical Psychology Master's program at the University of Saskatchewan. However, the first year of my Master's program did not go well. I got off track early on and never completely regained my footing. Although I went to school every day, I could not seem to make myself do more than the minimum I needed to survive or to fake my way through classes. Obviously, my marks and the perception my professors had of me suffered. A professor in the department recommended I consider transferring to the Educational Psychology program in the College of Education. Like a drowning person, I grabbed this life preserver and bolted from one program to the other. It ended up being one of the best decisions I have made in my life, for all the wrong reasons. This change in direction ultimately brought me to my work with individuals who have learning disabilities.

I graduated with a Master's degree after having two children (two more would come later) and "working" on my thesis over the three years after I finished my classes. There is nothing like a deadline to galvanize action. I defended my thesis two days before I would have required an extension. I got the first job I applied for, as a counsellor in the Basic Education program at SIAST in 1985, just before I graduated. By 1992 I had started doing psycho-educational assessments to identify learning disabilities and worked hard to support students in the Basic Education program who had learning differences. Shortly afterwards I started a private practice doing assessments. My passion for this field and the necessity of writing reports on a fairly continuous basis has mostly "cured" my procrastination problem. I now diagnose Attention Deficit/Hyperactivity Disorder (AD/HD) and realize that if I pursued a formal diagnosis, I would most likely be assigned this label. I am now for the most part the kind of student that I always wanted to be. I have broadened my private practice to include ADHD coaching/academic strategist to my roles. It seems both apt and ironic to imagine that I am supporting individuals at university who are struggling to maintain consistent performance in their studies and lives.

The ease at which I learned academically was not my younger sister's experience in school. She had great difficulties in math and teachers often compared her performance unfavourably to mine. I tried to tutor her in math but it was hard for me to understand why she had to do flashcards and homework all the time and still did not do well on the math tests at school. For knowledge based exams in other subjects as well, she would study for hours for marks that were lower than what I could achieve without studying at all. I didn't understand then the role that anxiety and feelings of being judged as less than, can affect an individual's ability to access their potential. I didn't understand what made things so difficult for her other than an observation that her memory was weak. At that time, students either sank or swam. If they had a learning disability, they mostly sank academically and then worked at jobs that did not require academic skills.

I have a cousin who failed many grades and could not read or write beyond a very basic level. He believed that he was stupid and probably his parents, teachers, and the other kids thought he was too. The confusing part was that when we played and talked with him, he seemed completely normal. My cousin quit school the day he turned 16 and was no longer required to attend. Going to school was a painful and humiliating experience for him. I realized many years

later as I started to work with adults who have learning disabilities, that my cousin probably has dyslexia.

Schools have more supports in place now than when my sister and cousin were in school. However, the experience of students with learning disabilities is still difficult and painful in many cases. These students often require supports that may be stigmatizing to them and in some cases create a dependence on others for things that they may have been able to do themselves. Being the parent of a child with a learning disability is a lot of work and can lead to a great deal of worry for this child's future. Most parents would do anything in their power to remove or reduce the disadvantages that their child faces academically and that may limit their career options. For this reason, any program seeking to provide services to children with learning disabilities and their parents has a high level of responsibility to avoid taking advantage of the desperation and vulnerability that will often be present. Society has a high level of responsibility to provide support to the children of parents who are not able to financially afford appropriate programming.

A quote by Christopher Reeve, who dealt with the challenge of becoming a quadriplegic after a riding accident, expresses my thoughts towards many individuals I have met with learning disabilities. "I think a hero is an ordinary individual who finds strength to persevere and endure in spite of overwhelming obstacles." This quote expresses my admiration for individuals with learning disabilities and their parents who have found a way to succeed academically and in their lives despite the learning challenges they have faced.

Through the years I have worked with many individuals with learning disabilities that have inspired me and given me a feeling of fulfillment when I have played a small role in their success. In some cases the assessment process itself comes at a time when the person is ready for a change or has reached some kind of crossroad in their lives where they need the validation the assessment will bring them. I feel privileged to be a part of their journey. It sometimes happens that adults I am conducting assessments with tear up or cry when they are telling the stories of their academic struggles in school.

Probably the most poignant story told to me was from a man in his 40s who got assessed after I diagnosed his daughter with dyslexia. He knew he had experienced similar learning problems with reading and spelling that led to his failing two grades in elementary school. The most painful experience of his childhood came when his grade 5 teacher placed the final report

cards on the students' desks on the last day of class. On the reverse side there was an indication as to whether the student had passed or failed the grade. If the student had passed they were to go to the front of the room and face the back of the classroom and if they had failed they were to stay in their desk facing the front. The man I tested that night cried as he explained that he was the only student left in his desk as all of the other students stared at him from the front of the class. Despite his emotional pain and academic struggles, he graduated from high school and went to university on an athletic scholarship. He met the woman who became his wife and she helped him with his papers, reading his textbooks, and studying for his exams. He was, at the time of the assessment, an art teacher that had avoided any situation where he had to read or write in front of other people. Understanding his learning disability and his learning strengths helped him to let go of this shame so he could be free to talk about his struggles openly. He is definitely a hero to me.

Just before I started my Ph.D. studies, I was asked to conduct research on the cognitive and academic changes made by students in a pilot of the Arrowsmith program at the Learning Disabilities Association of Saskatchewan (LDAS). The Arrowsmith program is a cognitive training program that aims to decrease the cognitive functioning deficits of individuals with learning disabilities, thereby allowing these individuals to perform academic, social, and other tasks independently or with reduced supports. The Arrowsmith program was developed in light of knowledge on the neuroplasticity of the brain or the brain's ability to change and adjust to the environment (Arrowsmith-Young, 2012; http://www.arrowsmithschool.org). My research on the LDAS Arrowsmith program indicated that the 12 students that started the LDAS Arrowsmith program in September 2008 overall made statistically significant gains on the Perceptual Reasoning and Working Memory indexes and Full Scale Score of the Wechsler Intelligence Scale for Children/Wechsler Adult Intelligence Scale (WISC/WAIS) and Long Term Retrieval composite of the Woodcock Johnson Tests of Cognitive Ability (WJ-III) after two years of participation in the LDAS Arrowsmith program (Kemp-Koo, 2010).

The level of cognitive changes evidenced in my research surprised me. For my dissertation research, I wanted to understand what the experience of participating in the LDAS Arrowsmith program was like on cognitive, academic, interpersonal, and emotional levels in the everyday lives of the students and their families. I hoped to understand the previous study results at a deeper and broader level. Consequently, I chose a case study approach to examine the effectiveness of the

Arrowsmith program and the experiences of some of the participants in the Arrowsmith program at the Learning Disabilities Association of Saskatchewan (LDAS). I decided to gather information from several sources including interviews with the students and their parents, school record information from the student cumulative folders, and the standardized testing available for each student. My hope is that I have honoured the stories of these participants.

Learning disabilities are present in approximately five to ten percent of the population (http://www.ldac.ca). Learning disabilities are invisible disabilities that affect not only the individual's cognitive functioning and academic achievement but also their emotional and interpersonal experiences. The Learning Disabilities Association of Canada (LDAC) released an official definition of learning disabilities in 2000:

> Learning disabilities refer to a number of disorders that may affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. These disorders affect learning in individuals who otherwise demonstrate at least average abilities essential for thinking and/or reasoning. As such, learning disabilities are distinct from global intellectual deficiency (http://www.ldac.ca).

Western society places great emphasis on education and most occupations now require completion of a grade 12 or postsecondary training or education. Coping with a learning disability can compromise the individual's ability to attain these levels of education and often increase the individual's dependence on supports and accommodations for educational programming and the workplace. Although these disabilities are common, they are often misunderstood and mistakenly believed to indicate low intellectual ability.

Wilson, Furrie, Walcot-Gayda, and Armstrong (2007) in their Putting a Canadian Face on Learning Disabilities (PACFOLD) study of what it means to be a child, youth, or adult with learning disabilities in Canada used information gathered from Statistics Canada data surveys. The key findings of the PACFOLD study are that young adults with learning disabilities, when compared to their peers without learning disabilities are: more likely to have not graduated from high school; less likely to be working; those who are working earn less; more likely to report their mental health status as fair to poor; less likely to handle unexpected problems appropriately; and more likely to report suicidal thoughts, depression, and distress (http://www.ldac.ca). Clearly, these

findings are concerning and point to the importance of research and programs that assist individuals with learning disabilities to reverse these trends.

Research has shown that learning disabilities affect academic and emotional development. Individuals with learning disabilities often fall farther and farther behind their peers even with supports and interventions in place. Given the importance that western society places on education, the academic struggles of children and adults with learning disabilities can negatively affect self esteem and place stress on families. Klein and Mannuzza (2000) conducted a longitudinal study comparing 104 children with learning disabilities and 124 children without learning disabilities. All of these children initially had no emotional difficulties. When surveyed sixteen years later, the group of persons with learning disabilities reported significantly lower socioeconomic status, lower employment and pay, and higher prevalence of psychiatric disorders and addiction issues.

Individuals with learning disabilities often do not reach their potential. In my experience as a counsellor and a school psychologist, I have met many individuals with learning disabilities who did not finish their education and felt that they had little to contribute to society. Many of these adults were never identified as having learning disabilities and they are often aware only of their learning challenges and not their learning strengths. In a true testament to the human spirit, many of them still have hope to someday accomplish their dreams despite all the setbacks and obstacles they have faced and the failures they have experienced.

I have often thought that if only the cognitive processing deficits that persons with learning disabilities have could be decreased or removed, these individuals might have a chance to grow into confident people who can function in society with a minimum of supports. This would be considered to be the most ideal situation to most persons with learning disabilities, their families, teachers, and the greater community. In return, these individuals would give back to society through more active participation and contributions.

Research on neuroplasticity or the brain's ability to change in response to the environment, has shown for many years that the brain is not static and unchangeable. Although the brain is not necessarily able to change fully, it is clearly not unchangeable. Recent advances have allowed researchers to study the brain in more detail than ever and have shown that the brains of individuals with learning disabilities process information differently than the brains of individuals who do not have learning disabilities (Klingberg, 2010; Meyler, Keller, Cherkassky, Gabrieli, & Just, 2008).

The question is, how to change the way the brains of individuals with learning disabilities process information so they can learn more efficiently and with fewer supports.

The Arrowsmith Program claims to change the brains of students with learning disabilities. The current available research is posted on the Arrowsmith website. Many of the studies, while showing promising results for the Arrowsmith program, contain serious methodological problems and are not peer-reviewed. Although survey information has been collected, the data gathered has for the most part been listed without any analysis of themes and without comparison between different respondents.

The current case study provides a convergence of evidence to evaluate Arrowsmith's claims of the effectiveness of their intensive cognitive training program. The addition of rigorous qualitative information from in depth interviews with students and their parents will provide depth to the current study and available research on the Arrowsmith program. The examination of school records and standardized test results will provide a triangulating source of information. Additionally, this study may contribute to evidence-based forms of interventions and open the door to future research related to neuroplasticity of the brain as it relates to learning disabilities. What does participation in the Arrowsmith Program mean in practical terms for its students and their families? I wanted to understand what worked and didn't work for students who made large and smaller changes in the LDAS Arrowsmith program and what their experiences were like at school and outside of school.

Purpose

The main purpose of this study was to explore the experiences of participants in the Arrowsmith program. Another purpose was to identify what changes have occurred for the students participating in the Arrowsmith program that can be discerned from their school records such as: marks, standardized test results, progress reports, teacher comments, and use of resource room and other academic supports in the schools. LDAS and the Arrowsmith program could use the information from this research to enhance the program they are offering to their clients. I hope also to contribute to the overall theoretical and practical information on identification of learning disabilities, cognitive development of individuals with learning disabilities, and neuroplasticity. As such, I will discuss the theoretical and practical implications of my findings.

Research Questions

Research question 1.

Based on examination of archived school records in the student cumulative folders and standardized testing information, how has participation in the LDAS Arrowsmith Program affected the lives of the students cognitively, academically, emotionally, and interpersonally?

Research question 2.

From the perspective of the students, how has participation in the LDAS Arrowsmith Program affected the lives of the students cognitively, academically, emotionally, and interpersonally?

Research question 3.

From the perspective of the parents, how has participation in the LDAS Arrowsmith Program affected the lives of the students cognitively, academically, emotionally, and interpersonally?

Research question 4.

How does information on the perspectives of the students and parents, compare and contrast with each other and with the information from the archived school records with respect to cognitive, academic, emotional, and interpersonal areas?

Definitions

Learning disabilities.

The Learning Disabilities Association of Canada (LDAC) released an official definition of learning disabilities in 2000:

> Learning disabilities refer to a number of disorders that may affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. These disorders affect learning in individuals who otherwise demonstrate at least average abilities essential for thinking and/or reasoning. As such, learning disabilities are distinct from

global intellectual deficiency (http://www.ldac.ca). The full definition is included in Appendix A.

Neuroplasticity.

The brain's ability to reorganize itself by forming new neural connections throughout life. Neuroplasticity allows the neurons (nerve cells) in the brain to compensate for injury and disease and to adjust their activities in response to new situations or to changes in their environment (Webster's New World Medical Dictionary, 2008).

Arrowsmith program.

The Arrowsmith Program purports to identify, intervene with, and strengthen the weak cognitive capacities that affect learning (http://www.arrowsmithschool.org). A list of the Arrowsmith cognitive functions and related features are in Table B1 in Appendix B.

Chapter 2: Review of the Relevant Literature

Before jumping into conducting a research study, it is important to understand what has come before and how this knowledge and understanding has evolved. In this chapter, I review the theoretical and research literature relevant to my case study research on the Learning Disabilities Association of Saskatchewan (LDAS) Arrowsmith program. The major literature areas related to my research with this program include: theories on cognitive development, identification of learning disabilities, neuroplasticity or brain plasticity, and the Arrowsmith program itself. Since the Arrowsmith program focuses on cognitive training for students with learning disabilities, I will start my review of the literature with a discussion of major theorists in the area of cognitive development.

Individuals with learning disabilities experience cognitive processing deficits that are directly related to their academic difficulties. As such, my discussion of literature on cognitive development will lead to a review of the major trends in identification of learning disabilities. Initially, learning disabilities were identified through the means of discrepancy criteria. Although this method is still used to some degree, most practitioners today use either a Response to Intervention (RTI) or cognitive processing analysis approach such as the Cattell-Horn-Carroll (CHC) theory, or a combination of both approaches to identify learning disabilities. The testing materials that are used to diagnose learning disabilities tend to focus on the measurement of cognitive processing areas and academic skills.

The Arrowsmith program is based on the premise that the cognitive processing/function deficits in individuals with learning disabilities can be improved. Therefore, I will review the research on neuroplasticity that supports this premise that the brain can change. The Arrowsmith program has been in existence for many years but the development of other cognitive training programs is definitely on the rise over the last few years. In particular, I will review literature on the Fast ForWord, Cogmed, and Lumosity programs that have gained a great deal of attention and use.

After reviewing the literature on cognitive development, identification of learning disabilities, and neuroplasticity, I will describe the Arrowsmith program and the published research and literature related directly to this program. I will deal with this research in chronological order

and discuss what this research tells us about the Arrowsmith program and what the gaps in the research are.

Theories of Cognitive Development

The two major theorists in the area of cognitive development are Piaget and Vygotsky. These two individuals were both born in 1896. They were aware of and influenced by each other's work. Although they emphasized different factors in the cognitive development of children and went about their research in different ways, their ideas can be seen as complementary in many ways. Both Piaget and Vygotsky see individuals as active agents in the construction of their cognitive development (Pass, 2004). The major ideas of these theorists related to the current research will be examined, as well as the extension of Vygotsky's work to the cognitive modifiability theory of Feuerstein and how he applied his theory to instruction and assessment.

Piaget.

Piaget discovered through his research that children think qualitatively differently than adults. Elkind (1976) observes, "His influence comes from the fact that theory and method aside, his descriptions of how children come to know and think about the world ring true to everyone's ear." The child needs to be cognitively ready in order to progress to the next level of cognitive development and this readiness is based on factors such as maturation, physical environment, social influences, and the brain's tendency towards balance (Gredler, 1997). Children must attain concepts to understand the world before the words for these concepts will make sense to them (Elkind, 1976). The child is an active participant in the construction of their own cognitive development and learning because their reality is never just a copy of what they perceive with their senses. Making mistakes is part of learning and cognitive development is assisted through a process of trial and error (Pass, 2004). Piaget sees the construction of reality through actions and interactions with the environment as being the basic task of infants (Piaget, 1952).

The educational implication of Piaget's theory is that cognitive development and learning cannot be rushed. Although it is important to provide enriching environments that allow the child to explore, progression of cognitive development will be affected by individual differences and readiness. Discovery learning where the teacher sets the environment with learning opportunities at the students' level of cognitive development, but does not actively direct instruction, most closely

reflects Piaget's theory in the educational setting (Athey & Rubadeau, 1970; Langford, 2005). Assessment materials should reflect qualitative differences in cognitive functioning (concrete or abstract) to determine the developmental level of the individual and what learning needs to take place to guide the individual to the next level.

Vygotsky.

Vygotsky, similarly to Piaget, believed that cognitive development occurred through the individual interacting with the environment. However, he placed a greater emphasis on the social experiences of the individual and less emphasis on the readiness of the individual for learning (Gredler, 1997; Pass, 2004). He saw speech as originating through social interactions that eventually becomes internalized thoughts (Vygotsky, 1986). The major concept in Vygotsky's theory of cognitive development is the zone of proximal development or the difference between the current cognitive development of the child without assistance and the higher level of potential development. Vygotsky believed that this distance could be bridged with experiences directed and assisted by an adult (Daniels, 1996; Vygotsky, 1978). He felt that direction was important to avoid the learner making mistakes that may lead to incorrect learning and development (Pass, 2004).

The educational implication of Vygotsky's theory of cognitive development is that social interactions directed by an adult are important to cognitive development. The teacher needs to teach and not just provide an environment for discovery learning (Langford, 2005). Bruner introduced the term scaffolding, based on Vygotsky's ideas, to describe how a teacher or other individual of higher cognitive development can assist the individual in moving beyond their current level of cognitive functioning. The teacher controls the parts of the problem that the individual is not able to understand so the individual can then complete the parts within their capabilities (Wood, Bruner, & Ross, 1976). Similarly, assessment from Vygotsky's perspective will focus on process and cognitive potential and less on current development (Daniels, 1996). Standardized tests make the assumption that the individual being tested has had an equal opportunity to learn the information or develop the skills measured by the tests (Brown & Campione, 1996). The individual's current functioning compared to others' their own age is emphasized (Gredler, 1997). In contrast, Vygotsky would stress that all individuals have had different social experiences and cannot be accurately compared.

Feuerstein.

Feuerstein extended Vygotsky's theory of cognitive development by emphasizing cognitive modifiability through applications to teaching and assessment (Daniels, 1996; Feuerstein & Feuerstein, 2001; Feuerstein, Feuerstein, & Falik, 2010; Feuerstein, Feuerstein, & Gross, 1997; Feuerstein, Rand, & Rynders, 1988). Feuerstein believed that individuals who have limited learning experiences or have cognitive processing deficits need a systematic, direct approach to instruction because they lack effective approaches or understanding to benefit from discovery learning. He developed the Instrumental Enrichment program to modify cognitive processing and help students reach their potential. Feuerstein sees the goal of special education to be a temporary support and that the child with a disability should be assisted so they can return to the classroom and fully participate (Feuerstein, 1980; Feuerstein, Rand, & Rynders, 1988). This goal matches the goal of the Arrowsmith program.

Feuerstein also developed a dynamic assessment approach that relies on process rather than end products. "The purpose of assessment is to reveal the potential of the individual and identify the deficient processes that may be impeding development" (Feuerstein, 1980, p.2). A test-train-test procedure characterizes the subtests in the Learning Potential Assessment Device (LPAD). The individual's functioning without support is measured and then the assessor provides intervention to determine what supports are needed to allow the individual to progress. The individual is then retested to determine their new level of functioning (Daniels, 1996; Feuerstein, Feuerstein, & Falik, 2010; Feuerstein, Feuerstein, & Gross, 1997). This kind of assessment is much more difficult to implement and evaluate than standardized testing is but it gives the assessor qualitative information that extends the understanding of an individual's cognitive functioning and potential (Daniels, 1996). Feuerstein and Feuerstein (2001) argue that dynamic assessment is compatible with the psychometric model.

> The LPAD is an attempt not just to assess an individual's intelligence but to derive a set of intellectual goals for him/her. Goals that are established solely on the basis of conventional testing may be set too low. However, if we establish educational goals based not on what a person can do now but on what we consider that he/she will be able to do when we offer him/her the intervention necessary to raise his level of functioning, these goals will be much

> more meaningful and influential for his/her future quality of life (Feuerstein, Rand, & Rynders, 1988, p. 206).

Feuerstein, Feuerstein, and Falik (2010) see the research supporting the neuroplasticity of the brain as supporting Feuerstein's theory of cognitive modifiability. They feel that it is important to understand what the nature of the changes in the brain are and what kinds of environmental conditions can produce these changes. Since the Arrowsmith program focuses on cognitive modification of individuals with learning disabilities, it is important first to understand how learning disabilities are identified and then what the research tells us about neuroplasticity.

Identification of Learning Disabilities

The initial labels for individuals with learning disabilities were medically oriented and included such terms as "congenital word blindness" and "minimal brain injury" (Vaughn & Fuchs, 2006). The term learning disabilities was introduced by Samuel Kirk in 1962, although references to individuals who had unexpected academic problems had surfaced in the literature since the 1880s. Kirk emphasized that learning disabilities involve consistent, persistent, and unexpected low achievement (Vaughn & Fuchs, 2006).

Discrepancy approach.

Bateman (1965) was the first person to propose a definition of learning disabilities that referred to a significant discrepancy between intelligence (estimated potential) and achievement (actual level of performance). This definition represented a shift away from a medically and neurologically based conception of learning disabilities and it was considered more parsimonious (Dombrowski et al., 2006). In 1977, the United States Office of Education established a severe discrepancy (more than two standard deviations) between intelligence and achievement as the primary criterion of learning disabilities and included discrepancy in the definition of a learning disability. The Individuals with Disabilities Education Act (IDEA) 1997 further established a discrepancy between intelligence and achievement as the primary identification for learning disabilities (Mather & Gregg, 2006). Most states in the United States and provinces in Canada adopted the discrepancy calculation for eligibility for special education supports but they varied in how they computed the discrepancy, the size of the discrepancy required, and the tests used to determine the discrepancy. These differences led to large inconsistencies in the reported prevalence

of learning disabilities across states and provinces (Fuchs & Fuchs, 2006; Fuchs, Mock, Morgan, & Young, 2003; Hale, Kaufman, Naglieri, & Kavale, 2006; Kavale, Kaufman, Naglieri, & Hale, 2005; Mesmer & Mesmer, 2008).

The discrepancy approach to the identification of learning disabilities has been criticized for being atheoretical and for the lack of direction indicated for educational interventions (Fletcher, Coulter, Reschly, & Vaughn, 2004; Hale, Kaufman, Naglieri, & Kavale, 2006; Lyon, 1987). Other problems with the discrepancy approach include: distinguishing English Language Learners (ELLs) who have a learning disability and those who do not (Liu, Ortiz, Robertson, & Kushner, 2008); over-identification or under-identification of learning disabilities in minority groups (Liu, Ortiz, Robertson, & Kushner, 2008; Moores-Abdool, Unzueta, Vazquez Donet, & Bijlsma, 2008); a wait to fail approach since it often took several years of struggle to reach the discrepancy criteria (Fletcher, Coulter, Reschly, & Vaughn, 2004; Francis, Fletcher, Stuebing, Lyon, Shaywitz, & Shaywitz, 2005; Fuchs & Fuchs, 2006; Macheech & Nelson, 2007; Mesmer & Mesmer, 2008; Richards, Pavri, Golez, Canges, & Murphy, 2007; Schatschneider, Wagner, & Crawford, 2008; Stuebing, Fletcher, LeDoux, Lyon, Shaywitz, & Shaywitz, 2002); and the lack of services and support for students who have academic difficulties who do not meet the discrepancy criteria (Dombrowski, Kamphaus, & Reynolds, 2004).

Since the discrepancy approach involves finding a discrepancy between intelligence and achievement, there should be a positive relationship between these measures for individuals who do not have a learning disability. However, the relationship between overall intelligence scores and achievement has been shown to be moderate at best (Vellutino, Scanlon, & Lyon, 2000). In fact, several researchers and academics have argued that the use of intelligence testing is irrelevant to the process of identification of learning disabilities since students with academic difficulties, regardless of intelligence test scores, are helped by similar reading interventions (Bocian, Beebe, McMillan, & Gresham, 1999; Finlan, 1992; Fletcher, 1992; Fletcher et al., 1998). Intelligence tests are an attempt to measure the construct of intelligence but they are not equivalent to intelligence. There is little agreement on how to measure ability and what intelligence is (Fiorello & Primerano, 2005; Vaughn & Fuchs, 2006).

Aaron, Joshi, Gooden, and Bentum (2008) referred to a phenomenon called the Matthew effect, named in reference to the biblical saying from the book of Matthew, chapter 13 and verse

12, "The rich get richer and the poor get poorer." Intelligence tests include measures that are influenced by education and achievement. For example, an ongoing reading problem often leads an individual to be unable to read difficult material and to avoid reading. This in turn affects the individual's level of vocabulary. Many intelligence tests use a measure of vocabulary in the calculation of overall intelligence and verbal ability. Over time the individual with a reading problem will have intelligence scores that decrease relative to their age norms. This decrease in intelligence scores will lower the discrepancy between intelligence and achievement, resulting in the under-identification of learning disabilities for some people with legitimate reading problems. These same individuals may have qualified as having a learning disability when they had a larger discrepancy in their scores (Lovett & Lewandowski, 2006; Stanovich, 1986).

Response to Intervention (RTI).

Dissatisfaction with the discrepancy approach to identification of learning disabilities has led to an alternative approach that emphasizes curriculum-based assessment as a basis for decision making towards student learning needs. A shift to Response to Intervention (RTI) was one of the major outcomes of the 2001 Learning Disabilities Summit in the United States. RTI was then included as an alternative to discrepancy for identification of learning disabilities in the reauthorization of IDEA in 2004 and in the No Child Left Behind Act (Fuchs & Fuchs, 2006; Kavale, Holdnack, & Mostert, 2005; Mesmer & Mesmer, 2008).

The RTI approach is used to identify students who are at risk for learning disabilities. All students are given screening tests to identify which students have significantly below average academic skills. These below average students are then given additional support with empirically-based academic interventions (Mesmer & Mesmer, 2008). Interventions include instructional strategies such as a specific phonics program. Tier 1 in most RTI models refers to the instruction in the general education classroom with all students. The instructor implements an intervention (instructional strategy) and monitors the students' response to the intervention. Students who do not respond or perform to an acceptable level are moved to tier 2 in the RTI model. In tier 2 students receive more intense intervention either individually or in a small group. Intensity can include increasing the number of times, length of time, and/or introducing a new strategy used for students who have difficulties. Intervention in this tier can be delivered in the general education

classroom or through pull-out instruction in the resource room. If the student is still not responding to this increased intensity of intervention, the student may be moved to tier 3 of the RTI model where they will qualify for special education supports such as regular resource room support, educational assistants, occupational therapy, and special classrooms with modified academic content. At this time students may be formally diagnosed with a learning disability based on their failure to respond to the academic interventions alone or referred for an assessment of their cognitive processing abilities with a school psychologist (Fuchs & Fuchs, 2006).

RTI gives students the opportunity to demonstrate their learning after explicit and appropriate instruction and is a way of assessing adequate opportunity for learning to take place (Fletcher et al., 2004). Many researchers and educators believe RTI should rightly precede the use of norm-referenced ability evaluations as a way to rule out poor or ineffective instruction as one of the possible causes of weak academic skills (Flanagan, Ortiz, Alfonso, & Dynda, 2006; Fuchs & Fuchs, 2006). Another advantage of RTI is the focus on early intervention and meeting the needs of all students who are struggling academically regardless of their disability status. Students get help right away and do not need to wait until an assessment is done by someone outside of the classroom. RTI reduces segregation, pull-out instruction, and labelling when not needed (Hale et al., 2006). It reduces the amount of money and time spent on intensive one-on-one assessment and these resources can then be focused on intervention (Dombrowski, Kamphaus, & Reynolds, 2004). The assessment involved in RTI tends to be based on the actual curriculum the students are covering and as such can be considered to be more ecologically valid than standardized tests (Dean, Burns, Grialou, & Varro, 2006).

Many researchers have asserted that more research on RTI is needed before it can be used for the diagnosis of learning disabilities. These researchers are not comfortable with a diagnosis of learning disabilities that is based only on a failure to respond to intervention and not the in-depth examination of the individual's cognitive processing abilities and background (Vaughn & Fuchs, 2006). Research is also needed on how to implement, sustain, and apply RTI (Vaughn & Fuchs, 2006). Hale et al. (2006) conclude that RTI identifies students who have learning problems but not necessarily students who have learning disabilities. RTI does not identify the existence of cognitive processing deficits that are present for individuals with learning disabilities. Exclusionary factors such as intellectual disabilities, behaviour problems, family problems, and sensory disabilities

would need to be considered by a school psychologist because they can also affect the learner's ability to respond to instruction (Scruggs & Mastropieri, 2002; 2006). Some students who receive more intense interventions make progress but they struggle as soon as the intensity of the intervention is decreased or discontinued (Fletcher et al., 2004). Children who do not learn in a standard way could be identified through RTI as having a learning disability. They could experience delays in appropriate instruction and a great deal of unneeded interventions that increase in intensity that could have been averted with more information on their learning profiles. An advantage to being identified as having a learning disability is the support they would receive for their learning differences (Kavale et al., 2005).

The Arrowsmith program suits the RTI model well because the individual is initially screened to establish a baseline just as the student at tier 1 in the RTI model is. A variety of interventions or cognitive tasks are introduced to ameliorate weak areas. The Arrowsmith cognitive tasks increase in intensity until the student reaches mastery and is moved on to the next level. The Arrowsmith program monitors progress on a continuous basis. The ideal goal of RTI and the Arrowsmith program is to improve the individual's performance so students are able to participate fully in the regular classroom setting.

Cattell-Horn-Carroll (CHC) theory of cognitive abilities.

Learning disabilities have long been considered to be neurologically based processing differences that lead to academic difficulties, a factor that the RTI approach alone does not take into consideration and is not able to measure. The original conceptualizations of learning disabilities and most current definitions refer to processing differences inherent to the individual (Kavale, 2005). Factor analytic research and the theoretical work of Cattell (1941), Horn (1965), and Carroll (1993) have been combined to form the Cattell-Horn-Carroll (CHC) theory of cognitive abilities. This work was expanded by McGrew (1997) and revised by McGrew and Flanagan (1998). CHC theory proposes ten broad abilities and over seventy narrow abilities that represent the multifaceted nature of cognitive abilities or intelligence. An overall general ability was part of the original theory of Carroll but it has been omitted in CHC theory (Flanagan, Ortiz, & Alfonso, 2007).

CHC theory is considered to be one of the best validated and comprehensive models of cognitive functioning (Fiorello & Primerano, 2005). It is supported by sources of validity evidence

such as genetic, neurological, developmental, and outcome studies (Mather & Gregg, 2006). Research has shown that specific processing abilities are important to understanding the development of specific academic skills. For example, a deficit in working memory can affect math and reading comprehension achievement. Deficits in these areas can lead to academic problems that are characterized as learning disabilities (Flanagan, Ortiz, & Alfonzo, 2007). Norm-referenced tests are used to identify below average academic achievement in combination with related cognitive processing deficits. The individual with a learning disability also has cognitive processing areas that are stronger. For example, the CHC processes that are fundamental to basic reading include auditory processing, crystallized or verbal ability, short term or working memory, long term storage and retrieval, and processing speed. A processing deficit in one or more of these areas can impact reading achievement (Flanagan, Ortiz, & Alfonso, 2007). Knowing which area is affected is relevant to the interventions that are recommended to assist the individual (Fiorella, Hale, & Snyder, 2006; Semrud-Clikeman, 2005). CHC theory provides a theoretical base for understanding learning disabilities.

CHC theory is embedded in many of the most commonly used assessment tools such as the Woodcock Johnson Tests of Achievement and Cognitive Ability. Research demonstrates which broad and narrow abilities are measured by the subtests in most standardized tests of cognitive processing and academic achievement. Most of the current versions of intelligence tests have been revised to align with CHC theory (Flanagan, Ortiz, & Alfonso, 2007). These advancements in cognitive testing match the current theory and research on the relationship between cognitive processing and academic achievement and have increased the efficacy of learning disability assessment. As a result, an improved understanding of the interventions and modifications needed for students with learning disabilities has emerged (Flanagan, Ortiz, Alfonso, & Dynda, 2006). In particular, areas such as phonological processing and working memory have been shown to be critical to academic achievement (Mather & Gregg, 2006). Research has identified the levels of cultural and language bias in standardized tests. Some of the cognitive processing areas in CHC theory such as processing speed and working memory have been shown to be less influenced by education, language, and culture than processing areas such as crystallized intelligence and quantitative reasoning (Flanagan, Ortiz, Alfonso, & Dynda, 2006; Rinaldi & Samson, 2008).

Although support for CHC theory is strong, there are researchers and educators who believe that information on cognitive processing abilities is unnecessary for the diagnosis of learning disabilities. They argue that CHC describes cognitive abilities in isolation of their functional requirements (Dombrowski et al., 2006). Fiorello and Primerano (2005) contend that there is little agreement about what a processing disorder is and how to document it. Intelligence tests are often used to document cognitive processing and their use is criticized because they often underestimate the ability of persons from minority groups and persons with disabilities (Liu, et al., 2008; Moores-Abdool, et al., 2008). Mather and Gregg (2006) noted that some psychologists discount CHC in favour of information processing models with intervention plans such as Planning, Attention-Arousal, Simultaneous, and Successive theory (PASS) introduced by Das, Kirby, and Jarman (1975) and refined by Das, Naglieri, and Kirby (1994) and Das, Kar, and Parrila (1996). Another criticism or problem with the highly researched CHC theory is that most of the research on academic skills and educational interventions has focused on reading and there is much less research on other academic problems such as math and science.

Combined RTI and CHC approach.

Many researchers and educators now agree that the best approach to learning disabilities identification and intervention involves the combined use of RTI and a cognitive processing model such as CHC theory (Flanagan, Fiorello, & Ortiz, 2010; Johnson, Mellard, & Byrd, 2005; Macheech & Nelson, 2007; Wodrich, Spencer, & Daley, 2006). The strengths of each approach provide a more complete picture and balance the weaknesses present in RTI and the CHC approach. A multi-tiered approach should start with RTI to rule out poor or ineffective instruction and lack of opportunity to learn. All students with weak academic skills should receive early intervention. Once these students are identified through early screening, they should receive evidence-based instruction and be retested to monitor their progress. When students fail to respond to goal-directed interventions based on empirically sound instructional methods, comprehensive processing deficit assessment should be undertaken and other factors related to academic achievement considered (Hale et al., 2006). This combination capitalizes on the best aspects of both RTI and CHC theory.

Effective learning disability assessment, identification, and interventions involve the use of trained clinical judgment that combines information from a variety of sources and interprets this

information within the context of the community, the school, the family, and the individual's unique situation and learning needs (Bateman, 1992; Dombrowski et al., 2006). Dynamic assessment, testing the limits of the test, and clinical judgment are a necessary component of a complete assessment picture, particularly when the individual does not match the norm group for the standardized tests (Grigorenko, 2009; Moore-Brown, Huerta, Uranga-Hernandez, & Pena, 2010). Including aspects or methods from Feuerstein's dynamic assessment approach (LPAD) should provide information on the individual's learning potential (Feuerstein, Rand, & Rynders, 1988). Neuroplasticity research supports this dynamic approach that the brain is changeable. Increases in cognitive processing abilities through participation in programs such as Arrowsmith lend support to neuroplasticity and to dynamic assessment approaches that indicate standardized tests often test what capabilities the individual has now and not necessarily what they could have.

Neuroplasticity

The field of neuroplasticity offers a great deal of promise to individuals with learning disabilities. If the brain can be changed then it may be possible to reduce or eliminate the cognitive function/processing deficits that lead to academic and learning difficulties. Hebb (1949) contradicted the belief that brain functioning was static and unchanging. His discussion of the competing brain requirements of change and stability set the stage for later neuroplasticity research. In the 1960s, Rosenzweig conducted groundbreaking research showing that the brains of rats were changed based on environmental conditions such as enrichment or impoverishment, training, and/or social groupings or isolation (Rosenzweig, Krech, Bennett, & Diamond, 1962). Rosenzweig and his colleagues conducted further research to discount the argument that social grouping alone was responsible for the brain changes found in rats. They were able to show that while social grouping affected the brains of rats, enrichment and training also produced changes in the brain on their own (Rosenzweig, Bennett, Hebert, & Morimoto, 1978).

Rosenzweig's results showing that the brains of rats change in response to environmental conditions and training have been replicated under many conditions and with other species of animals. Studies show that these brain or neurochemical changes can include: changes in the cerebral cortex and increases in cortical weight, cortical thickness, size of synaptic contacts, number of dendritic spines and dendritic branching (Rosenzweig & Bennett, 1996). In particular,

many steps have been identified in the neurochemical pathways in the formation of long term memory, starting from neural stimulation to encoding of memories (Rosenzweig, 1996). Norepinephrine, dopamine, and other neurochemicals have been found to be involved in neuroplasticity (Benloucif, Bennett, & Rosenzweig, 1995; Soderqvist et al., 2012). Neuroplasticity can take many forms and can be activated through several different mechanisms (Grafman, 2000). Recent research has focused on how to make the neural changes that will produce positive outcomes for humans who have cognitive processing deficits for a variety of reasons.

Neuroplasticity research with humans.

Much of the information we have on brain function and neuroplasticity with humans involves information gained from working with individuals with acquired brain injuries as the result of strokes, accidents, and disease. In humans, the brain can reorganize itself after brain damage, even after many years have passed since the injury (Bach-y-Rita, 2003). Psychosocial factors such as self-efficacy, social supports, and determination can influence the effectiveness of brain restoration efforts (Bach-y-Rita, 2001; 2003).

More information is now being gained on neuroplasticity of normal brains across the lifespan. While neuroplasticity decreases as we age, it continues to affect areas such as executive functioning and working memory throughout our lives (Asaka, Mauldin, Griffin, Seager, Shurell, & Berry, 2005; Brehmer, Li, Straube, Stoll, vonOertzen, Muller, & Lindenberger, 2008; Dahlin, Nyberg, Backman, & Stigsdotter Neely, 2008; Goh & Park, 2009; Li, Schmiedek, Huxhold, Rocke, Smith, & Lindenberger, 2008; Noack, Lovden, Schmiedek, & Lindenberger, 2009; Zollig & Escher, 2009).

Other factors also affect the level of neuroplasticity in humans. Cardiovascular fitness has been shown to be associated with increased cognitive functioning (Aberg et al., 2009). Mental stimulation and cognitive self-efficacy also impact cognitive functioning and neuroplasticity (McDougall, 2009).

Much of the research on neuroplasticity indicates that learning is often specific and does not easily generalize. Green and Bavelier (2008) discuss the characteristics of training programs that produce learning results that generalize to cognitive tasks beyond the training. They found that two factors were most important to increase the level to which a training program generalized to other

cognitive tasks. One of these factors is the ability of the training to increase arousal or physical and mental alertness. The training program needs to increase the arousal level of the participants to an optimal level without increasing this level too high. As well, the training programs that provide the most generalization to other cognitive tasks include variable tasks that require many different types of cognitive processing to complete them (Green and Bavelier, 2008).

Several other factors increase the level to which brain training programs generalize to other cognitive tasks (Green and Bavelier, 2008). When cognitive training programs start at a mildly difficult level and then increase gradually, they are more likely to generalize. When the motivation of the participant to learn is high and/or the program helps to improve the motivation level of the participant, more generalization takes place. Feedback that is immediate and frequent works best for generalization to other cognitive tasks at the beginning of training programs (Green & Bavalier, 2008).

Examples given of activities that produce generalized neuroplasticity include learning and playing a musical instrument, athletic participation, and computer games (Green & Bavalier, 2008). Basak, Boot, Voss, and Kramer (2008) studied elderly participants with a strategy computer game while Stine-Morrow, Parisi, Morrow, and Park (2008) engaged elderly participants in competitive, small group problem solving tasks. These tasks required the participants to use their working memory and attention in goal directed activities. The results appear to show a greater generalizability and maintenance of gains in working memory and attention.

The Arrowsmith program includes several of the characteristics outlined by Green and Bavelier (2008) that increase generalization of learning to other cognitive tasks. The Arrowsmith program has several different tasks and is individualized in difficulty level. These tasks tend to be done separately and not consecutively as may be more advantageous. The individual is given work near the top of their functioning and moved up gradually as they improve. The tasks can be quite repetitive though and may be perceived as boring or disconnected from academic achievement by some students. The focus on work at a challenging level should increase the emotional and cognitive arousal of the students, hopefully to an optimal level. Perhaps with some of the students who make smaller changes through participation in the Arrowsmith program, their arousal levels are too high or too low. Feedback on the individual's performance is immediate and frequent. Mastery of a level provides reinforcement that the individual's efforts have met with success.

Neuroplasticity and learning disabilities.

A relatively small number of studies focus on neuroplasticity for individuals with learning disabilities. This dearth of research is surprising considering the research that shows brain differences in processing for individuals with learning disabilities and Attention Deficit/Hyperactivity Disorder (Helmuth, 2001; Richards et al., 2000; Semrud-Clikeman, Steingard, Filipeck, Biederman, Bekken, & Renshaw, 2000; Shaywitz et al., 2001). The benefit to individuals with learning disabilities is obvious since cognitive processing directly affects academic achievement (Flanagan, Ortiz, & Alfonso, 2007). Meyler, Keller, Cherkassky, Gabrieli, and Just (2008) obtained fMRI information at three points for fifth grade poor readers: prior to remediation, after 100 hours of instruction (using four different reading programs), and a year after the instruction. They found that changes in brain functioning in the left parietal and angular gyrus regions of the brain continued to increase and normalize after the instruction and a year later. Auditory processing training through computerized programs have been found to increase neural synchrony and neural encoding of speech sounds in children with language learning disabilities (Hayes, Warrier, Nicol, Zecker, & Kraus, 2003; Russo, Nicol, Zecker, Hayes, & Kraus, 2005). Penolazzi, Spironelli, Vio, & Angrilli (2010) used EEG measures to study the brain changes after 6 months of phonological training in children with dyslexia. Reading speed improved, error rates decreased, and an increase in the left posterior EEG beta power were evidenced in these children.

Several cognitive training programs have gained attention for their focus on neuroplasticity. The Fast ForWord program by Scientific Learning Corporation (http://www.scilearn.com) has been widely used in schools to increase auditory processing in an effort to improve the reading and writing skills of children with learning disabilities. The Cogmed Working Memory training program by Pearson Inc. (http://www.pearsoncanada.ca) was initially designed to improve working memory and attention in individuals with AD/HD and is considered to be an evidence-based program based on the controlled research support for this program. This research demonstrates the possibility of applying neuroplasticity through the use of computer based programming. The level of fidelity in the implementation of the programs is often critical to the potential success of these changes. Lumosity by Lumos Labs Inc. (http://www.lumosity.com) is a cognitive training program that is highly advertised on the internet and television. The Arrowsmith program, like Lumosity, has less empirical support than programs such as Cogmed and targets a wider spectrum of cognitive

processing functions. The lower level of empirical support does not necessarily mean that these programs are not effective but it certainly identifies a gap in the research literature and a need to address this lack of research on the effectiveness of these programs.

Cogmed working memory training. Klingberg (2010) proposed the idea that led to a computer program called Cogmed that implicitly trains working memory and attention by repeating working memory tasks with feedback and rewards and by gradually increasing the working memory demands of the tasks. The meta-cognitive strategies that are directly taught in most programs to improve attention, focus, and working memory for individuals with ADHD and learning disabilities are not explicitly taught in the Cogmed program. Nevertheless, completion of the Cogmed program has resulted in brain plasticity and increased activity in the prefrontal and parietal cortex (Mangina Beuzeron-Mangina, 2004; Olesen, Westerberg, & Klingberg, 2004). Given that working memory deficits are common in individuals with learning disabilities and ADHD and are considered to be a major contributing factor to academic and learning difficulties, evidence-based programming to improve working memory is a major breakthrough (Soderqvist et al., 2012).

Most of the research evidence supporting the Cogmed computer program's effectiveness in improving working memory has been with individuals with AD/HD (Beck, Hanson, Puffenberger, Benninger, & Benninger, 2010; Gibson, Gondoli, Johnson, Steeger, Dobrzenski, & Morrissey, 2011; Green et al., 2012; Holmes, Gathercole, Place, Dunning, Hilyon, & Elliot, 2010; Klingberg et al., 2005; Klingberg, Forssberg, & Westerberg, 2002; Mezzacappa & Buckner, 2010). However, recent research has now shown that working memory can be improved with other groups who struggle in this area as well, including individuals with reading disabilities (Dahlin, 2011), individuals with acquired brain injuries (Johansson & Tornmalm, 2012; Westerberg et al., 2007), children with social, emotional and behavioural difficulties who do not have comorbid ADHD (Rougham & Hadwin, 2011), and older adults (Brehmer, Rieckmann, Bellander, Westerberg, Fischer, & Backman, 2011; Brehmer, Westerberg, & Backman, 2012).

Recent research has also shown that the Cogmed program helps to produce gains in executive functioning (Diamond & Lee, 2011) and fluid reasoning (Bergman Nutley, Soderqvist, Bryde, Thorell, Humphreys, & Klingberg, 2011; Jaeggi, Buschkuehl, Jonides, & Perrig, 2008). Many of the studies that provide support for the Cogmed program are randomized, controlled

studies. Such support has led to the Cogmed program being listed as an evidence-based program by the What Works Clearinghouse (http://www.w-w-c.org/), a United States government supported organization that lists educational programs that have research support.

Fast ForWord program. The Fast ForWord program focuses on training auditory processing and spoken language through intensive computer exercises. The program was originally designed for children with central auditory processing disorder and language learning disabilities such as dyslexia who have difficulties with reading and writing (Merzenich, Jenkins, Johnston, Schreiner, Miller, & Tallal, 1996; Miller & Tallal, 2006; Tallal et al., 1996). Functional MRI research has shown that activation in the brains of individuals with dyslexia differs from the activation present for individuals who are normal readers. Individuals with dyslexia have deficits in the neural mechanisms underlying phonological processing (Shaywitz et al., 2001). The Fast ForWord program has been shown to increase activation in the left tempero-parietal cortex and left inferior frontal gyrus as well as improving speech, language, and reading skills (Gaab, Gabrieli, Deutsch, Tallal, & Temple, 2007; Temple et al., 2003). Other studies have produced mixed results with increases in some aspects of students' language skills but not broader measures of language acquisition or reading skills (Rouse & Krueger, 2004); improvement in phonemic awareness but not reading (Loeb, Gillam, Hoffman, Brandel, & Marquis, 2009); and little to no improvement in language and reading comprehension test scores (Borman, Benson, & Overman, 2009). The transferability of Fast ForWord training to academic achievement has not been fully demonstrated with these field studies. Some of these studies note that not all of the participants completed the Fast ForWord program in the prescribed way.

Most of the research evidence supporting the Fast ForWord program has involved comparing individuals before and after completing the program. However, in randomized, controlled studies with large numbers of school students, completion of the Fast ForWord program did not produce statistically significant gains in academic skills related to language (Borman, Benson, & Overman, 2009; Rouse & Krueger, 2004). Strong, Torgerson, Torgerson, & Hulme (2011) conducted a meta-analytic review of all the randomized, controlled studies of the Fast ForWord program. They concluded that there is no evidence to support the effectiveness of this program in improving the reading or oral skills of children.

Lumosity online cognitive training program. Many other computer programs targeting cognitive processing, including some that combine physical activities with the computerized portions and some that are available online, are emerging. There is a great deal of variation as to how well researched these programs are. As well, more and more books are connecting brain research to practical applications to the classroom and other contexts. The most prominently advertised of the online cognitive training programs is Lumosity that targets several cognitive processing areas. Although there appears to be much less research conducted with this program, there are some studies that support the improvement of executive skills in children with cancer-related brain injuries (Kesler, Lacayo, & Jo, 2011), older adults with mild cognitive impairment (Finn & McDonald, 2011), math skills in a girl with Turner syndrome (Kesler, Sheau, Koovakkattu, & Reiss, 2011), and in enhancing visual attention and working memory with healthy adults (Hardy, Drescher, Sarkar, Kellett, & Scanlon, 2011).

Arrowsmith Program

The Arrowsmith Program, as developed by Barbara Arrowsmith-Young, is based on the premise that the cognitive function/processing difficulties experienced by individuals with learning disabilities can be decreased or removed when they are exercised by a series of cognitive tasks meant to target and strengthen the areas of the brain that are relatively weak. Barbara Arrowsmith Young herself experienced severe learning disabilities in combination with superior abilities as a child and young adult. She worked very hard to achieve academic success and did so mostly through her strong memory, determination, and compensatory strategies (Arrowsmith-Young, 2012; Doidge, 2007).

In graduate school, Arrowsmith-Young conducted an outcome study of children with learning disabilities at a clinic that taught children compensations for their learning disabilities. Her research showed that very little gains were being made by these students and she felt that there must be a more effective and long term solution to improve their academic success. Arrowsmith-Young became aware of research findings on the neuroplasticity of the brain. This research changed how she thought about her own learning disability. She designed cognitive exercises to improve her cognitive processing difficulties through a combination of studying the available research on cognitive functions and trial and error with herself as the subject. Arrowsmith-Young

used the knowledge she had gained to design a cognitive training program to teach other individuals with learning disabilities (Arrowsmith-Young, 2012; Doidge, 2007).

The discovery of the neuroplasticity of the brain had a huge impact on Arrowsmith-Young. If permanent changes could be made to the cognitive function/processing difficulties underlying a learning disability, compensations would no longer be needed or could be greatly reduced. The key would be figuring out how to make these changes happen. Arrowsmith-Young believed that if she could target the areas of the brain that had been identified as being involved in various learning processes by providing cognitive training exercises to stimulate these areas, the brain would strengthen in the weak areas that were causing the learning disabilities. She set about designing and testing cognitive exercises or tasks using herself as the subject. Arrowsmith-Young developed cognitive exercises that helped her learn how to tell time, relate symbols, and understand math, grammar, and logic. She also began to understand information as it was happening and not just after a great deal of examination after the fact. Arrowsmith-Young had not previously been able to do these tasks or was greatly deficient in them (Arrowsmith-Young, 2012; Doidge, 2007).

Arrowsmith program schools.

A private school using the Arrowsmith program was opened in Toronto, Canada in 1978. Numerous other private schools in the United States and Canada now offer the program and it has also operated in the Toronto Catholic District School Board. Arrowsmith-Young identified 19 cognitive functions that are assessed at the outset of programming (Arrowsmith-Young, 2012; http://www.arrowsmithschool.org) and these cognitive functions are listed in Appendix B (Table B1.). An individual plan is developed to work on the cognitive functions that each individual has difficulties with. Written, visual, auditory, and computer exercises are in place to meet each individual at the level at which they encounter difficulties. The levels are increased when the student reaches mastery. The exercises are repetitive in order to intensely stimulate specific cognitive areas in the brain that are weak. Each student is retested on the 19 cognitive functions at the end of the year and their program is adjusted in response to their new profile (Arrowsmith-Young, 2012).

The teacher to student ratio in Arrowsmith schools is one teacher to ten students. Some students have eight (forty minute) modules of Arrowsmith programming and are full-time in the

program. Other students take four modules of Arrowsmith programming with academic instruction at the Arrowsmith school or another school. When students are full-time in the Arrowsmith school, they are taken out of their studies in the regular Kindergarten to grade 12 school system if they are at an elementary or high school age. The Arrowsmith modules include computer or paper-pencil tasks that are designed to specifically target the below average Arrowsmith cognitive functions. The testing done by the Arrowsmith program identifies the cognitive functions that the student needs to improve and gives an estimate of how much time will be needed to improve the weaker cognitive functions. Schools offering the Arrowsmith program must pay a licensing fee per student per year and have their instructors complete the three week Arrowsmith training program that is offered in the summer (http://www.arrowsmithschool.org).

Students in the Arrowsmith program should be of average intelligence or higher in at least some areas. It should be noted that due to the diverse abilities that people with learning disabilities have, their full scale intelligence scores are often low estimates of their ability. The students often have been diagnosed with a learning disability and/or AD/HD and can be at an elementary, secondary, or postsecondary level. Individuals with acquired brain injuries, autism spectrum disorders, intellectual disabilities, and severe emotional/behavioural disorders are excluded from the program. Arrowsmith-Young believes that these groups of students will receive less benefit from her program.

Arrowsmith program research.

A search of published research in peer reviewed journals indicates that there are no articles directly involving research on the Arrowsmith program. Only a few studies on the Arrowsmith program are available and all but the Kemp-Koo (2010) study can be accessed through the Arrowsmith School website. The lack of peer reviewed, independent research on the Arrowsmith program continues to be a factor that limits the acceptance the program has achieved. The lack of randomized, controlled studies, while very difficult to conduct with a program such as Arrowsmith, prevents this program from being labelled evidence-based. The currently available research on the Arrowsmith program is presented in chronological order.

APA convention (1997) poster presentation. Young and Burrill (1997) presented a poster session at the 1997 American Psychological Association (APA) Convention. A group of 12

individuals with learning disabilities were compared to a control group of 35 adults who were not diagnosed with learning disabilities to see if a test for motor symbol sequencing could discriminate between these two groups and if the test correlated with standardized tests of copying and handwriting. The motor symbol sequencing test is used to measure the cognitive function by this name in the Arrowsmith program. The authors found that the group of students with learning disabilities scored significantly lower on the test of motor symbol sequencing than the control group (Young & Burrill, 1997). This result supports the ability of the Arrowsmith motor symbol sequencing task to distinguish between individuals with learning disabilities and individuals who do not have learning disability. However, this difference should only occur with some types of learning disabilities and not with others. Additional research is needed to determine if the Arrowsmith motor symbol sequencing test distinguishes between individuals with related learning disabilities that affect writing and individuals with unrelated learning disabilities to writing.

The length of time it took the subjects as a whole to complete the motor symbol sequencing test was negatively correlated (at a statistically significant level) with the textual copying and crossing out letters subtests of the Monroe Sherman test, the clerical speed and accuracy subtest of the Differential Aptitude Test (DAT), the handwriting subtest of the Test of Written Language (TOWL), and the reading speed measure from the Nelson Denny Reading test for both of the groups combined. Significant negative correlations between the length of time to complete the motor symbol sequencing task and all of the previously listed measures except for the Nelson Denny measure (a reading task) were found for the control group (Young & Burrill, 1997). For the group of students with learning disabilities, only the crossing out letters subtest showed a significant negative correlation with the length of time to complete the motor symbol sequencing test (Young & Burrill, 1997). This lack of significance, while possibly due to the smaller number of individuals with learning disabilities in the study, is problematic to establishing the construct validity of the Arrowsmith motor symbol sequencing test for individuals with learning disabilities. Repeating this research with a larger group of individuals with learning disabilities would be needed to determine whether construct validity is present with this group of people. Establishing construct validity with this group is critical because individuals with learning disabilities are the main target group of the Arrowsmith program.

Also, the group of students with learning disabilities in the Young and Burrill (1997) study includes children and adults and is younger as a group than the control group that only included adults, making the comparisons less valid. It is also possible that the control group included individuals with undiagnosed learning disabilities or were different in other important ways other than age but this appears less likely due to the statistically different scores in the two groups on the motor symbol sequencing test. Standardized tests such as the Wechsler Intelligence Scale for Children-IV (WISC-IV), Wechsler Individual Achievement Test-III (WIAT-III), and Woodcock-Johnson Tests of Achievement and Cognitive Ability-III (WJ-III) that are more commonly used in schools and by school psychologists and have higher validity and reliability should be used to establish construct validity of the Arrowsmith cognitive function tests.

St. Patrick pilot Arrowsmith program (1998). In November 1997, a seven month pilot project of the Arrowsmith program was initiated in St. Patrick Catholic Secondary school in Toronto. Seventeen of the grade nine students with diagnosed learning disabilities at St. Patrick were selected to participate in the pilot and these selected students had below average scores on at least 9 of the 19 Arrowsmith cognitive functions that were tested prior to the start of the pilot. Four Arrowsmith cognitive functions were targeted in the pilot (Motor Symbol Sequencing, Symbol Relations, Symbol Recognition, and Supplementary Motor). The students spent half of their day working on Arrowsmith exercises in these areas and the other half of their day in grade 9 credit courses (St. Patrick Catholic Secondary school and Arrowsmith program pilot project, 1998).

The students were measured before and after the 7 month pilot on overall percent average in their course work from term 1 to term 2 and standardized measures of achievement and aptitude. The students and parents completed a survey to rate perceived changes in a variety of areas from extremely noticeable to no change noticeable and provided open-ended comments on participation in the pilot project. The mean change in overall percent average in course work from term 1 to term 2 was 11%. The standardized achievement test comparisons showed improvements but these comparisons were made in grade equivalents with no tests of statistical significance, greatly limiting their utility. Comparisons from some of the subtests from the DAT, TOWL, and other tests were made using percentile scores but no tests of statistical significance were reported. These subtest changes ranged from improvements of 8 to 21 percentile points (St. Patrick Catholic Secondary School and Arrowsmith program pilot project, 1998).

On most items on the survey, both the students and parents rated the perceived changes as very noticeable to extremely noticeable in over half of the cases. Most of the other students and parents rated the perceived changes as noticeable to somewhat noticeable. The anecdotal comments noted in the report were very positive in nature (St. Patrick Catholic Secondary school and Arrowsmith program pilot project, 1998). The following are some examples of typical comments written by parents of the students in the program: "Jonah is starting to show his true strengths, where before they were locked in his head. He used to spend hours on one assignment and still not be able to express his thoughts in writing."; "Scott has made more progress in this year than in any other year."; "Michael has more confidence to try doing his schoolwork on his own and gets really excited when work he has done has gone well and he gets a good grade" (St. Patrick Catholic Secondary school and Arrowsmith program pilot project, 1998).

The small sample size, lack of a control group, use of grade equivalent measures, and lack of tests of statistical significance greatly reduces the generalizability and validity of the results of the St. Patrick pilot study. Nevertheless, the changes in test scores and positive feedback from the questionnaires led the Toronto Catholic District School Board to continue Arrowsmith programming at St. Patrick school and expand to other elementary and secondary schools in the district.

APA convention (2000) poster presentation. Young and Burrill (2000) presented a poster session at the 2000 APA Convention on the treatment outcomes for cognitive exercises meant to improve scores in the cognitive function of motor symbol sequencing. A group of 12 students with learning disabilities at the Arrowsmith School in Toronto were administered the motor symbol sequencing test designed by Barbara Arrowsmith-Young and used in the Arrowsmith program before they started treatment and after treatment. They were also administered the textual copying subtest of the Monroe Sherman Achievement test, the clerical speed and accuracy subtest of the DAT, and the handwriting subtest of the TOWL before and after treatment. Tests of motor reaction time and lexical memory were given before and after treatment to control for the general effects of treatment (Young & Burrill, 2000).

The students ranged in age from 15 to 24 and were average to above average in intelligence with a diagnosis of a learning disability that involved the motor symbol sequencing aspect of writing. The latter distinction may have been made on the basis of the Arrowsmith

program cognitive functions test, although this is not clear. The students completed cognitive training through the Arrowsmith program to specifically address the area of motor symbol sequencing. The mean length of treatment was 10.8 months with a mean of 6 hours of training a week. Significant improvements were found in the Arrowsmith motor symbol sequencing test and the standardized measures related to motor symbol sequencing. The control measures of motor reaction time and lexical memory showed no significant changes (Young & Burrill, 2000). The small number of students in the sample, lack of younger children in the sample, and the lack of a control group limit the generalizability of these findings.

Lancee (2003) study in TCDSB. Lancee (2003) conducted a study comparing all 30 students with learning disabilities enrolled in Arrowsmith programming in four elementary schools offering the Arrowsmith program in the TCDSB, and a control group of 10 students with learning disabilities from another elementary school in the district that were in regular programming with standard resource room support. There was no randomization in assignment to the group because of ethical and practical considerations. There were no dropouts from the study and the test administrators were measured to have 90% accuracy with each other on test scoring.

All of the participants in the Lancee (2003) study were given pre and post measures that included 12 subtests or overall test measures from the Wide Range Achievement Test-3 (WRAT-3), Woodcock Reading Mastery Test (WRMT), Monroe-Sherman Achievement Test, Otis-Lennon Mental Ability Test, Peabody Picture Vocabulary Test-3 (PPVT-3), and the Arrowsmith program cognitive functions testing. Relative progress comparisons were made using grade equivalent scores assuming that in a school year, approximately 1.0 in grade equivalent points should increase for the average student without a learning disability and little to no gain would be made by the average student with a learning disability. The latter group will tend to fall farther and farther behind their peers. Unfortunately, even though the grade equivalent comparisons in this study yielded significant increases for the Arrowsmith program students and not for the control group students, the use of grade equivalents to achieve a measure of progress is not statistically sound. The comparison of percentile scores between the two groups, as a whole, yielded statistically significant differences between all of the measures when improvements of the percentile scores were compared (Lancee, 2003).

The small number of students in this study limits the generalizability of the results. The inclusion of a comparison group adds to the information gained but the two groups were selected on the basis of having a learning disability and were not matched on other factors such as grade, gender, and initial levels on the comparison measures. The differences in the groups may account for some or all of the significant differences between them. The control group of 10 students with learning disabilities received lower percentile scores in the post-testing in almost every measure which seems like an unusual situation. Grade equivalents are inappropriate for progress and other comparisons. These scores are often mistakenly understood to reflect the grade level functioning of the individual. A great deal of interpolating and estimation is often involved in determining what appears to be a very exact score. A single item more or less correct, that could easily happen by chance, can sometimes affect the grade equivalent score by more than a grade level. Several of the measures such as the Monroe-Sherman Achievement and Otis-Lennon Mental Ability tests that were used for comparisons, are not commonly used by school psychologists and have less validity and reliability than other tests that could have been given.

Lancee (2005) study of Toronto Arrowsmith School. Lancee (2005) conducted a three year study of 79 children with learning disabilities who were attending the private Arrowsmith School in Toronto. At the conclusion of the study, a decision was made to exclude 6 of these students because they differed from the majority of students in the sample. Some of these 6 students were adults while the participants who were included in the analysis were children and the other students who were excluded had milder learning disabilities than the included students. Thirteen students who had enrolled the previous year were added to the study and their retrospective data from the previous year was used for their year 1 data and so on. All of the students in the study completed at least one year in the Arrowsmith program with most of them completing two years and some of them completing three years. At the end of the study many students had completed their Arrowsmith studies and left for other educational pursuits. The other students had not completed their Arrowsmith studies and continued at the Arrowsmith School. Most of the students who participated in the study were taking 6 forty minute modules of Arrowsmith programming a day with 1 forty minute period a day each of English and math at the Arrowsmith School. Some of the students took only Arrowsmith programming or took four modules of Arrowsmith programming

with the other half of their day spent at the Arrowsmith school or another school in academic instruction.

Percentile scores from fifteen achievement subtests from the Monroe-Sherman Achievement test, WRAT, WRMT, and TOWL were taken before the start of programming and at the end of each year. The students were also grouped by severity level in three levels based on the number of these fifteen measures being below the 25th percentile. Ten students were identified as severe since all 15 measures were below this level, 40 students were identified as moderate with 8 to 14 of the measures below this level, and 29 students were identified as mild with less than 8 of the measures below this level (Lancee, 2005).

Lancee (2005) found that the rate of improvement on achievement measures was not dependent on age, gender, intelligence level, or type of learning disability. The students in the severe group made continuous progress on standardized achievement tests over the three years and needed all three years to see full or major changes. The moderate group made their largest gain in the first year but were steadily improving in the next two years. The mild group made most of their gains in the first year and only small gains in the next two years. It should be noted that these comparisons are not based on cognitive functioning tests that are the focus of this cognitive training program. The Arrowsmith program itself does not focus on academic instruction, although some of these students did receive some academic instruction apart from their Arrowsmith programming. The length of time away from academic instruction could increase the amount of time needed to catch up with the academic instruction these students have missed. Increases in cognitive functioning should assist with this process of academic learning once it takes place. A factor analysis of test scores on the Arrowsmith cognitive function tests and standardized achievement tests found that improvements of Arrowsmith cognitive functions were positively correlated with improvements in related standardized achievement test scores (Lancee, 2005).

Although the Lancee (2005) study avoided the problem of using grade equivalents for comparisons, standard score comparisons would be superior to percentile scores because standard scores have equidistant points and percentile scores do not. The Lancee (2005) study involved a larger sample size but no comparison or control group was present. As with the Lancee (2003) study, the choice of achievement measures could be improved with the choice of tests that have greater validity and reliability. The severity level finding, while limited by the way the groups were

defined, is interesting because it may point to the amount of time needed for students to benefit academically from the program.

Report on the Arrowsmith program in the TCDSB (2007). The Toronto Catholic District School Board (TCDSB) offered the Arrowsmith program as a choice for students with learning disabilities in their schools, starting with the pilot project in St. Patrick Secondary School in 1997 noted previously. The positive research results gathered from this pilot project, led to an expansion of Arrowsmith programming in the TCDSB that eventually included seven elementary schools. The TCDSB offered the only publicly funded Arrowsmith program but this program was cut in 2009 due to funding cutbacks related to the economic downturn. Parents of the students enrolled in this Arrowsmith programming at time obtained a court injunction that required the TCDSB to complete Arrowsmith programming for these students before cutting the program from its schools. A change in the funding decision eventually led to the Arrowsmith program being retained in four elementary schools.

The 2007 TCDSB report includes data from 235 students enrolled in the Arrowsmith program since September 1997 in seven elementary schools. The students were tracked on a variety of progress measures including standardized achievement tests, amount of resource room support needed pre and post Arrowsmith program, feedback measures from teachers, students, and parents, and achievement in high school and postsecondary programs. However, pre and post Arrowsmith program scores on standardized achievement tests were available for only 120 of the 235 students. Although the Report on the Arrowsmith program in the TCDSB (2007) indicates average gains of one and a half to three times higher for academic skills through participation in the Arrowsmith program, these comparisons were hampered by the use of grade equivalents and a lack of statistical analysis for significance. Also, these numbers were based on questionable logic and lack of concrete evidence that the average student gains a full grade on the grade equivalent scores in a year. Students, teachers, and parents completed questionnaires and reported noticeable changes in cognitive abilities, academic skills, confidence, and self-esteem. The students who participated in the Arrowsmith program required less resource room support for their academic studies while in the Arrowsmith program. Prior to entering the Arrowsmith programming, just over half of these students required 50 to 100% resource room and/or educational assistant support and just under a half of these students required one to two periods of resource or other support. When the students

who completed Arrowsmith programming in elementary school entered high school, 69% of these students were not using any resource support at all, and 26% of these students had one period of support a day or less compared to what they received in elementary school. It may be that this change to one period a day of support is a common shift of support for students with learning disabilities when they enter high school. No comparison of the usual level of supports compared to other high school students with learning disabilities who did not take the Arrowsmith program was made. The overall high school average of the students who completed Arrowsmith studies in elementary school was 79% (Report on the Arrowsmith program in the TCDSB, 2007). Only a few students had gone on to postsecondary studies at the time the study was completed so the information in this area is of limited value in terms of generalizability.

The Report on the Arrowsmith program in the TCDSB (2007) report does not include a control group but it does provide pre and post measures of academic gains and resource room support for the Arrowsmith students to show an increase in academic achievement and a decrease in resource support. Larger numbers of students over a longer period of time lends more credibility to the results. The St. Patrick Catholic Secondary school and Arrowsmith program pilot (1998), Lancee (2003), Lancee (2005), and the Report on the Arrowsmith program in the TCDSB (2007) studies all show gains in academic skills. The information from questionnaires filled out by students, parents and teachers lends additional support suggesting academic, behavioural, and emotional changes in the participants.

Eaton (2011) case studies. Eaton (2011) reports 8 case studies of students who have attended the Eaton Arrowsmith schools in Vancouver and Victoria. These students have different learning disabilities. Selected scores pre and post Arrowsmith program participation from measures such as the Wechsler Intelligence Scale for Children (WISC-III or WISC-IV), Woodcock Johnson Tests of Achievement and Cognitive Ability (WJ-R or WJ-III), Beery-Buktenika Developmental Test of Visual-Motor Integration, Test of Nonverbal Intelligence – 3 (TONI-3), and others are reported. Although single cases do not lend themselves to generalizable results, particularly when diverse learning disabilities are represented, the case studies provide depth of information on the students with the learning disabilities and their families that cannot be captured with a purely quantitative approach. Eaton (2011) provides the pre and post Arrowsmith program scores for the 8 individuals of his case studies that show improvements in cognitive areas such as

working memory, processing speed, and spatial/nonverbal reasoning. The only areas reported in most cases involve improved scores that are consistent with the academic and other gains the students made, so it may follow that the other scores not reported were already within the normal range or did not increase. There is no information to explain how the case studies for the book were selected or how they were conducted other than the information that is given. Nevertheless, the case study approach used by Eaton (2011) provides information that allows the reader to understand the cognitive, academic, emotional, and interpersonal struggles these children have experienced and how participation in the Arrowsmith program has changed their everyday lives.

Kemp-Koo (2010) LDAS Arrowsmith program research report. The Learning Disabilities Association of Saskatchewan (LDAS) started a pilot Arrowsmith program in 2008-2009 with an enrolment of twelve students. Kemp-Koo (2010) conducted research on the pilot program to gain information on the cognitive and achievement changes made by the students who all had previous assessment results that included WISC or WAIS scores. A committee made up of LDAS staff and board members, that Kemp-Koo was a member of as a board member of LDAS, decided that these students would also be administered the subtests for the long term retrieval and auditory processing composites on the WJ-III since the WISC and WAIS do not measure these important processing areas. The WISC/WAIS and WJ-III Cognitive measures would be reassessed at the end of two years of programming to avoid retest issues. The WJ-III Achievement subtests in reading, written language, and math would be administered to the students at the start of the program and at the end of each of the first two years of programming. These tests have high validity, reliability, and alignment with CHC theory. Discussion concerning a control group concluded that given the small numbers and diversity of age and learning disabilities in the LDAS Arrowsmith pilot, it would be too difficult to match another group of students with learning disabilities in a classroom situation on the relevant variables. Randomizing the groups was not possible since the private fees for the Arrowsmith program are paid by the parents. The LDAS Arrowsmith program was being offered at LDAS and not in the Kindergarten to grade 12 school system.

Kemp-Koo (2010) compared the WJ-III achievement results of the twelve LDAS Arrowsmith students at the end of each of the first two years of their participation in the program. Standard scores were chosen for the comparisons since the points between the scores are equidistant. Matched t-test comparisons at the end of the first year indicated that there were

statistically significant (at the .05 level) increases in all five of the composites (broad reading, broad written language, math calculation skills, academic skills, and academic fluency) and five of the nine subtests (letter-word identification, reading fluency, math fluency, writing fluency, and writing samples). The increases in the calculation and passage comprehension subtests approached significance. At the end of the second year, the writing samples subtest showed a statistically significant increase. Many of the students increased from half time Arrowsmith programming in their first year to full time Arrowsmith programming in their second year. The Arrowsmith program itself does not focus on academic skills. This reduction in the amount of academic instruction students received may account for the fewer changes that students made in achievement during their second year. No significant differences were found in the PPVT-4 scores at the end of the first or second years. Overall, the LDAS Arrowsmith students scored in the average range in receptive vocabulary and remained in the average range (Kemp-Koo, 2010).

The LDAS Arrowsmith students in the Kemp-Koo (2010) study made statistically significant gains, as measured by matched t-tests on the Perceptual Reasoning and Working Memory indexes and on the Full Scale intelligence score of the WISC-IV/WAIS-IV after two years of participation in the LDAS Arrowsmith program. Their increase on the Processing Speed index was close to significant. There was no significant increase on the Verbal Comprehension index (Figure 2.1). Similar to the PPVT-4 results, this language-based area was solid for most of the students before they entered the LDAS Arrowsmith program. On the WJ-III Cognitive Scales, the students as a group showed statistically significant increases in long term retrieval. The comparison between the auditory processing composite scores was not significantly different (Figure 2.2).

The small number of students, lack of a comparison group, and higher percentage of female students to male students than is typical in individuals with learning disabilities limit the generalizability of Kemp-Koo's (2010) research with the LDAS Arrowsmith pilot program. The use of standard scores for comparisons and standardized tests with high reliability, validity, and alignment with CHC theory increase the utility of the results when compared to previous studies with other Arrowsmith program groups.

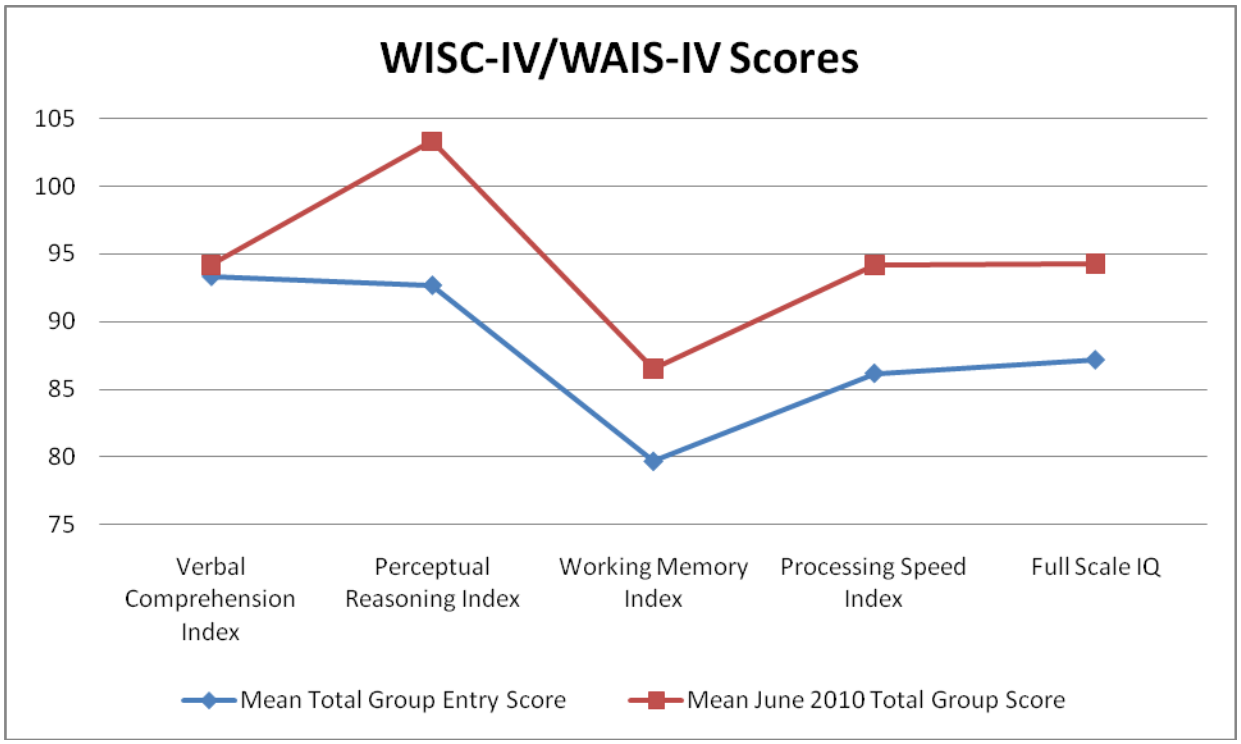

Figure 2.1. Comparison of WISC/WAIS Scores of LDAS Arrowsmith Students. The vertical numbers represent standard scores. The mean total scores are for the twelve students who entered the LDAS Arrowsmith program in September 2008. The entry scores were obtained prior to September 2008 (Kemp-Koo, 2010).

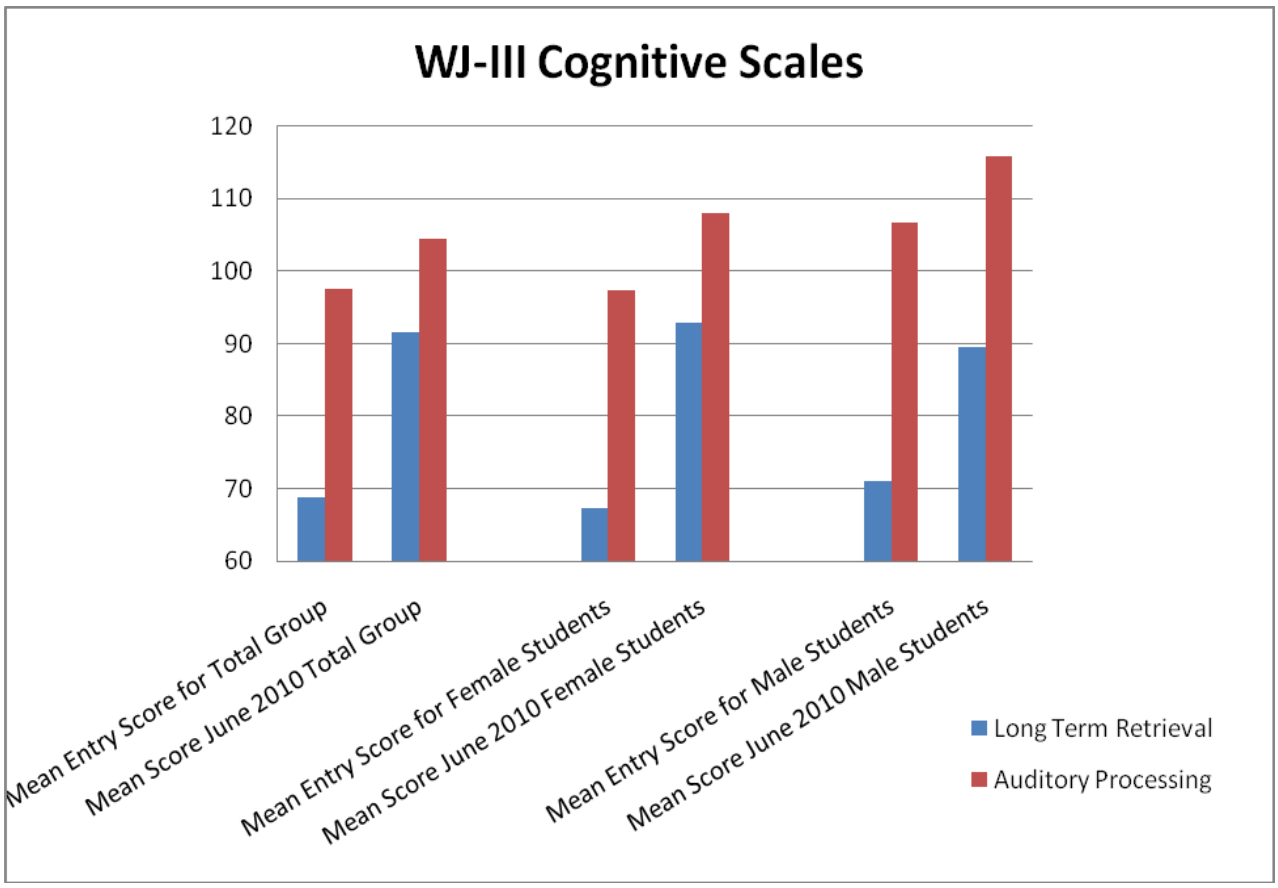

Figure 2.2. Comparison of WJ-III Cognitive Scores for LDAS Arrowsmith Students. The vertical scores are standard scores. The mean entry score on the horizontal axis refers to the mean standard score when the students entered the LDAS Arrowsmith program in September 2008. There were 12 students in total with four male students and eight female students (Kemp-Koo, 2010)

Summary

The relevant literature related to the current case study was reviewed to understand what knowledge and understanding has already been gained. This review also points to the gaps in the literature that give direction to the current study and future research. Firstly, a discussion of the cognitive development theories of Piaget and Vygotsky was undertaken to understand how cognitive or intellectual development occur. Piaget and Vygotsky both see the person as an active agent in constructing their own reality and learning. Piaget emphasizes cognitive readiness and exploration. Vygotsky emphasizes the social contributions to learning and direct teaching with support. A combination of discovery learning as recommended by Piaget with direct instruction and scaffolding recommended by Vygotsky will likely be the best approach to take with most individuals. However, individuals with learning disabilities, the focus of the current case study, appear to do better with direct instruction with scaffolding. Feuerstein extended Vygotsky's theory with applications to instruction and assessment. The Learning Potential Assessment Device (LPAD) is a dynamic assessment approach that uses a test-teach-test format that provides some information on learning potential that can supplement the information gained from standardized tests, particularly for individuals with learning disabilities.

Second, the literature review discussed what learning disabilities are and how they are identified. Definitions of learning disabilities point to academic difficulties that are caused by a deficit in one or more cognitive processing area(s) in combination with cognitive processing areas that are average or higher. Problems with identifying learning disabilities based on the discrepancy between cognitive ability and academic achievement, led to the emergence of Response to Intervention (RTI). This approach puts an emphasis on early screening so individuals at risk receive evidence-based instructional methods with increasing levels of frequency and/or support if they continue to experience difficulties. When individuals continue to struggle when given appropriate instruction and support, they are deemed to have a learning disability. Many psychologists are not comfortable with diagnosing learning disabilities based on RTI alone because the approach ignores whether or not cognitive processing deficits mixed with cognitive processing strengths are present. The Cattell-Horn-Carroll (CHC) theory approach advocates the measurement of cognitive processing abilities and academic skills. Learning disabilities are identified when an individual has cognitive processing deficits that are consistent with the weak academic skills while

having cognitive processing areas that are intact. CHC theory aligns well with definitions of learning disabilities. Many psychologists today feel that a combination of the CHC theory approach and RTI should be used to identify learning disabilities. This combined approach can also be used to determine if a learning disability has decreased in severity or scope or has been removed altogether.

Third, it follows that if the cognitive processing deficits experienced by individuals with learning disabilities face can be removed or reduced, the academic difficulties these individuals have can be removed or reduced. In some cases, the evidence-based instructional strategies used in the RTI model may lead to changes in cognitive processing when the deficits are mild and/or the intervention occurs early on. Research on the neuroplasticity of the brain supports this possibility. Cognitive training programs are increasing in number, variety, and research support. For example, the Cogmed working memory training program has controlled double blind studies that support its effectiveness and it is considered to be evidence-based as a result. However, although working memory is a cognitive processing area that is often weak for individuals with learning disabilities and/or AD/HD, many individuals with learning disabilities have cognitive processing deficits in other areas or in areas in addition to working memory.

Fourth, the Arrowsmith program was designed in response to the evidence of neuroplasticity more than thirty years ago. This program aims to reduce or remove a wide variety of cognitive deficits of individuals with learning disabilities. Although this program does not have any peer-reviewed research support, it has received attention through television profiles, magazine articles, and testimonials from students and parents. This lack of peer-reviewed research support does not mean the Arrowsmith program is not effective in reducing or removing the cognitive processing deficits of individuals with learning disabilities. However, this lack of rigorous and independent research is a major drawback preventing this program from receiving more widespread support.

Kemp-Koo (2010) compared the cognitive processing abilities and academic achievement scores of the twelve individuals in the pilot program of the LDAS Arrowsmith program. She found that after two years of participation in Arrowsmith programming, the overall group of students made significant gains in their overall intelligence scores, working memory, visual processing/fluid reasoning, and long term retrieval. The current case study follows up with five of the twelve

students in the Kemp-Koo (2010) study and their parents. The standardized test results capture only some of the information relevant to the changes these students made, what their experiences were like, and how their participation in the LDAS Arrowsmith program affects their lives today in cognitive, academic, emotional, and interpersonal areas. There is currently no published research on the Arrowsmith program that provides the level of depth and rigor that the current case study provides. Although neuroplasticity is now well established, there is little research that has focused on how to change the cognitive deficits of individuals with learning disabilities. The current case study will add to the application of neuroplasticity research to this group of people with an instructional program meant to improve the cognitive functioning of these individuals.

Chapter 3: Methodology

In this chapter, the rationale for the choice of a qualitative research plan using a case study method to answer the research questions detailed in chapter one is articulated. An explanatory case study method was chosen to not only explore what the experiences of participation in the LDAS Arrowsmith program were like but also to provide some explanation of how this participation may have led to the changes noted by the participants and the archived school record information. I described the process of data collection through semi-structured interviews with the five students who participated in the current research and their parent(s). I also described the process of data collection through accessing the school cumulative folder information from the K-12 school system and the standardized test information gathered from the LDAS Arrowsmith program pilot research report and additional reports provided by the parents (Kemp-Koo, 2010). After I have described the process of data collection, I explained the process of data analysis and the stages I employed to illustrate the results in the descriptive and visual formats I decided best represented the experiences of the participants and my observations and conclusions relative to these experiences. A discussion of rigor of the case study method and the criteria I used to show validity and reliability of my findings follow the data analysis description. This chapter concludes with a presentation of the ethical issues I considered throughout my research.

Qualitative Research

The methodology for research should follow from the research questions (Yin, 2009). Given that most of the data I collected in my research was qualitative, including the interview with the students and their parents and some of the school record information that involved teacher comments and descriptive recommendation and statements in the assessment reports, it made sense that I employed a qualitative research approach to understanding this data. Even the quantitative information I gathered such as school marks and scores on standardized tests could be understood with a qualitative research perspective since statistical analyses would be fairly meaningless given the small number of participants and the inconsistencies I discovered in the data available in the student cumulative folders through the K-12 school system. Some quantitative comparisons were made by comparing the confidence intervals of standardized test scores to see if they differed

outside of the standard error of measurement or what could have occurred by chance, but there was no statistical analysis of these comparisons.

Constructivism

Johnson and Gray (2010) indicate that the constructivism is the most commonly used paradigm in qualitative research. Since the current study involves research questions that are qualitative in nature and a qualitative research approach was chosen to address these questions, a constructivist stance was adopted to understand the information gathered through interviews of the students, parents, and teachers. The constructivist stance posits that all of reality is subjective and that all individuals construct their own meaning of their experiences (Creswell, 2003). Merriam (2009) summarizes the main interest of qualitative researchers as being "understanding the meaning people have constructed" (p. 13).

Although they express these ideas in somewhat different wording, Marshall and Rossman (2011), Merriam (2009), and Yin (2011) describe the five characteristics of qualitative research. First, the research focuses on the meaning for the participants in a naturalistic or real world setting. Second, the process involves interpretation so the researcher plays an active role in the process and the experiences and biases of the researcher must be transparent. Third, the process is evolving and inductive. The data are transformed through the process of interpretation and eventually the themes and main ideas emerge. These themes and concepts can be descriptive and also explanatory. Fourth, in most cases multiple sources of evidence are used to increase the rigor and richness of the information gained through the research. Fifth, the context of the participants and the case are important considerations to understanding the data that is gathered.

The constructive stance points out that the researcher's perspective and meaning attributions are important to consider so they interfere as little as possible with the participant's own meaning (Creswell, 2003). Although I do not have a learning disability or have a child with a learning disability, I have a great deal of experience working with individuals who have learning disabilities, parents of children with learning disabilities, and teachers through my work as a counsellor and a school psychologist. My perspective and the meaning I attach to issues related to learning disabilities are influenced by these experiences. I endeavored to be as transparent as possible so the results in my research can be understood in the context of my experiences and biases. The most

appropriate interview format with a constructivist perspective is semi-structured with open-ended questions. This format allows the participants to tell their experiences from their own frames of reference.

Case Study Approach

Once it became apparent to me that I would be doing qualitative research to address the research questions that interested me and provided information that addressed gaps in the literature on cognitive training programs and more specifically on the Arrowsmith program, I chose the case study method. Yin (2009) states that the most appropriate research method can be determined by answering three questions. Yin (2009) first recommends asking oneself what form the research questions take. The current study is asking questions of why and how, so this indicated that an experiment, historical analysis, or case study is the best method. How and why questions ask for explanations and often point out the need to look at events or perspectives over time. Since most of the data I gathered was qualitative in nature, I eliminated the experiment method from consideration.

The second question concerns the level of control the researcher has over the phenomenon (Yin, 2009). Since participation in the Arrowsmith program is a complex experience with not all participants receiving the same treatment and environment or having the same learning challenges, an experiment would require more control than I could have with the program I planned to study and could also be eliminated as a method on this basis. A historical analysis is the most appropriate method when little to no control is able to be exerted over the conditions being studied such as in events that have already taken place. The current study is more consistent with a moderate level of control since the experiences are complex and are still taking place. As such, this research is most suited to the case study approach.

The third question relates to whether or not the research will focus on contemporary events. This study will in fact focus on the current perspectives and situations for the students in the LDAS Arrowsmith program. The historical analysis approach can be eliminated because it focuses on events that have already taken place. In this case an experiment or case study is suited to answering this question (Yin, 2009). Since I have already eliminated the experiment method based on the two

previous questions, I decided that with the research questions I have developed, the case study method is most suited to my needs.

A case study method was selected due to its utility in answering all three of the above questions. The current study asks how and why questions, has only moderate control of events and perspectives based on the complexity of the real world situation, and focuses on contemporary events.

Yin (2009) provides a twofold definition of the case study method:

1. 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.
2. The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to data collection and analysis (p. 18).

The case study can include single or multiple cases and can include qualitative data, quantitative data, or both. Case studies can be used to explain why educational and other programs are effective or not effective, describe programs that are in real-life settings, and illustrate or describe the experiences of individuals within programs that do not have any clear, single set of outcomes (Yin, 2009).

Explanatory case studies.

Explanatory case studies seek to answer questions related to how and why situations exist or changes are occurring in real-life settings. The complexity of these settings makes it difficult to exert the control needed for an experimental approach. Explanatory case studies attempt to explain outcomes (Yin, 2012). The current research is an explanatory case study because it addresses the reasons why some students have made large improvements in their cognitive, academic, emotional, and/or interpersonal functioning and why one of the students made minimal gains in these areas and experienced new emotional and interpersonal difficulties. The use of replication through multiple examples of the case, multiple sources of information for each example, and examination of rival

explanations increases the explanatory power of this case study. Since the current research is not an experiment, the cause-effect relationships are inferred and postulated and not proven.

Framework for organizing the case study.

The case study approach is sometimes criticized as lacking a systematic or rigorous approach to data gathering and analysis (Yin, 2009). Although the flexibility of the case study approach can produce new information and insights that a more controlled and focused approach might, it was important that I used a framework to mitigate the level of spontaneity in the current research. A framework for organizing the case study was used to assist in understanding the linear but iterative process of conducting the case study (Yin, 2009). The inquiry steps in sequential order are: Planning (for the case study research), Designing (the case study), Preparing (for data gathering), Collecting (the data), Analyzing (the data), and Sharing (the results). The process involves a reciprocal process between Preparing and Collecting and also between Collecting and Analyzing. In other words, the collection of data may require revisiting the preparation of the study and lead to more data collection. Similarly, the analysis of the data may lead the researcher to collect more data for analysis. The steps of Collecting and Analyzing can also lead the researcher back to the Designing step if major unanticipated changes need to be made in order to properly answer the research question (Yin, 2009).

Another important consideration when developing the framework for the current case study research involved whether the current research involved a single case or multiple case design (Yin, 2009). Since the focus of the research questions involved participation in the LDAS Arrowsmith program, it is this participation that framed what the "case" in the current research was. In other words, the case study method employed involved a single case design with the unit of analysis or case being participation in the LDAS Arrowsmith program. Since the participants in this program had many differences from each other such as: experiences leading up to their participation, length of time in the program, ages, type of learning disabilities and comorbid disorders, and severity of learning disabilities, it was initially decided that four student participants would be chosen from those that volunteered to gain insight into the diversity of the single case of participation in the LDAS Arrowsmith program but five student participants were eventually selected for the case study. Embedded within each of the multiple variables (individual student participants) were the

multiple sources of evidence gathered for each one: interviews with the students, interviews with the parent(s), and examination of information from the student K-12 school system cumulative folders, standardized test scores from the LDAS Arrowsmith program pilot research, and other information the parents provided on their children. All of this information was gathered to understand what the experiences of participation in the LDAS Arrowsmith program were and what explanations can be given for the changes (or lack of changes) that these students evidenced.

The Case

An important step to take before starting research is to establish boundaries to focus the research so the questions of interest can be answered. Since the case I planned to study was participation in the LDAS Arrowsmith program and how this participation had affected the cognitive, academic, emotional, and interpersonal functioning of the participants, it made sense to talk to the student participants themselves. I also decided to focus on the original twelve students who had started the LDAS Arrowsmith program in September 2008. This narrowed focus allowed me to use the standardized achievement test and cognitive test data that had been gathered as part of the pilot research report (Kemp-Koo, 2010). Another reason for focusing my case study on this group of students involved having the best opportunity to see how participation had affected the participants over a longer period of time and once the students had left the LDAS Arrowsmith program.

Participants

To gain a depth of information through the interviews and other sources, I chose to narrow the group of twelve students who started the LDAS Arrowsmith program in September 2008, to what I hoped would be a group of four student volunteers. The amount of data might have been overwhelming and reduced the overall information and explanations I gained if I had decided to study all of the participants. Since the students did not have any obligation to participate, it was unlikely that all of them would choose to be part of the case study. I knew from my previous research with this group of students that all but one of the twelve students had completed their Arrowsmith studies and many had returned to the K-12 system. Of course, the inclusion of these participants also led to ethical considerations that needed to be addressed since I had written the research report and conducted the cognitive testing at the end of two years of participation on each

of the twelve students. I was also a board member with the Learning Disabilities Association of Saskatchewan (LDAS) and though in my role as a board member I was not involved in the details of programming and running programs, I might be perceived by the parents to have influence and/or involvement in the operations of LDAS. As well, most of these students were children and all of them had learning disabilities, increasing the ethical considerations when conducting my research. I realized that the ethics board would consider my research to be above minimal risk. I knew that I needed to carefully plan my research to minimize the risk to the participants.

I needed parental permission for any of the students who were under 18 to participate in the case study and assent from the child participants. Children usually have less ability to express their thoughts reflectively and verbally than an adult would have. As well, these children in many cases had learning disabilities that could further impact their ability to express their thoughts in the interviews and likely they did not have all of the information leading up to their participation in the LDAS Arrowsmith program. I decided that I would get a much richer base of information to describe and explain participation in the LDAS Arrowsmith program if I interviewed the parents of the student participants. If any of the adult students volunteered I had planned to give them a choice as to whether or not they wanted their parents contacted for interviews. The parents in this case would also have a choice to participate or not. I decided to only consider inclusion when both the student and parent were willing to be interviewed. I initially planned to include the perspective of teachers through interviews but after more consideration I felt that this perspective could be represented through the examination of the Kindergarten-Grade12 school cumulative folders that included teacher comments, marks, etc. and would be much easier to manage since all of the students would have some information rather than run the risk of having a student and parent volunteer without a teacher willing to be interviewed.

Planning for the Case Study Research

The planning phase of case study research involves identifying the research questions, deciding on the use of the case study method, and understanding the strengths and weaknesses of the case study method (Yin, 2009). The research questions for the current study have been reported in chapter 1. A case study approach was chosen to research the experience of participation in the LDAS Arrowsmith program since the research questions asked how and why questions, the

research had a contemporary focus and the questions being asked were wide ranging and difficult to control and to separate the program from the context.

Case study research has several strengths. First, case studies can explain possible causal relationships between real-life educational programs and their outcomes (Yin, 2009). The LDAS Arrowsmith program students as a group made statistically significant gains on the Perceptual Reasoning and Working Memory indexes and Full Scale scores of the WISC/WAIS and the Long Term Retrieval composite of the WJ-III Cognitive Scales (Kemp-Koo, 2010). Although this finding cannot be established as causal because the research did not include randomly assigned groups with a control group, there is a possible causal relationship present. A case study approach will help explain why this relationship may exist.

Second, the case study approach can describe the educational program and its real-life context (Yin, 2009). Each student in the LDAS Arrowsmith program had a different situation with respect to the programming in the Arrowsmith program, the K to 12 school system, and their family. They all had different learning disabilities and severity of learning difficulties, ages, and genders. A case study approach would better explain how the students' experiences were similar and how they were different. The students may have made cognitive gains in different areas and for different reasons. What they all had in common is participation in the LDAS Arrowsmith program and having a learning disability.

Third, the case study approach can show specific topics within an educational program within a more descriptive light (Yin, 2009). The cognitive and achievement testing that has already been done with the LDAS Arrowsmith students does not provide information on the emotional and interpersonal functioning of the participants, areas which also contribute to success in life. The case study approach and interviews with key informants will allow these factors to be studied from the perspective of the key informants while providing detailed and rich descriptions of these areas. As well, the examination of school records will provide information on the experiences of the students in the K to 12 school system.

Fourth, case studies can be used to enlighten situations where an educational program that is being evaluated has no clear or single set of outcomes, (Yin, 2009). This situation was present in the case of the Arrowsmith program where students participated in cognitive training aimed at improving diverse cognitive processing areas to decrease the student's need for academic supports

and increase their academic progress. Feedback from questionnaires used in the Report on the Arrowsmith program in the Toronto Catholic District School Board (2007) and St. Patrick Catholic Secondary School and Arrowsmith program pilot project (1998) indicate that parents in particular often cited changes such as increased self-confidence as significant for their children as a result of participation in the Arrowsmith program.

Several concerns have been raised about case study research. Probably the most common concern raised by researchers and others more comfortable with a controlled, quantitative approach, is that the method lacks rigor or is subject to bias. Although the researcher's perspective and beliefs will always affect any research to some degree, one of the main ways to guard against bias or the experimenter's views unduly affecting the results is the development of a case study protocol, addressing the threats to validity, and consideration of rival explanations (Yin, 2009). These issues were dealt with in the designing section of the methodology.

A second concern about case study research is diminished generalizability of the results (Yin, 2009). This concern is valid but ignores that not all of the research that reveals information worth knowing is immediately generalizable. In many cases, detailed or deep understanding of a situation will lead to more research that provides replication through additional cases or aids in the design of experimental or quasi-experimental research. In other cases, case study research provides more detailed information about the results of experimental or quasi-experimental research. The inclusion of five students, their parents and their school records and testing information provides some measure of replication through the different examples of participation in the LDAS Arrowsmith program and different sources of information about these examples. Understanding how and why the students in the LDAS Arrowsmith program made or did not make changes will help to provide information to assist other individuals with learning disabilities.

A related concern about case study research is that it cannot show causal relationships (Yin, 2009). In a similar way, the lack of verification or illumination of a causal relationship does not diminish the value of case study research. Case studies can help to explain why outcomes have occurred and this is the best research format when only a moderate level of control is possible and real life considerations and complexity are important to consider. Case studies can provide explanations but not in a way that proves causation (Yin, 2012). The current research used an explanatory case study design to illuminate the reasons why four of the five students in the case

study made substantive improvements in their cognitive, academic, emotional, and interpersonal functioning as a result of participation in the LDAS Arrowsmith program. The reasons why one of the five students in the case study made much smaller improvements in cognitive functioning and academic functioning and experienced difficulties in emotional and interpersonal functioning were also addressed.

Case study research is sometimes criticized for producing long and hard to read papers (Yin, 2009). The current research attempted to avoid this problem through identification of themes and organization of the students' cases by the different sources of information or perspectives. This was accomplished by presenting information on each student separately and then clearly labelling the cross-informant analysis sections. Visually presented information in the form of flow charts and circle graphs also addressed this issue.

Designing the Case Study

Yin (2009) lists several steps in the design phase of case study research: define the unit of analysis and the likely cases to be studied; discuss the theory, assumptions, and issues underlying the case study; identify the study as being single or multiple and holistic or embedded; and defining the procedures that will be adopted to maintain the integrity of the research.

The unit of analysis in the current study is participation in the LDAS Arrowsmith program. Since there is only one unit of analysis or "case", the current research has a single case study design. Several sources of information were chosen to illuminate how participation in the LDAS Arrowsmith program affected the cognitive, academic, emotional, and interpersonal functioning of the students in this program. It was decided to gather information from the students themselves through interviews, the parents of the students through interviews, and from school record and standardized testing information. These three sources of information were used to describe and understand why changes were made through participation in the LDAS Arrowsmith program. Only the twelve students (with their parents) who started the program in September 2008 were invited to participate and five of these students with their parents volunteered and were eventually selected to represent the overall single case of participation in the LDAS Arrowsmith program. The inclusion of five examples within the overall case of participation in the LDAS Arrowsmith program and also the inclusion of three sources of information within each of these examples, makes the current

research a single case study with an embedded design rather than a holistic one (Yin, 2009). The single case is embedded with multiple examples and multiple sources of information for each example that were compared with each other.

Participants.

The students in the LDAS Arrowsmith program had ability levels that varied greatly and learning disabilities that were also diverse. Given the cost factor of the program, they all came from families with access to the financial means to pay for the private fees. The students had all been diagnosed with learning disabilities, attended schools in the K to 12 school system, received resource and/or educational assistant supports, and participated in the LDAS program for at least 2 years. As such, they will provide replication evidence on the experience of participation in the LDAS Arrowsmith program. However, these students had many differences with each other based on age, gender, type of learning disability, severity of learning disability, amount of cognitive processing increase, level and type of Arrowsmith programming, and level and type of academic supports in the K to 12 school system. These differences helped to provide information on the varied experiences of participation in the LDAS Arrowsmith program. Interviewing students and parents helped to provide information on participation in the LDAS Arrowsmith program from different perspectives. Cross-perspective analysis was helpful to understand the similarities and differences in experiences of participation in the LDAS Arrowsmith program. The student interviews, parent interviews, and school record documentation and archived cognitive functioning assessment data provided triangulating information from several sources to gain a more complete picture and explanation of how participation in the LDAS Arrowsmith program led to changes or failed to lead to changes in the cognitive, academic, emotional, and interpersonal functioning of the students in the program.

Theoretical connections to the case study research.

Research based on the Cattell-Horn-Carroll (CHC) theory has produced evidence of the link connecting deficits in cognitive processing areas and deficits in related academic skills. All five students in the case study research showed statistically significant gains in at least one cognitive processing area and at least one academic achievement area. Based on research generated from CHC theory, these gains should be reflected in reports of cognitive, academic, emotional, and/or

interpersonal functioning gains through the student and parent interviews. The school records information should also reflect changes consistent with the gains in cognitive functioning such as higher levels of programming, reduced supports, higher marks, more positive teacher comments, and higher scores on standardized tests. It was likely that all three sources of information (students, parents, and school records) would report gains in these areas but it was possible that they may have reported different gains or have emphasized different gains. The five examples in the case study would provide confirmatory evidence of CHC theory if the students' increased cognitive processing resulted in positive changes in these students' academic functioning. Increases in these areas would provide confirmatory evidence of the effectiveness of participation in the LDAS Arrowsmith program in producing changes that matter in a practical sense in the real world.

Response to Intervention (RTI) is a model of assessment and intervention that is applied to elementary and high schools. All of the students in the LDAS Arrowsmith program have experienced serious academic difficulties and have required modifications to their studies and academic supports such as resource room assistance. As such, these students would be located in tier three of the RTI model where intensive, individual supports are needed. The LDAS Arrowsmith program can be considered an intervention strategy to improve the cognitive and academic functioning of these students. The baseline measures prior to this intervention and also some of the measures after this intervention were included in the research report by Kemp-Koo (2010). Using an RTI model to illustrate the measurable changes made through participation in the LDAS Arrowsmith program will be continued through the current case study research to gain more insight into how and why these changes took place.

Rigor in case study research.

A variety of approaches were included to maximize the validity and reliability of the case study research. First, construct validity is the degree to which the information gathered reflects what was intended to be measured (Yin, 2009). Since the interviews in the current case study research were conducted to understand the experience of participation in the LDAS Arrowsmith program, construct validity was enhanced by having the participants review and make the changes they wished to make to the interview transcripts.

Second, internal validity refers to the degree to which the research findings can identify the causes for the outcomes that are observed or described (Merriam, 2009; Yin, 2009). In the current case study, rival explanations to the results such as: the results are due to chance, maturation, instruction from the K to 12 system, the implementation process and not the intervention itself, and/or a combination of factors influenced the results were discussed. The use of multiple sources of evidence and a comparison of information gathered to describe the student`s functioning before and after participation in the LDAS Arrowsmith program was used to enhance internal validity.

External validity or the ability to generalize the results to other people and situations was enhanced through the use of replication with multiple examples of participation in the LDAS Arrowsmith program (Merriam, 2009; Yin, 2009). The results still represent only a small number of students that attended only one location offering the Arrowsmith program but it is hoped that this case study will provide beginning descriptions and explanations regarding participation in the LDAS Arrowsmith program.

Ecological validity or the ability of the results, methods, and materials to approximate the real world conditions being studied was addressed through the use of student cumulative file records. Reliability or the consistency of measurement was enhanced by using a case study protocol and creating a database to organize the data (Merriam, 2009; Yin, 2009).

Preparing for Data Gathering

Yin (2009) describes several components to prepare for case study research. The case study researcher must ask good questions and be able to interpret the responses, be a good listener, be adaptive and flexible, have an understanding of the issues involved, and be wary of confirmatory bias or the tendency to look only for information that confirms one's beliefs and predictions. In many ways, the role of the case study researcher mirrors my work as a school psychologist. Although I must have a strong understanding of learning disabilities and knowledge of the strengths and limitations of assessment tools, I need to build rapport and be attuned to nonverbal behaviour and the setting variables. I need to be observant and a good listener. I need to go in with a plan and gain some information in a standardized way but be flexible enough to confirm or disconfirm my initial hypotheses by using other tools and testing the limits. I use a theoretical position to observe patterns but I understand that individual differences in experiences can change the interpretation of

these patterns or the patterns themselves. Although psycho-educational assessment is not exactly like case study research, my experience in this area and in counselling helps prepare me for the case study process. Reading literature on this methodology and auditing a class on qualitative methods also helped me prepare for the research.

Ethical considerations.

Human subject protection is critical to the preparation for case study research. This is particularly true given that all of the student informants are children or adolescents. I gained informed consent from the parents of the students and assent from the students, and permission from the LDAS Arrowsmith program and the Saskatoon Public School System, and Barbara Arrowsmith-Young (the developer of the Arrowsmith program who owns copyright on the program) before gathering the data for the case study research. I needed to protect the participants from harm, avoid deception in my research, protect the privacy and confidentiality of the informants, and abide by the Canadian Code of Ethics for Psychologists, the Saskatchewan College of Psychologists' Professional Practice Guidelines, and the Research Ethics Board of the University of Saskatchewan (Yin, 2009). A copy of the ethics approval for my case study research and a copy of the letter of permission for independent research from Barbara Arrowsmith-Young are in Appendix C. The permission letter sent to the school divisions/school principals is in Appendix F. The parent consent form is in Appendix G and the child/youth assent form is in Appendix H. The anonymity of the participants was enhanced by withholding the real names of the students and their K-12 schools.

Case study protocol.

A case study protocol helps the researcher stay focused on the plan and the research questions and enhances the reliability of the case study research. Yin (2009) recommends including the following sections to the case study protocol: an overview of the project; field procedures; case study questions for the researcher to keep in mind and the sources of information to answer these questions; and a guide for the case study report. The overview of the report was shared with the participants to explain the purpose of the case study research. The field procedures included where the interviews and data collection will take place, informed consent forms, equipment, data to be collected, a schedule of activities, and procedures to be followed. The copy

of the interview transcripts with highlighted statements that could be used as direct quotations in the results were given to the parents to review. The case study protocol should identify what questions will be asked of specific informants. These questions include the actual questions that will be asked of the participants and the overall questions the researcher has for the case study. The protocol should list the sources of evidence likely to answer the questions (Yin, 2009). A preliminary guide for the case study report is also included in the protocol. This guide organizes the information sequentially, identifying each of the informants to assist in the analysis of the data and clarity of the report writing. The case study protocol for the current case study can be found in Appendix D.

Collecting the Data

Collection of the data needs to involve following the case study protocol, obtaining multiple sources of evidence, creating a case study database, and maintaining a chain of evidence (Yin, 2009). The case study protocol was reviewed before the collection of data in each case. Multiple sources of evidence in the current research included archival data on the cognitive functioning and academic skills of each student, the history of each student, school records for each student, and two interviews with each of the students and their parents. The parents chose where the interviews took place (the parents' homes, the researcher's home, or the researcher's office). The parent interviews were approximately one to one and a half hours in length while the student interviews tended to be a half hour or shorter.

Interviews.

Interviews provided vital information on the experiences of the participants in the LDAS Arrowsmith program, particularly in the areas of emotional and interpersonal development. Semi-structured interviews with the students and their parents were conducted to gain information on the experience of participation in the LDAS Arrowsmith program. Although a list of open-ended questions were used to frame the interview (Appendix I) and facilitate comparisons, the interviewer also followed the path of the participant's story to allow them to fully explain their perspective and experiences. Some of the questions asked were demographic and therefore close-ended in nature. This demographic information was helpful in understanding the similarities and differences among the students and parents who participated in the case study research.

The interviews were audio taped and transcribed exactly so comparisons could be made in the answers to the questions and the additional information given by the participants. The parents were given the transcripts of the first interviews (with highlighted statements that might be directly quoted) of both their interview and that of their child to review and make the changes or add explanations they wished to make. The parents had the opportunity to make changes to their statements and could choose to keep the transcripts or return them. The parents were given transcripts and highlighted quotations of these second interviews as well to make the changes. Transcript release forms were signed by the parents when both transcripts had been reviewed and approved. A copy of the transcript release form is found in Appendix K and a copy of the quotation release form is found in Appendix J. Analysis of the information from the interviews was grouped with respect to themes present in the data.

School records. School records data included: marks, amount of resource or teacher assistant time, level of modification and accommodations provided, and progress and report card comments. Data was collected in these areas for the time before participation in the Arrowsmith program and for each of the three and a half years since commencement of the Arrowsmith program participation. The progress and report card comments were analyzed for themes. Observation would not be particularly useful for this case study because it would not provide the longitudinal focus that the interviews and other data can. The types of data were compared for each student and between data sources.

A chain of evidence was followed by reviewing the data in relation to the theoretical propositions of CHC theory. Also, the data was reviewed on a continuous basis in relation to the research questions. A case study database was formatted in several different ways to allow comparisons of the different sources of information and different students who participated in the LDAS Arrowsmith program. A hard copy of the data including transcribed interviews with each informant for each case was collected in colour-coded files with a different colour for each student and separate files for each type of data and for each informant. A computer database was organized in a similar fashion using highlighter in different colours to identify the interview statements for the five different students from both the students themselves and their parents.

Analyzing the Data

The use of a theoretical perspective to guide case study analysis is identified as an effective strategy to guide analysis of qualitative data (Marshall & Rossman, 2011; Merriam, 2009; Yin, 2009; Yin, 2011; Yin, 2012). The theoretical proposition of CHC theory was a key factor in the development of this case study research and was considered in the data analysis. A constructivist stance to cognitive development evidenced in the theories of Piaget, Vygotsky, and Feuerstein and in the gathering of data for the case study was also employed. The research questions that were developed from these theoretical considerations were a major focus of the data analysis. It also follows that the current case study focused on how and why participation in the LDAS Arrowsmith program led to improvements in some areas and a lack of improvement in other areas of cognitive, academic, emotional, and interpersonal functioning.

Marshall and Rossman (2011), Merriam (2009), and Yin (2009; 2011; 2012) also emphasize the use of multiple sources of information to provide triangulating evidence for the case study results and conclusions. Interviews with the students, their parents, school records information from the K-12 school system cumulative files, and standardized test information from the LDAS Arrowsmith program research and psycho-educational assessment reports were collected for each student and provided triangulating evidence in the analysis of the data. Descriptions of the journey each student and their parents have experienced were detailed to present a clear picture of the similarities and differences in the experiences of these students.

Rival explanations.

Another strategy that is particularly important for explanatory case study research is the consideration of rival explanations for the changes reported through interviews, observations, and/or examination of documents (Marshall & Rossman, 2011; Merriam, 2009; Yin, 2009; Yin, 2011; Yin, 2012). These rival explanations can be placed into the two main groups of craft rivals and real-life or substantive rivals (Yin, 2009; Yin, 2012).

Craft rivals. The prospect that the changes occurred based on chance alone is an inherent craft rival to most research studies. Another craft rival to consider involves threats to the validity of the changes observed. Examples of this type of threat relevant to the current case study include the possibility that the changes made by the students in the LDAS Arrowsmith program were due to

maturation of these students, problems with the standardized testing process, whether or not the individuals who volunteered for the case study reflect what participation in the LDAS Arrowsmith program is generally, or a combination of these factors (Yin, 2009). The inclusion of several examples of students in the LDAS Arrowsmith program and several sources of information on these student examples (student interviews, parent interviews, K-12 school cumulative file information, and standardized testing information) reduce the impact of threats to validity.

The presence of investigator bias is a third craft rival that will be present in any research study, including case study research since the investigator's perspective affects the direction taken in the research (Yin, 2009). In the current research, the participants were interviewed on two occasions and were given the transcripts of the interviews with possible quotations highlighted to change as they saw fit, before the coding and theme development was started. The journey of each student was described in detail in order to provide the context that each student brought to their participation in the LDAS Arrowsmith program and for comparisons of the students' functioning before participation in the LDAS Arrowsmith program with their functioning after participation in the program. Direct quotations were used to reflect the experiences and perspective of the participants. The researcher described her experiences and beliefs relevant to the case study research to provide the transparency and context needed for the reader to interpret the results.

Real-life/substantive rivals. Real-life or substantive rivals involve the possibility that another explanation exists that fully or partially accounts for the results in the case study research (Yin, 2009; 2012). For example, in the current case study that examines how and why participation in the LDAS Arrowsmith program led to gains in cognitive, academic, emotional, and interpersonal functioning, a rival explanation could be that interventions or support that the students were receiving through their K-12 schools or at home were responsible for or partially responsible for the changes these students made. Other substantive rival explanations could be that it was the supportive environment, lower teacher to student ratio, individualized programming, mastery of levels reinforcement, or inclusion in a group of students who also had learning disabilities that led to the observed gains and not the cognitive training tasks themselves. These possibilities are difficult to rule out because they are all part of the LDAS Arrowsmith program as a whole but an attempt to examine these rival explanations was made in the discussion chapter of this dissertation.

As Merriam (2009) explains, "data analysis is the process of making sense out of the data" (p. 175). This process involves grouping, reducing, and categorizing the data into codes and then themes (Merriam, 2009; Saldana, 2009). The interview data for this case study was analyzed manually to initially code each piece of relevant data and look for themes that generally expressed the trends in the individual codes (Saldana, 2009). The qualitative data was manipulated into various arrangements related to the research questions and categories of cognitive, academic, emotional, and interpersonal functioning to gain insight into the arrangements that provided the greatest explanation and understanding. This process went through many stages of development that grouped and narrowed the data. With the standardized tests, any comparison of subtest and index standard scores where the confidence intervals did not overlap (beyond the standard error of measurement) indicated that the two scores should be different 95% of the time. The descriptive data for each student in the case study was reported separately before the comparative analysis and explanations to allow the reader to make their own conclusions as much as possible (Yin, 2009).

Sharing the Results

Yin (2009) recommends that the case study report be written with the intended audience in mind. The current research is part of a doctoral dissertation and was written to meet the qualifications of this level of research and analysis. An alternate condensed version in everyday language will be written after the dissertation is completed, to provide the participants in the case study and the LDAS Arrowsmith program with an overview of the results. The written format of the case study reports each student example separately first describing the student`s experiences before they entered the LDAS Arrowsmith program, during the program, and after they left the program. This section includes flow charts, circle graphs, and line graphs of the standardized test information for each student to provide a visual reference of the information gathered for each student. The themes for each of the student, parent, and school records perspectives were then analyzed. A linear-analytic structure was adopted for the report with an introduction, followed by a review of the literature, then methodology, results, discussion, and conclusion (Yin, 2009).

The case study approach in the proposed study aimed to understand the previously documented cognitive changes made by the students participating in the LDAS Arrowsmith program and how and why these changes affected the academic, emotional, and interpersonal

functioning of the students (from several perspectives). The students themselves and their parents were interviewed with open-ended questions to understand their perceptions of how participation in the LDAS Arrowsmith program has affected the LDAS Arrowsmith students. The student K-12 cumulative files and standardized test results were examined to provide triangulating information from another source to compare with the interview information. Cross-informant comparisons were made to examine the similarities and differences present.

A sign in Einstein's office in Princeton displayed the following quote by Cameron (1963), "Not everything that can be counted counts and not everything that counts can be counted." The case study research on the LDAS Arrowsmith program attempts to provide a rich understanding of the experiences of students in this program and what led to the changes they made or did not make. Cognitive training programs such as the Arrowsmith program promise to change the cognitive functioning of individuals with learning disabilities. These cognitive changes may then improve the outcomes of these students and allow them to participate more fully in society with their maximized potential. Research on the effectiveness of the Arrowsmith program is important so individuals with learning disabilities, parents of individuals with learning disabilities, and educators can make informed decisions about whether or not the Arrowsmith program is suited to their situation.

Chapter 4: Results

To investigate the experiences of students in the LDAS Arrowsmith program, I sent out letters of invitation to participate in the study on behalf of my supervisor (Appendix E). The letters were sent to the parents of the child and youth students and to the adult students of the original twelve students who started the LDAS Arrowsmith program in September 2008. The letters explained that participation was voluntary and would include two interviews to be conducted with each participant (parent(s) and student) and permission to examine the school records and standardized testing scores of the students.

I had originally planned to choose four volunteers for the study and felt that it was likely I would have no difficulty getting at least this many volunteers. Participation in a program such as the Arrowsmith program involves a great deal of investment of time, hopes, and financial resources. It was not a difficult leap of faith to believe that the parents and students may wish to talk about their experiences. At the same time, I have to confess a small level of fear that I would have no volunteers and therefore no research study! As expected though, I got seven responses to the letter, despite the fact that the letter went out at the beginning of summer vacation.

I waited two weeks to get the responses, all of which came by email. At that time I had five student/parent volunteers and one mother who volunteered herself but her child was reluctant to participate. I decided not to proceed with the mother alone but thanked her for her willingness to participate. Rather than reject only one volunteer that included both a parent and child and also given that all of the volunteers brought something unique to the case study, I decided to expand my original plan and accept all five volunteers. Shortly after I made this decision and confirmed participation with all five volunteers, I was contacted by email by an additional mother who simply communicated that the Arrowsmith program had not been particularly effective with her daughter. She suspected that as a result, I would not be interested in her participation in the study. Due to my previous quantitative research on the LDAS Arrowsmith program, I realized that the volunteers I had received up to that point had all made large cognitive gains while participating in the LDAS Arrowsmith program. I also knew that there were several students who had made smaller cognitive gains who had not volunteered for the case study.

Although accepting this volunteer would increase my number of cases to six, I felt that it was important to hear all types of experiences related to participation in the LDAS Arrowsmith

program and this particular student's experience was the most different from all of the other student participants' experiences in my study. I emailed this mother to let her know that her experiences were valuable to my research and that her participation was voluntary nonetheless. She decided to participate with her daughter in the case study research.

One of the original volunteers had to change an interview time and eventually decided to withdraw from the study when her daughter changed her mind about participation. No interview or school record information had been collected at this point. I reassured the mother that she had every right to withdraw. This situation brought my case study numbers back to five with three male students and two female students. I had mixed emotions about this development. On the one hand, I was relieved to be focused on fewer cases; but on the other hand, I was disappointed because this particular student was the only student of the original 12 who did not appear (through cognitive and achievement tests) to have a learning disability any longer.

In two of the confirmed volunteer cases, both parents participated and in the other three cases, only the mother participated. I gave the parents the choice as to whether they wanted to do the interviews at their home, my home, or in my office at the University of Saskatchewan. Parents of two of the students chose their home for the interviews. Parents of two of the students chose my office for the interviews. The remaining parent chose my office for the first interview and then my home for the second interview since it happened to be closer to her home. In two cases, the parents chose to be present for their child's interview (Michael and Kayla). In one of these cases, the child (Kayla) stayed for the parent's interview as well while in the other case (Michael), the child was not present for the parent's interview. The other student and parent interviews were conducted separately.

I started off the parent interviews by asking the parents to tell me about the journey they have experienced concerning their child's learning disability and/or ADHD from birth to when they entered the LDAS Arrowsmith program (Table 4.1). Starting in this way helped me gain an understanding of the incredible difficulties they have faced with their child. I think the word journey is a very apt one to describe their experiences and I first would like to share the journey of each case in written form and with a flow chart to visually represent some of the major events in the process of accepting that their child had a learning disability. Creating the flow charts helped me organize the information and understand the key events and experiences in each student's journey.

Jim

Jim was the student in my case study who had the most severe learning problems. In psychological assessments, Jim was variously described as being delayed, having a visual processing disorder, weak working memory, an auditory processing disorder, cognitive disability, and an acquired brain injury. In most of his assessments, the psychologists concluded that his cognitive scores may be a low estimate of his ability. During my previous research, I had been shocked to find that Jim's cognitive processing scores prior to the LDAS Arrowsmith program were more consistent with the presence of a mild intellectual disability. I have since discovered that Jim's cognitive test results have been varied and not all results have been as low as the testing he did closest to entry to the LDAS Arrowsmith program.

Jim had the weakest academic skills when he entered the LDAS Arrowsmith program and he had received the greatest degree of academic supports in school and outside of school. Jim is a quiet, polite, and cooperative young man who gets along well with his peers and has always been well liked by his teachers. He persists with tasks even when it appears that he is making little to no progress. A flowchart (Figure 4.1.) and circle graph (Figure 4.2.) depict information gathered on Jim from the interviews and school records.

Jim's mom Emily.

Emily was the first parent to contact me and this fact I think closely reflects her approach to supporting and advocating for her son Jim. She is very organized, calm, determined, open, and upbeat. She very much wanted to participate in the study to communicate how the LDAS Arrowsmith program had changed her son's life in a positive direction. She was the parent who was the least focused on her child's future educational pursuits. Emily has accepted now that Jim may or may not be able to graduate with a grade 12 and will not be pursuing postsecondary education. Nevertheless she reports that Jim will now be a 'lifelong reader' and has grown in self-confidence, ability to reason, make decisions, and to regulate his own emotions.

Before the LDAS Arrowsmith program.

Jim was somewhat delayed in meeting many of the milestones for infants and toddlers. At age 2 to 3 years, Emily took Jim to have a speech/language assessment and therapy because he was not yet talking. He was described as quiet and cooperative and a child who responded well to

encouragement. A speech/language assessment in grade 2 recommended phonemic awareness intervention and remarked that reading appeared to be important to Jim. Emily agrees with the assessment, "I've always said from when he was little, 'he's my kid who's a reader who can't read'."

Jim attended preschool and was reportedly loved by his teachers. He entered kindergarten at his first school and at that time Emily saw his problems as being only in the speech area. In November of kindergarten, Emily remembers the teacher turning around in the hallway to say to her, "I think something's really wrong with Jim and we're going to get him tested." Emily burst into tears. Jim's lack of behavioural problems and quiet, cooperative personality likely made it easy to miss his difficulties.

Jim was referred to the Kinsmen Children's Centre (KCC) for assessment and he received occupational therapy there for 1 ½ years. Jim developed chorion tics and he received a diagnosis of "chronically health impaired" that allowed him to receive an Educational Assistant (E.A.) and a Personal Program Plan (PPP) throughout elementary school without any need to reapply for these supports. A year and a half later it was discovered that Rheumatic Fever at age 5 was responsible for the tics. He went on antibiotic therapy for an extended time and the tics disappeared.

Before the end of kindergarten, Emily researched the schools in Saskatoon to find out which one(s) would provide Jim with the best supports and environment given his learning difficulties. She narrowed the field to two schools and the family bought a home right across the street from the one she picked. Emily became an active parent in the school and cultivated positive relationships with Jim's teachers and the administration. .

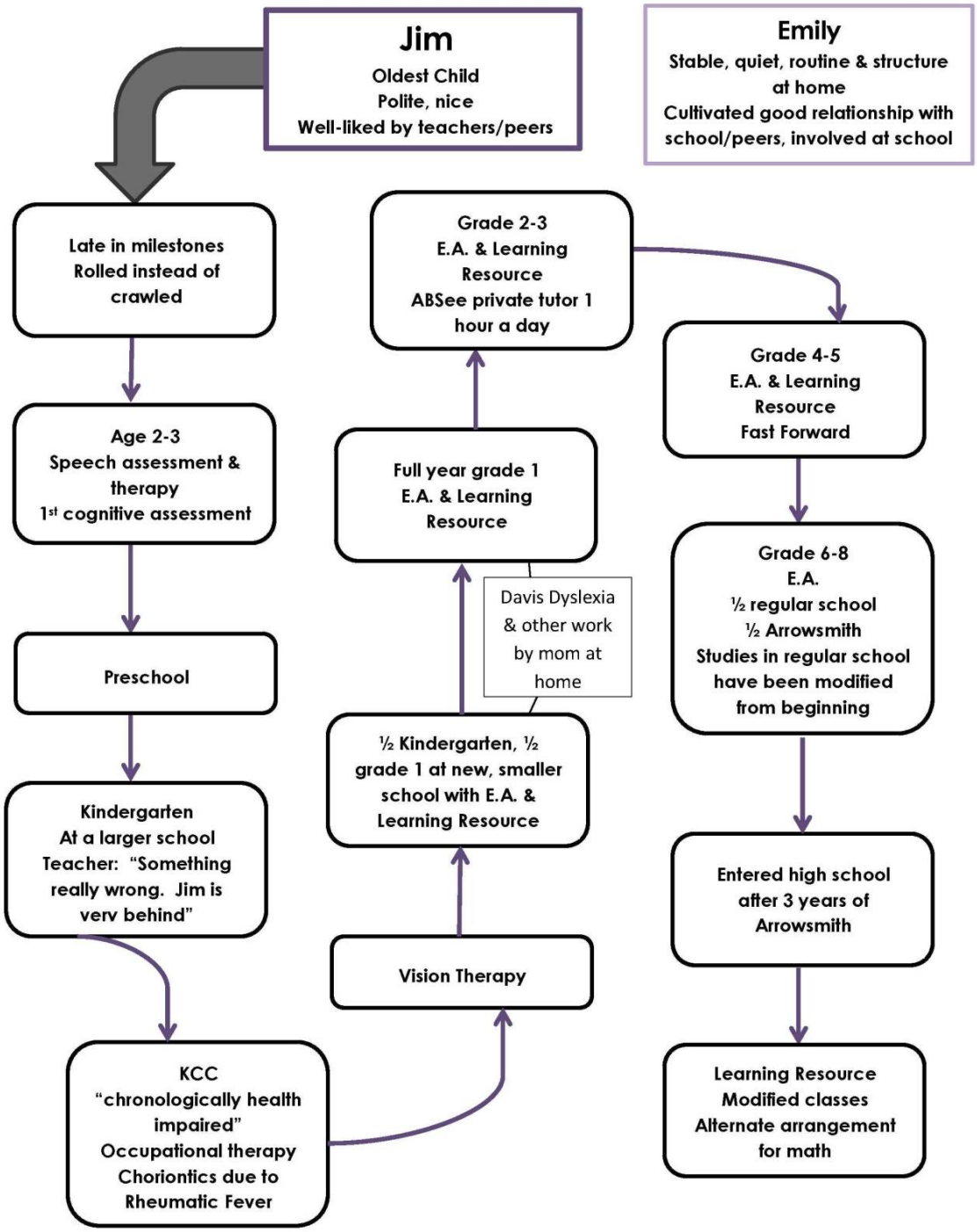

Figure 4.1. Jim's Flowchart.

In Jim's first year at his new school he took grade 1 half of the day and repeated kindergarten half of the day with an E.A. assigned to him for the full day. The next year Jim did a full year of grade 1. It was this year that Jim received an E.A. that stayed with him until the end of grade 8. Emily was online looking for "anything and everything" that might help Jim. She investigated the Davis Dyslexia program and worked with Jim at home forming letters with play-doh and other recommended activities to help him learn how to read, spell, and do math. In grade 2 she heard about the ABSee program at the Learning Disabilities Association of Saskatchewan (LDAS). Jim's parents paid for a tutor to come to his school one hour every day for two years to deliver the ABSee program to him and a laptop for him to use at school. At this time, Jim also had an E.A. and an hour of Learning Resource every day. However, he made little to no progress.

For grades 3 and 4, Emily and her husband paid for two years of instruction every day with the computer program Fast ForWord that is based on the neuroplasticity of the brain. Most students complete this program in far less time but Emily states that, "Fast ForWord was the single only thing up to that time that made a difference...it's the first time we had seen progress without doing a ridiculous amount of intervention...It absolutely helped and that was when we started seeing some progress."

Emily credits Jim's thriving emotionally, behaviourally, and socially with the stability he received from a consistent E.A., his stable, consistent environment at home, a strong relationship with his dad and grandpa, a caring school, administrators, and teachers, and Jim's cooperative nature. "He's never felt that a teacher didn't like him. He's just always been really loved by everybody. Everyone would always go that extra mile for him." Emily indicates that she had to work a lot harder to make sure that Jim was accepted socially. Jim was never at the top of the social ladder of popularity with his peers but he was never at the bottom. He was friends with everybody. The comments on Jim's reports describe him as having a positive attitude, wanting to please others, being responsive to directions from the teacher, and being respectful. Jim is described as kind, well-liked by peers, pleasant, and someone who enjoys participating in group activities.

Despite all the intensive supports that Jim had and the stability in his environment, learning was often confusing, frustrating, and very difficult for him. Jim describes his learning problems prior to the Arrowsmith program as, "I have a hard time in reading, I couldn't read at all. It was hard, I couldn't write and I didn't know how to spell." Emily indicates that although Jim was

usually quiet and cooperative, he was also self-centered and had trouble with empathy. He was the oldest child in his family in terms of chronological age but not emotionally, behaviourally, and in his level of responsibility. Emily said in the interview that Jim took more time and energy to raise than all of her other three kids combined. At times Jim would get so frustrated that we would bang his head with his fists or against a wall and say, "I hate my brain." He tended to make poor decisions, be reactive without thinking first, and needed external support to calm down. Emily summed up Jim's academic experience as a mainstreamed student in elementary school as, "everything's hard, every day, and you're never good at anything."

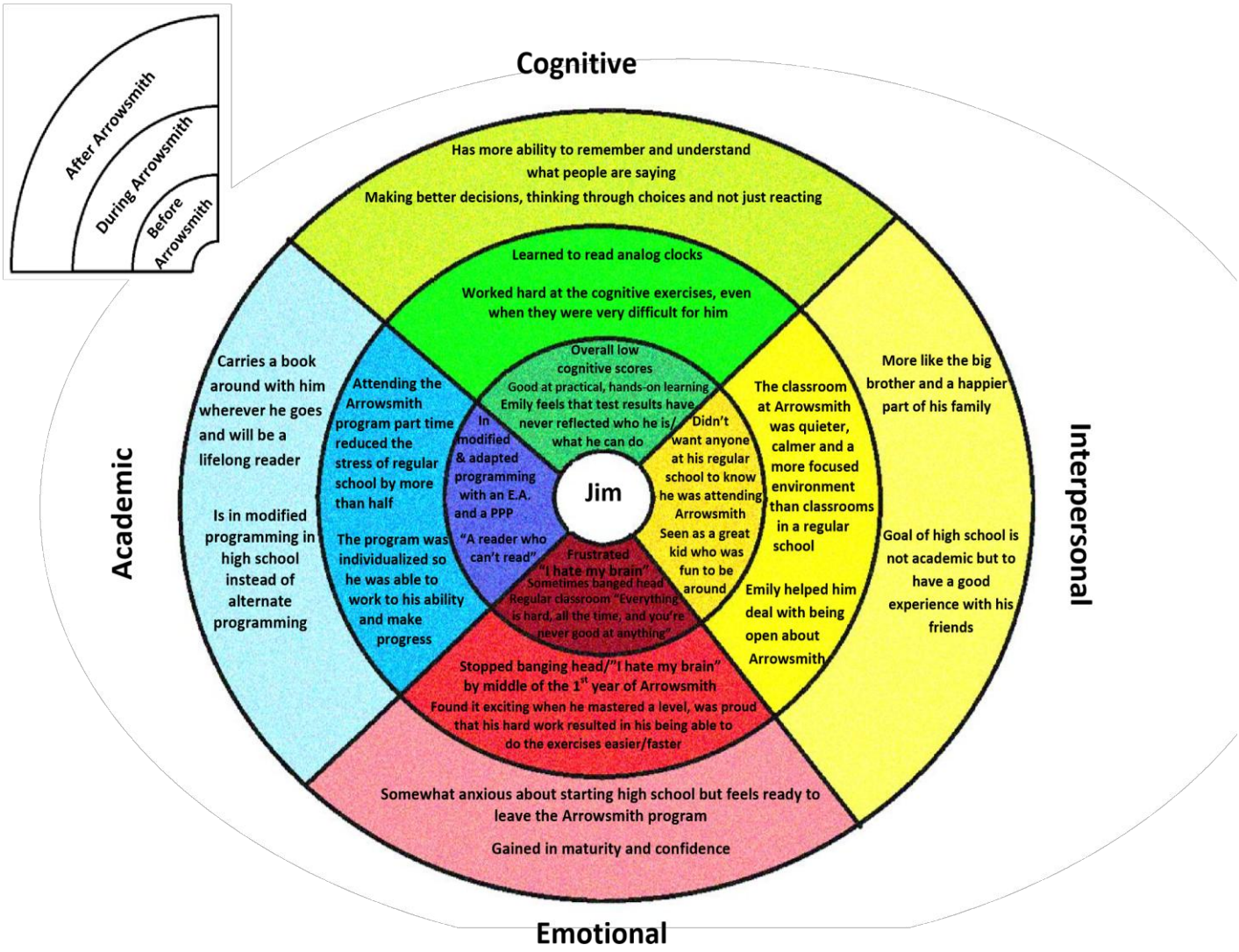

Figure 4.2. Jim's Circle Graph.

During the LDAS Arrowsmith program.

Jim had been receiving tutoring and programming through LDAS for many years when the informational session on the Arrowsmith program was presented, so Emily and Jim's father went to this session to hear about the program. Emily felt that the program was a good match for Jim right away but Jim's dad was skeptical. Emily was convinced that the Arrowsmith program would help Jim because the Fast ForWord program that is also based on neuroplasticity of the brain had helped him.

Emily felt that no price could be put on her child's future. Her hopes were, "that it changes the brain, that it is a fix...our hope was that we would see significant improvements in the way we had with the Fast ForWord program, but in every area...that it would help and help significantly." She didn't have any fears about the program itself but more so how to make it work so that Jim's social standing with his peers and his self-esteem were not adversely affected. At first Jim did not want to leave his regular school and he did not want the other students to know that he was going to the Arrowsmith program. "I was sort of nervous...I didn't really know anyone...I wasn't going to know the teachers...that's why I didn't want to go at first...but then I got to know everyone...I started to feel comfortable and started enjoying it."

Due to the severity of Jim's cognitive processing issues, the Arrowsmith program recommended that Jim attend full time for four years but Emily felt that part time worked better for Jim. The family decided that Jim would attend his regular school for half the day and the LDAS Arrowsmith program for half the day. As Emily expressed:

> It was a perfect solution where he still got to be a regular kid in a regular classroom but the stress was cut, not just in half but by a ton...he didn't have all of the stress of having to spend every day, all day, in the regular classroom...and in Arrowsmith he was able to feel success because it was an individualized program.

Given that there was no way to participate in the Arrowsmith program and make it a secret as Jim wanted, Emily went to the school to deal openly with the plan:

> Because it's a small school, he had been in the same class with the same kids from kindergarten, obviously they knew he had a T.A....it wasn't a big surprise that he had a hard time learning but that he was Jim, he was a great kid, lots of fun to be around...I went in and I knew all of the kids and I just said this is the deal, Jim gets to go to this school in the

> mornings but he's going to be here in the afternoons and I told them a little bit about Arrowsmith and asked them if they had any questions...and I was proactive in talking to a lot of parents that would make sure to talk to their kids about that this doesn't mean Jim is different, this is just he's going to learn different things in the morning...I think because I was so open with the other parents and kids that it was always a positive thing...if anything it was lucky Jim because he wasn't there all day.

Emily felt that the classroom environment at the LDAS Arrowsmith program was ideally designed to support Jim's progress and increase his self-esteem:

> Arrowsmith was such a focused, calm...it's routine...you walk in there and you could hear a pin drop...these are 10 or more of the most learning disabled kids out there and the classroom is as calm and quiet as anything you could ever see...it was a calmer, quieter routine, a lot like out home...he thrived in that kind of environment where it was individualized for him... he felt comfortable...he was able to be in an environment where he could work to his ability...there was something he could always do with a goal, the classroom was completely encouraging...they cheered you on when you met your goal...you felt that success that you don't get when you're younger in a mainstream classroom...so he made progress.

In the Arrowsmith program the student is placed at a level for each cognitive function area that they are working on that is at the outer limits of their current functioning. This practice is consistent with Vygotsky's (1978) conceptualization of the zone of proximal development and how pushing the limits of the individual's current functioning with incremental steps can promote growth and learning. They work at this level with increasingly more difficult tasks until they reached a level of mastery and then move on to the next level. Reaching mastery can take a few days in some cases or much longer in other cases. Jim responded very positively to reaching mastery. "It felt exciting...I liked it because I could tell it had gotten easier and each time I mastered, it seemed like I could do it faster" Achieving success in the Arrowsmith program increased Jim's self-confidence and Emily noticed some changes in him soon after he started the program that amounted to major changes for Jim and their family. "He started in September and it was Christmas when I realized that he's not wanting to bang his head anymore...which is a BIG, BIG thing...over that first year what disappeared was 'I hate my brain'." After he started the LDAS

Arrowsmith program, a school progress report described Jim as joyful and having increased in volunteering his ideas, and independence.

Jim attended the LDAS Arrowsmith program half days for three years. Emily, with Jim's father, made the decision to have Jim exit after this time because he was entering high school and Jim had "maxed out" with special programming and needed a break. Jim felt anxious about the transition to high school but said he was ready to leave the Arrowsmith program and move on to the next step. I think also that participation in the Arrowsmith program had clarified to Emily what academic and cognitive areas were as strong as they were going to be and the new focus needed to be on supporting Jim's success with his current skills and capabilities. Since the family owns businesses and can provide employment for Jim in an area that he can achieve success in, they do not fear for his future.

Emily had discussions with Jim's high school to set up his programming and classes. The high school wanted to put him in Life Skills/Alternate programming based on his academic skills and elementary school programming. Emily was completely opposed to this plan because the Life Skills program did not match where Jim was at socially and being placed in this special program would be detrimental to Jim's self-esteem. From her perspective, the goal of high school for Jim was not academic but for him to have a good experience with his peers. To that end, she wanted Jim to only be in classes in which he could reasonably participate and be successful in. Emily negotiated for an individualized alternate math class in the resource room for Jim since it was apparent that he is not able to make further progress in this area.

Changes after the Arrowsmith program.

Jim is taking regular programming with some modifications in high school in every class but math instead of the alternate programming that he likely would have been taking. He has moved on to high school with his peers that have been together since kindergarten. Emily has arranged for Jim to be in classes with friends that support him and teachers that are a good match for his learning needs. Jim was nervous before beginning high school but he has adjusted well. Emily sees high school as an opportunity for Jim to have a good experience with his friends and to build his self-esteem. She was not willing to consider him attending the Life Skills Work Study

program because this is not where Jim is at socially and being put in this class would tear down the progress that has been made with his self-confidence.

Jim can read quicker than he could before and Emily feels that he will be a lifelong reader because he reads for pleasure on his own time. Jim has improved in his independent reading skills and the neatness of his writing but Emily realizes that he is way below grade level in these areas. She estimated that Jim is reading at a grade 5 level, even though she realizes that the standardized testing places him much lower and does not show an improvement in any of his composite academic skills. Emily feels that the test results have never really shown what Jim is able to do. The standardized test results for Jim after three years of part-time participation in the LDAS program indicate some subtest scores have increased relative to his age peers and others have decreased relative to his age peers. Jim received only part-time academic instruction in each of these three years at his regular school. In most terms he was taking English or math but not both of these subjects. Jim, Emily, and Jim's teacher at his regular school all believe that Jim's reading has increased since his participation in the LDAS Arrowsmith program. It is not clear why this perceived change is not evident in the standardized test scores.

Emily observes that Jim's ability to listen, comprehend, and remember have improved. Jim can tell time from analog clocks now. He makes better decisions by thinking through the choices and being less reactive than he was before. Emily feels that Jim was not processing most information previous to taking the Arrowsmith program and now he is able to slowly process information. She has confidence that the changes he has made are permanent because they are changes that are made to the brain.

Jim has gained in confidence and maturity. He likes himself and felt pride and success in his accomplishments in the Arrowsmith program. This increased confidence and the above mentioned improvement in his listening skills likely led Jim to notice that he is better at talking to people he doesn't know. Jim has become less self-centered and more empathetic to others. He is a happier part of his family. The family dynamic has changed as a result and Jim is more like the big brother that he is and less the child whom required much more work than all of his siblings combined. Jim is less frustrated and handles the frustration he experiences more effectively. He has the ability now to calm himself down. This ability allows him to be less reactive, think things through, make better decisions, and be more independent.

A CASE STUDY OF THE LDAS ARROWSMITH PROGRAM

Half way through his first year of high school, Jim is taking regular classes in every area but math and has some modifications and supports for his classes. His marks at the end of the first semester were in the 50s and 60s in core academic subjects and in the 80s in practical, hands-on classes. Standardized testing cognitive testing (Figure 4.3.) and achievement testing (Figure 4.4.) scores for Jim compare his functioning before and after participation in the LDAS Arrowsmith program.

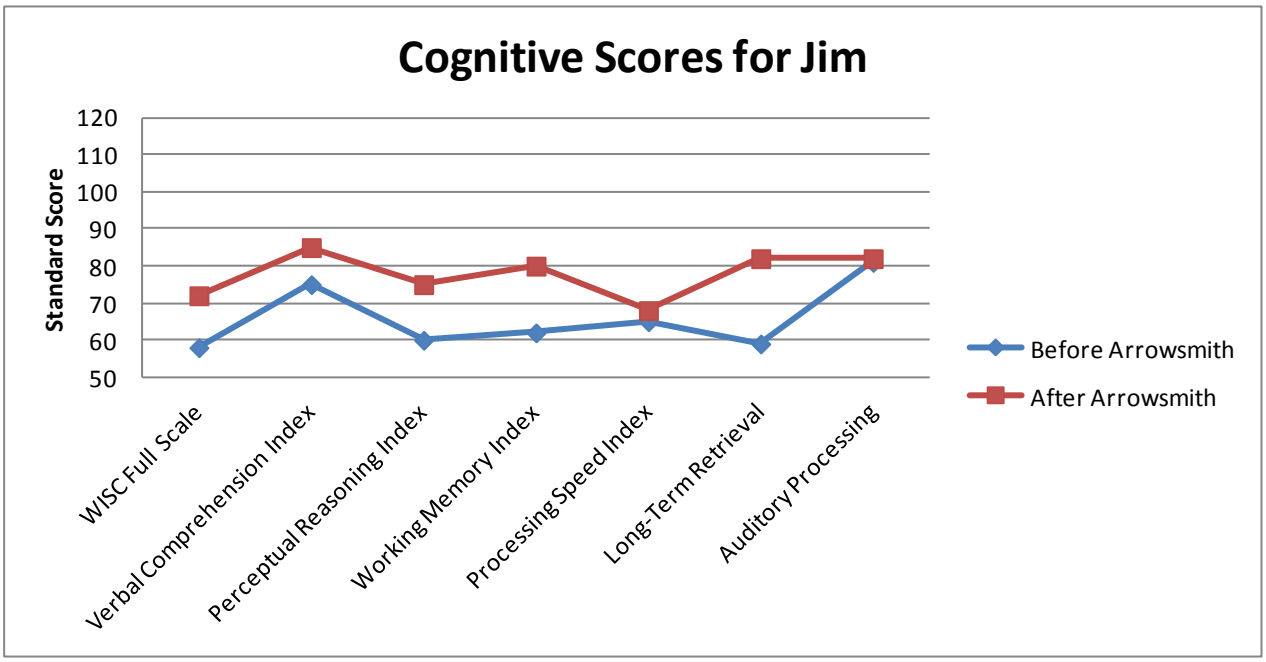

Figure 4.3. Standardized Cognitive Test Results for Jim. Before Arrowsmith standard scores were obtained prior to September 2008 and the after standard scores were obtained in June 2010.

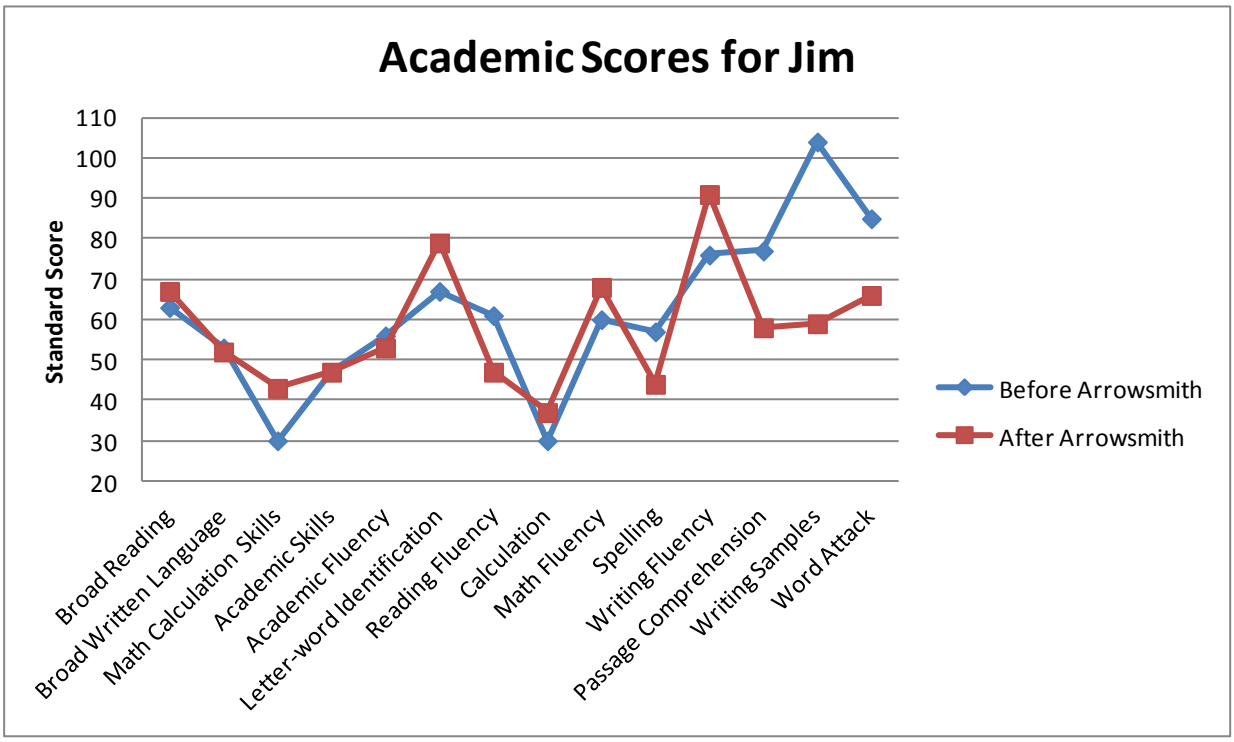

Figure 4.4. Standardized Achievement Test Results for Jim. The before Arrowsmith standard scores were obtained in August 2008 and the after Arrowsmith standard scores were obtained in June 2011.

Michael

Michael is the student in the case study who had the most varied overall scores on intelligence tests prior to entering the LDAS Arrowsmith program. One assessment described him as having average intellectual ability while another assessment placed his overall ability as being at the lower limit of the borderline range of intellectual ability. Michael had academic difficulties in all subjects but was weakest in math and writing. His speech was delayed and his mother Sandy brought him for speech and language assessment at age 2. "I remember her (the speech pathologist) saying, she didn't know if he would ever learn to talk normally, so it was so delayed that we didn't even know if he was going to be able to have normal speech." Michael had speech therapy and frequent speech/language assessments through much of his childhood but his speech articulation problems have been mostly ameliorated now. A flowchart (Figure 4.5.) and circle graph (Figure 4.6.) depict information gathered on Michael from the interviews and school records.

Michael's mom Sandy.

Just as Emily contacted me by email, Sandy sent me an email to express her desire to participate in the study. Sandy wanted to tell the story of how the LDAS Arrowsmith program had changed her son Michael's life in a positive direction, "I see possibilities for him that I didn't see before."

Sandy is a very determined woman who was very involved in Michael's education and went to great lengths to support him. She was against ADHD medication for Michael and preferred to use nutritional supplements and other natural remedies instead. She often felt like she was on her own and without direction to help him. "There are just no answers out there so you feel like you're an explorer breaking a frontier to figure out how to make his brain and his life work so he can succeed...you have to figure it out yourself and once you figure out some possibilities...you have to go to the doctor...and then you go on a waitlist for a year."

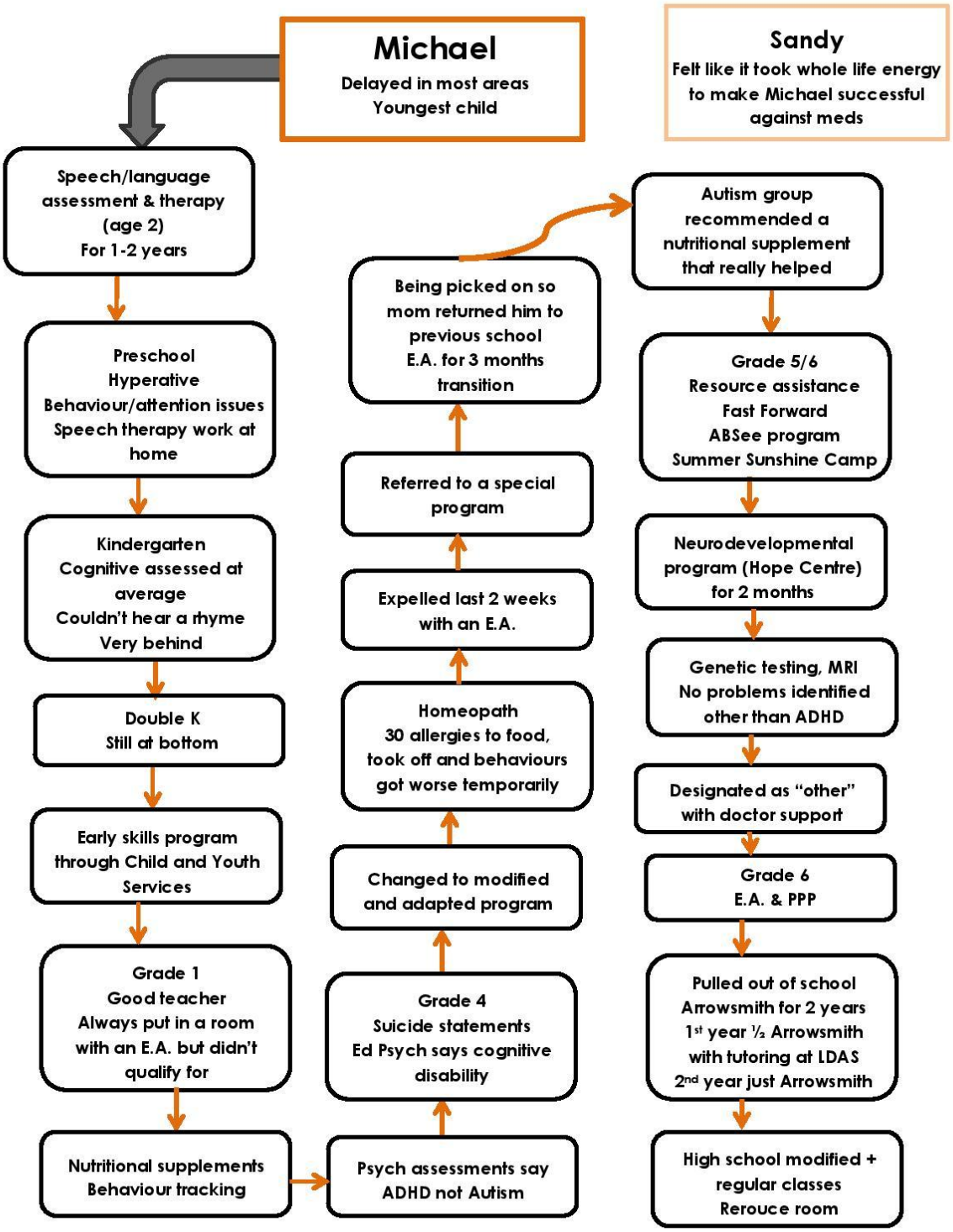

Figure 4.5. Michael's Flowchart

Before the LDASArrowsmith program.

Michael went to preschool and then kindergarten. He was very hyperactive and was behind in everything. One of Michael's teachers commented that he "needs to listen more carefully to instructions." During an assessment, the examiner noted that Michael tends to fidget. Michael has several comments on the progress reports in his cumulative folder indicating he needs to make better use of class time, be more consistent, and ask for help. Sandy explained in the interview that "with Michael it was always a lot of work to get him to try to make progress...it always took a huge amount of effort to get anything out of him." Raising Michael took significantly more effort than her other children combined. At the end of kindergarten, Michael was well behind his peers so Sandy suggested that he repeat kindergarten. The next year he took two classes of kindergarten (one in the morning and one in the afternoon). He participated in a program to work on his behaviour issues and social skills. At the end of this repeated year with double kindergarten, "he was definitely stronger, but he was still at the bottom of the class."

Michael did not have an educational assistant assigned to him on an ongoing basis or a Personal Program Plan (PPP) until later in elementary school but he was always put in a classroom where an educational assistant was present and had resource room assistance. His mom put him in the Fast ForWord and ABSee reading programs at LDAS and in the intensive Neural-developmental program at the Hope Centre for two months.

Michael was a very active and friendly child who had social/emotional/behavioural problems. There are many statements on progress and assessment reports in his cumulative folder that indicate behaviour problems from at least kindergarten. Michael is noted to: misinterpret social cues, have trouble maintaining friendships, lack social judgment, have lower impulse control, have trouble handling frustration, and speak in a whiny voice. Other comments indicate that Michael did not always respect the rights and needs of others, tended to seek approval and be very reward based, and got into trouble when he lashed out in frustration. In kindergarten there is documentation that an outside agency arranged social skills training for Michael at school that lasted six weeks. He was diagnosed with Attention Deficit/Hyperactivity Disorder (AD/HD) when he was quite young. His mom Sandy described Michael's interpersonal difficulties:

> He has had friends but he always does stuff, it's like he's not aware of how he affects people with his behaviour, he would miss a lot of the cues and the normal social stuff...when

> he was younger, probably up to grade 3 or 4 I think kids are kinder and little girls are very compassionate...there were always little girls taking care of him that were really nice to him and then after grade 4 it gets a little rougher.

In grade 4 Michael was having so much difficulty in school and his stress was so high that he started to talk about killing himself. His cognitive functioning was assessed again and was found to be consistently in the extremely low to borderline range. Sandy remembers having meetings to discuss the radical difference in the new cognitive tests results and what to do about it. Michael's programming was modified and adapted which helped lower his stress. A special program at another school was recommended for him. "I remember going to watch...the counsellor from the school went with me...it was so sad, it brought tears to my eyes to think...is that really where he belongs and where he is going to fit in...what's going to be best for him."

Michael started grade 5 in the special program but Sandy pulled him out shortly after when she found out that Michael was afraid to go out at recess because the kids were picking on him. He returned to his original school where he was eventually designated for intensive supports that included an educational assistant for part of the day and a PPP.

When I asked Michael what it was like having a learning disability, he said, "A lot of people don't accept you, leave you out, and stuff." Having a son with learning and behaviour problems was also difficult for Sandy. "It just took so much of my life force, it was all consuming just trying to raise him and trying to make him succeed and supporting him...it's like my career became trying to help him succeed in his life." Sandy spent many hours with Michael working with him to complete homework. "It was really hard as a parent to help him do something, knowing what normal expectations are and wanting him to do his best and wanting him to have a role model of what good looks like, and then knowing how much I can do, should do, and how much he should do."

During the LDAS Arrowsmith program.

Sandy found out about the Arrowsmith program 4 years before it started in Saskatoon at LDAS. Someone told her about an article they had read, so Sandy did some internet research on Arrowsmith and considered selling her house and moving to Toronto. Michael was doing Fast ForWord at LDAS when Sandy found out that Arrowsmith may be coming to Saskatoon. Sandy

decided to put Michael in the program right away but she was afraid that he would not be accepted due to his latest cognitive test results. At the Arrowsmith presentation, she talked to the program representative from Toronto and was reassured that the test results from kindergarten that showed Michael having average intellectual functioning should allow him to qualify for the program.

Sandy was relieved when Michael was accepted. "My hopes were that we could bring his brain functioning up so that he could be able to learn and be able to function independently as an adult and have some sort of career or trade so that he had the potential to have a good, fulfilling life...and that I wasn't going to be caretaking him for the rest of my life." The LDAS Arrowsmith program was started at a time that she was becoming more and more worried for her son's future:

> I had talked to other people who had kids on the Autism spectrum of disabilities...and if they're not doing well they'll often end up on drugs or in trouble with jail, they don't make good choices...and you spend the rest of your life getting them out of the legal system or getting them off drugs, it just seemed like once you're going down that path, you just spend the rest of your life trying to keep them alive...I just thought it's put the money in now and it gives him the possibility of having a future, a life...it's like you get desperate and you want to do anything you can for your child to give them a better opportunity.

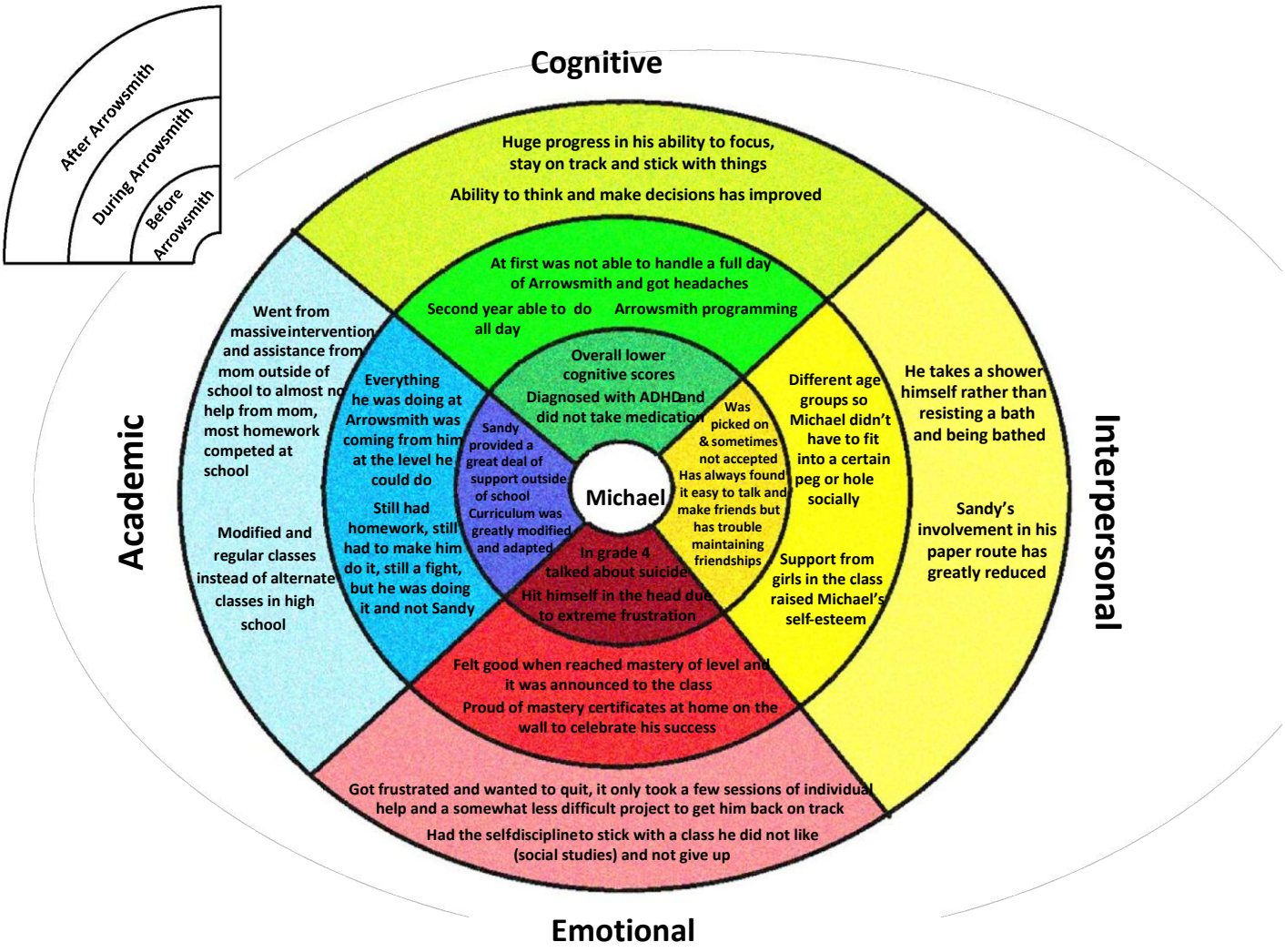

Figure 4.6. Michael's Circle Graph

Michael was pulled out of his regular school completely for two years while he attended the LDAS Arrowsmith program. Although Sandy had managed to finally get him designated for intensive supports the year before, Michael did not have a strong social network at his regular school due to his problems with social skills. His school work was modified and it was clear that he would be put in alternate programming for high school unless major changes happened in the next two years. Due to Michael's hyperactivity and difficulties with focus, he was put into Arrowsmith programming only half the day with the other half devoted to tutorial support in math and English. For the first while he frequently had headaches at the end of the day from the level of focus and concentration that was required for the tasks. As he got used to the requirements of the program, his headaches stopped.

Sandy explained the aspects of the Arrowsmith program that she felt were important to Michael's success, "everything he did at Arrowsmith was coming from him...it was the development of his brain, at the level that he could do...he had goals every day, I loved the way they broke it down." Since his programming was individualized and tailored to Michael's abilities and skills, he was able to do his own work:

> What I loved about the Arrowsmith program was that it wasn't me trying to help him with these projects that he wasn't capable of doing and it was maybe 50 to 75% of my energy going into it...it was like suddenly I didn't have to do that...everything he did at Arrowsmith was coming from him...he still had homework and I still had to make him, and it was still a fight, but he was doing it, not me.

Another benefit of the Arrowsmith program for Michael was the safe social environment it provided for him. He was no longer being bullied or picked on and he was attending school with other students who also had learning challenges. "Arrowsmith was so good for him because it was a wide range of ages so you didn't have to fit into a certain peg or hole...I really loved that aspect of having the different ages together... so it was a really good and positive experience." Michael, like Jim, enjoyed the feeling of accomplishment when he mastered a level. "It felt kind of good...they announced it (proud look on face)...yeah it was pretty nice...you were like the star student of the day pretty much if you were the only one."

Changes after the Arrowsmith program.

In Sandy's opinion, the time when you realize how big a change your child has made is when they go back into the school system. Michael would have entered high school into the Life Skills or Alternate program but instead took a mix of regular and modified classes. He did well in grade 9 and was then accepted into regular and modified programming at a high school that would not previously consider him for anything other than alternate programming. He is taking a higher level of academic work and needs much less support in order to do so. Michael is able to read faster and take notes better. His significantly decreased math scores on the standardized testing after two years of participation in the LDAS Arrowsmith program appear to reflect his reduced academic instruction in math while he was in the LDAS Arrowsmith program. Michael was able to successfully pass his math class when he re-entered the regular school system when he was able to review the skills he had forgotten. The comments on his progress reports after leaving the LDAS Arrowsmith program indicate that effort/work habits are greatly improved in some classes but in others the teachers still want to see more growth. Michael is described as having more ability to focus, being thoughtful and attentive, beginning to accept feedback through listening to instructions, and having improved listening skills. Michael has some comments on his progress reports after he returned to the K-12 system that commend him for hard work and dedication, improved attitude and effort, having good work habits in the writing process, and making good use of class time. Another comment seems to indicate that Michael's effort is related to external pressure, "capable of getting work done when required."

Michael has a career goal and Sandy believes that he has the ability to become an independent adult now. Michael has demonstrated more independence with a summer job, doing most of his homework on his own, taking a shower on his own, and doing a paper route mostly on his own. His ability to think and make decisions has improved. His ability to understand interrelationships has increased. Michael has made huge progress in his ability to focus, block out distractions, stay on task, and stick with things when he is frustrated, is bored, or finds something difficult to do.

Michael continued to struggle with social skills after he returned to the K-12 system. Standardized testing cognitive testing (Figure 4.7.) and achievement testing (Figure 4.8.) scores for Michael compare his functioning before and after participation in the LDAS Arrowsmith program.

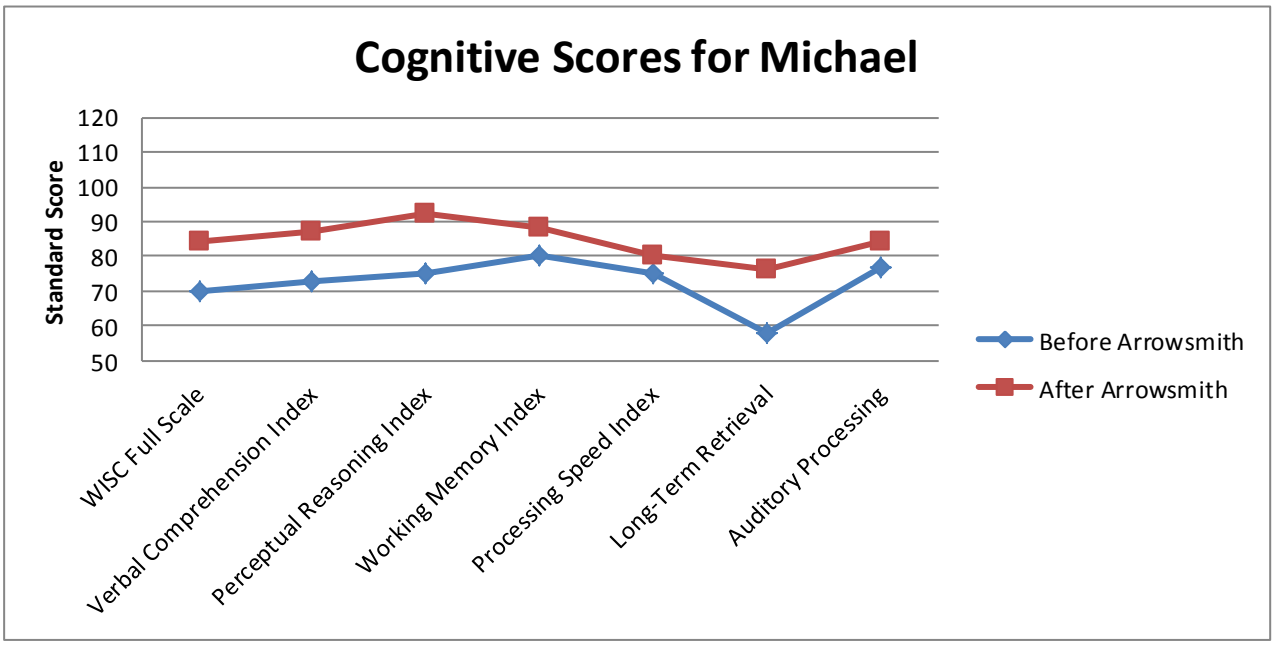

Figure 4.7. Standardized Cognitive Test Results for Michael. Before Arrowsmith standard scores were obtained prior to September 2008. After Arrowsmith standard scores were obtained in June 2010.

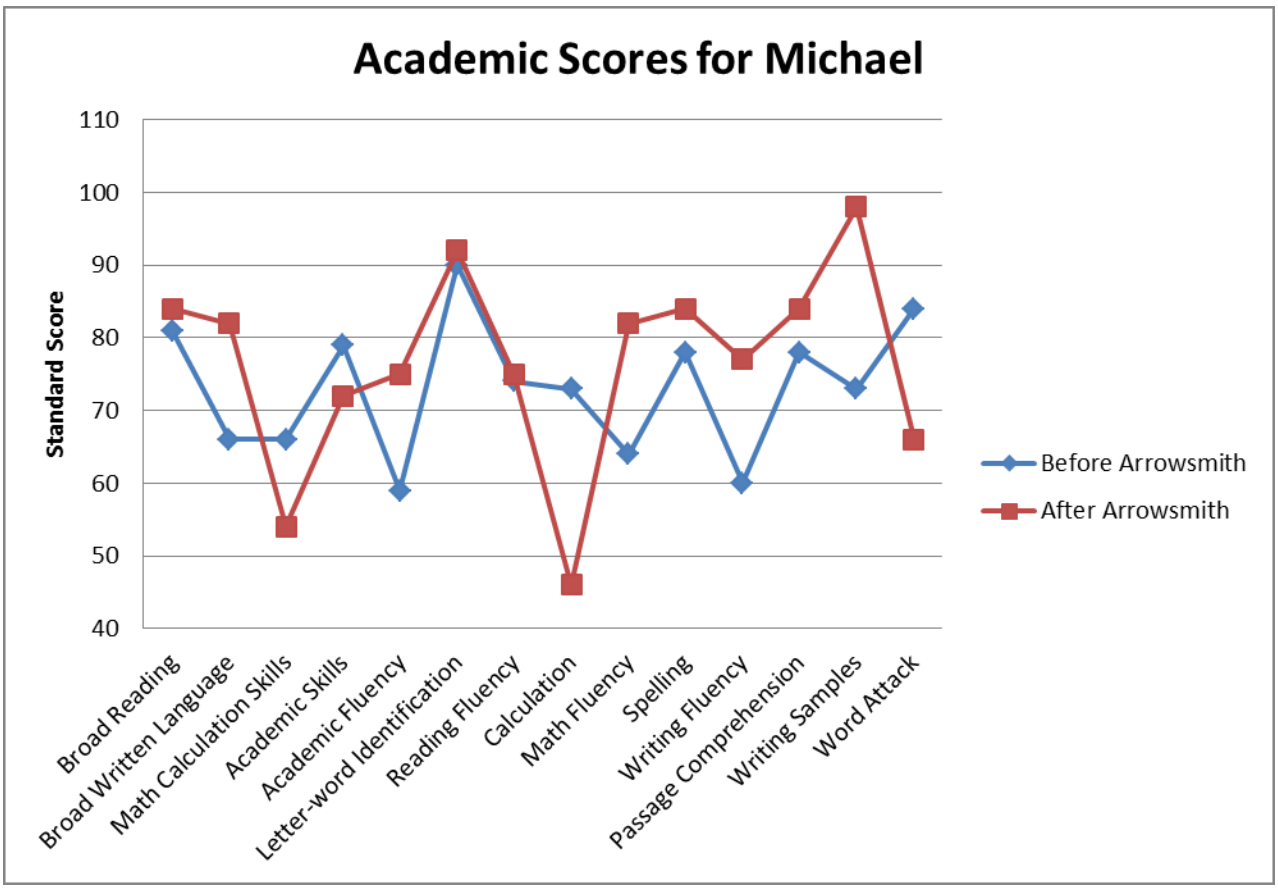

Figure 4.8. Standardized Achievement Test Results for Michael. Before standard scores were obtain in August 2008. After standard scores were obtained in June 2010.

Evan

Evan is the only participant in the study who was still attending the LDAS Arrowsmith program when I conducted the interviews. He had the strongest cognitive scores overall and was the only student in the case study who had not repeated a grade. Evan had been identified by teachers as having probable attention issues as early as grade 1 and he was eventually diagnosed with AD/HD. His parents did not start him on AD/HD medication until after he started the LDAS Arrowsmith program. Evan had academic difficulties in most subjects but was particularly weak in math, spelling, and writing. Evan has strong social skills and is a mediator among his friends. A flowchart (Figure 4.9.) and circle graph (Figure 4.10.) depict information gathered on Evan from the interviews and school records.

Evan's parents Dave and Angelina.

I received an email from Evan's mother Angelina indicating that she and Evan's father Dave wished to participate in the study to share their experiences. Dave and Angelina were friendly and inviting during the interviews at their home. Evan was interviewed separately from his parents and in both cases he was interviewed first. Dave and Angelina were interviewed together. During their interview they showed me a binder that has information relevant to Evan's education and learning difficulties in chronological order. They want to help Evan develop his academic skills to their highest possible level so Evan will have many options for his future. Dave and Angelina have spent a great deal of time supporting their son by providing homework help and programming to help him improve the areas in which he is weak.

Before the LDAS Arrowsmith program.

Evan was a content baby but very active. His babysitter came to their home and told Dave and Angelina that she had to lay down while Evan was napping because she was so exhausted running after him all day. Evan was opposite in many ways to his sibling but his parents initially felt that this may be because they were different genders. They began to notice problems in organization and coordination. Evan sometimes slammed himself on the floor for no apparent reason and this concerned them. He was very talkative and expressed himself well verbally but he didn't like to use a pen and he had great difficulty putting his thoughts on paper.

Towards the end of grade 1, due to concerns raised about Evan's ability to focus and pay attention, his parents and teacher filled out the Connor's Rating Scale for AD/HD symptoms. His teacher rated him as high in every area including, oppositional behaviour, hyperactivity, cognitive problems/inattention, and overall AD/HD index. Dave and Angelina did not see Even as being oppositional or hyperactive but they rated him high in the other two areas. Evan's teachers describe him in progress reports as restless, having attention problems, fidgeting, and "misplaces things and wastes time looking for them." His teacher rated him as needing growth in taking responsibility for his own learning. Evan's teacher commented that he needs organizational strategies and was "not always willing to give his best effort in story writing." His progress reports also identify positive characteristics such as: respects the rights of others, has a positive attitude, and follows expectations. One of Evan's assessment reports states that he "has no emotional or behavioural issues other than probable attention problems." Dave and Angelina feel this was the point that they realized there was a problem that may not go away easily, "around grade 2 the teachers were noticing what they thought was maybe AD/HD or something like that, so I think it all started for us there...we had to go through the system...assessing and setting up meetings with teachers."

In grade 2 Evan had a Personal Performance Plan (PPP) with regular programming supplemented by in class and pull out small group support. Through a miscommunication related to where he should be assessed, Evan was seen by Mental Health. The conclusion of the psychiatrist was that he did not have any emotional or behavioural problems other than probable AD/HD. Dave and Angelina were reluctant to put him on medication, particularly because they found improvements at home when they provided more structure. A cognitive assessment was completed at school. The examiner felt that attention was not an issue while Evan's teachers felt strongly that it was.

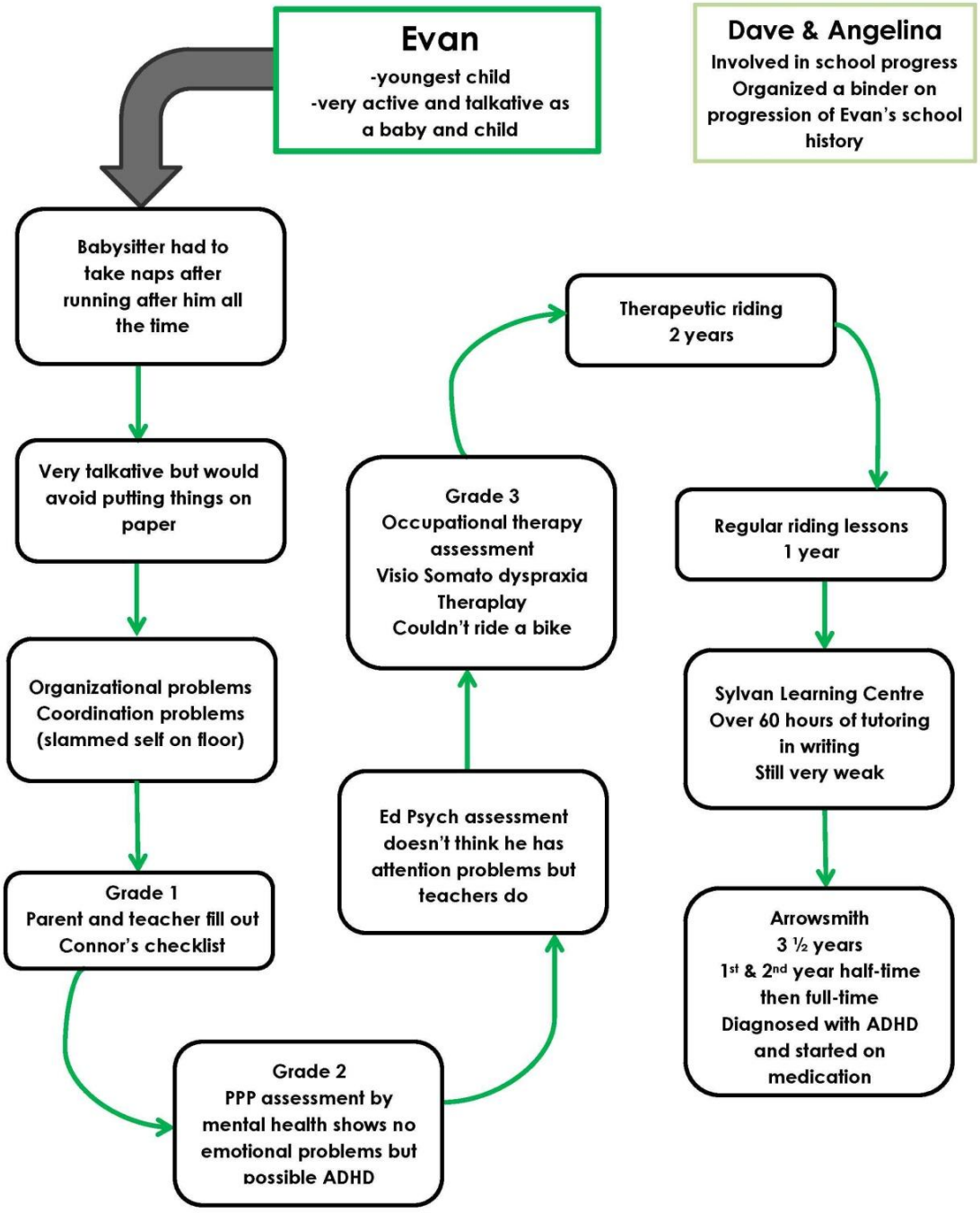

Figure 4.9. Evan's Flowchart

At the beginning of grade 3 Evan received occupational therapy and assessment. He had difficulties with fine motor control and the production of writing. The report indicates the presence of sensory integration dysfunction in the realm of praxis, "Visuo- and Somato Dyspraxia." Evan was given occupational therapy and took therapeutic riding for two years and regular riding lessons for one year. He didn't learn how to ride a bike until very recently. Dave feels that he was able to learn for the last two or so years but didn't want others to see him learning at his age. Finally his desire to learn overcame his embarrassment about not knowing how.

Evan was experiencing more and more frustration and anxiety at school and with his homework:

> He was left to himself to figure out what he had to do and with his memory problems, not remembering what she (the teacher) said to do is an anxiety producing kind of thing...we would try to help him do his work and not really knowing what we were supposed to be doing but trying to help him do it...It was really frustrating for everybody involved to get home... plus he's tired, he's had his whole day of school and here we are sitting him down to do more.

Later in grade 3 Evan received tutoring at Sylvan, primarily in the writing area with a substantial number of hours (approximately 65 hours). His skills in writing continued to be well below his peers after this tutoring. Evan recognized his problems in this area and had a strategy to mask his difficulties, "sometimes when I am writing, if I know where it is wrong, I usually just make it look like I messed up a little so it looks like I knew what I was doing." Dave and Angelina were frustrated by the lack of answers and support. They were searching for alternative education options and summed up their feelings, "at this point we really felt we had no other options...we had to try it because there was nothing else that we knew to do and no other direction we knew to go...other than back to the school system and we didn't have a lot of faith in the school system at that point."

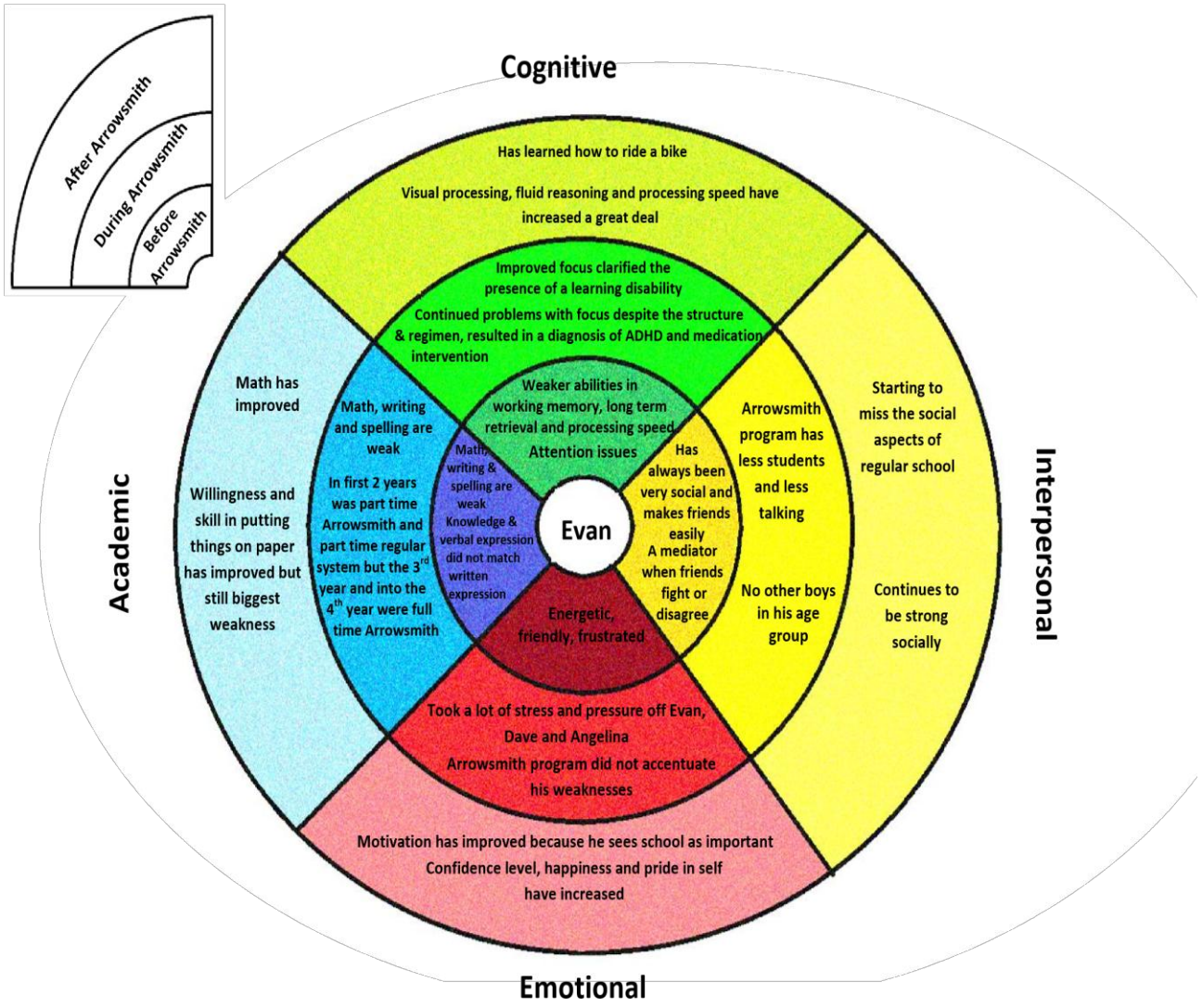

Figure 4.10. Evan's Circle Graph.

Prior to entering the LDAS Arrowsmith program, Evan had not received a formal diagnosis of a learning disability or ADHD although there were suspicions of both of these disorders. A psychologist at LDAS interpreted the information on the grade 2 assessment report as follows, "a learning disability in the areas of processing speed and memory process." Subsequent to entering the Arrowsmith program, Evan was diagnosed with ADHD by a physician and prescribed medication to manage his symptoms.

During the LDAS Arrowsmith program.

Dave and Angelina cannot remember exactly how they found out about the LDAS Arrowsmith presentation but they think it was through a poster or letter in the mail:

> I think they hit us right at the point when we were just...we don't know what to do...we have to do something, but we don't know what to do...so we went there and I think with LDAS promoting it helped quite a bit, because it wasn't just a private school...because there is very little research other than what was done by them (the Arrowsmith program)...here's LDAS promoting it, well they must have looked at it and it provides credibility and we went that way.

Dave and Angelina hoped that the program would work for Evan but they were also worried that it wouldn't. "My biggest fear, what bothered me the most is that it wouldn't work at all and we would take 2 or 3 years of his life... I think he would have preferred to stay in school in more of a social way...and you know there's always a small percentage of anything that doesn't take to anything."

Evan attended the LDAS Arrowsmith program half time with half time at his regular school for the first two years. "I felt like we were taking maybe not a big gamble, but a bit of a risk." As a result, they felt that a cautious approach would be most appropriate:

> Right off the bat it took a lot of pressure off Evan, he was frustrated at school, especially when there would be a big essay type assignment he just wasn't capable of doing...for example, we did one on Native Americans, the Algonquins...his knowledge on it verbally was quite extensive but to put it all together in a package that was at his grade level was just beyond him...it took a lot of stress and pressure off us too, because we were always trying to help him do his homework...and help him without actually doing it for him and

> that's really hard...you want him to do well but at the same time you don't want it to be your work.

When Evan started the LDAS Arrowsmith program, it became clear to Dave and Angelina that Evan was unable to focus or fully benefit from programming because of his attention problems. The structured and regimented approach of Arrowsmith helped Evan but also made it obvious that a lack of structure in his regular school was not the only reason he was having trouble maintaining focus. They took him to a doctor that diagnosed ADHD and put him on medication. Evan was now able to benefit fully from the structure of the Arrowsmith program. "Having the same thing, the set things to do and he knew what to do then, that took a lot of pressure off him I think...structured, very structured, they know what to do, let's just do it...there was no uncertainty that was coming before." Despite the benefit to structure and repetition, Evan expressed that it was sometimes boring. Like Jim and Michael, Evan enjoyed the feeling of mastering a level in the cognitive exercises, but he also got bored if it took too long to reach mastery. At his regular school that he attended half time, a progress report comments that Evan is using class time wisely and is showing responsibility. This comment is a departure from the progress report comments prior to his entry to the LDAS Arrowsmith program. When describing the differences between the LDAS Arrowsmith program and his regular school, Evan said, "there's less talking and less people."

Evan was one of the few students who did not switch from part time to full time after the first year of the LDAS Arrowsmith program:

> Just after he finished second year, we thought maybe we should put him in full time just to get that big cognitive bang...and I (Angelina) was kind of scared to approach him because I thought he was not going to like that because he's going to miss his friends and everything and surprisingly enough it was almost like he was relieved.

However, after three years of Arrowsmith Evan has changed his mind. All of the original twelve students have now left the LDAS Arrowsmith program to go to regular schools or pursue other goals. "He really wants to go back to his regular school because he knows he has improved significantly and he's not scared to go back to it...it has flipped now and he desperately wants to go back and be with his friends"

Dave and Angelina were waiting for the Arrowsmith test results to see if his cognitive function scores were still progressing and if any areas were still weak. Academically Evan still

shows problems in spelling and writing that they are concerned will not be addressed or accommodated for in a regular school. By the time of the second interview they had made a decision to leave Evan in full time Arrowsmith programming for at least a half year more and reassess his participation at that time. They felt that he was still progressing and had more progress to make before he returned to a regular school. Evan's parents see his further participation in the LDAS Arrowsmith program to be related to whether or not he is continuing to make academic and cognitive processing progress. They are concerned about him re-entering the K-12 system when he continues to have some deficit areas. They are not confident that he will receive consistent accommodations and supports so they do not want him to return until all of these issues are addressed. They are still hoping that will happen.

Changes after Arrowsmith program.

Evan had not actually left the Arrowsmith program at the time I interviewed him and his parents. However, Evan and his parents have noticed changes that he has made since he started the Arrowsmith program. His memory has improved, which makes learning much easier. Evan has finally learned how to ride a bike. His math skills and reading speed have definitely improved. Evan has more ability to and more willingness to put information down on paper. His writing is less messy and he is more likely to recognize mistakes in his writing and spelling. Evan and his teachers in the LDAS Arrowsmith program see an improvement in spelling but Evan's parents do not see this change because the standardized test scores in spelling have not improved. I explained to Dave and Angelina that an improvement in spelling may not result in a change in the standardized scores if Evan's errors are qualitatively better or closer to the words than they used to be. Evan's writing and spelling are still his biggest weaknesses. His parents see an improvement in motivation because Evan now sees his academic skills as more important and believes that he is able to be successful academically. Standardized testing cognitive testing (Figure 4.11.) and achievement testing (Figure 4.12.) scores for Evan compare his functioning before and after participation in the LDAS Arrowsmith program.

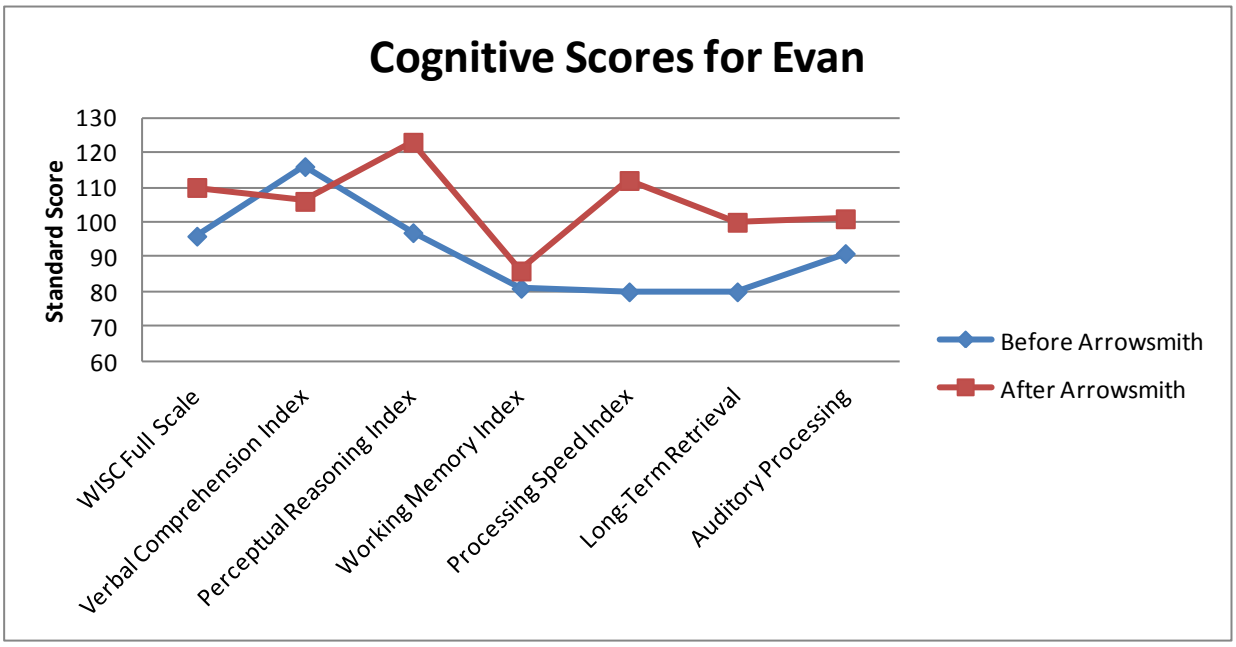

Figure 4.11. Standardized Cognitive Test Results for Evan. Before Arrowsmith standard scores were obtained prior to September 2008. After Arrowsmith standard scores were obtained June 2010.

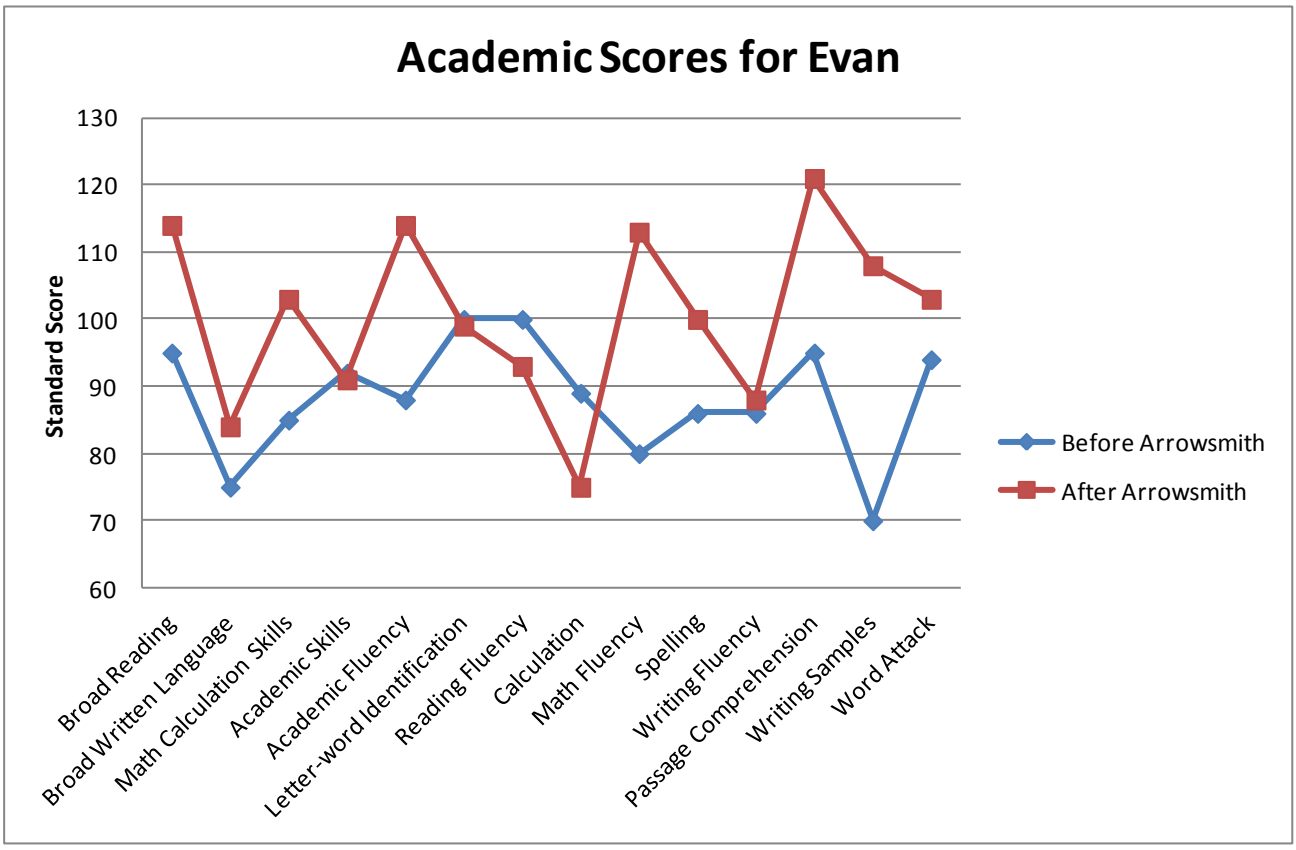

Table 4.12. Standardized Achievement Test Results for Evan. Before Arrowsmith standard scores were obtained in August 2008. After Arrowsmith standard scores were obtained June 2011.

Kayla

Kayla liked attending school even though she had difficulty with the core academic subjects. She liked art, history, and field trips. The social aspect of school was important to her and was an area she excelled in. Kayla is described as quiet, cooperative, hard-working, and kind by her teachers and mother. She is artistic and loves animals, especially horses. Kayla tried her best in school but she found reading, writing, spelling, and math stressful. Her academic program was modified and adapted as a result.

Even though her participation in the LDAS Arrowsmith program was ended because her parents felt that she had made minimal progress and had in fact experienced social difficulties due to being separated from her peer group at school, Kayla wanted me to know the things she liked about the LDAS Arrowsmith program. Kayla was open and emotionally expressive so she was easy to interview. A flowchart (Figure 4.13.) and circle graph (Figure 4.14.) depict information gathered on Kayla from the interviews and school records.

Kayla's mom Kate.

Kate explained that she volunteered to participate in the case study because she felt that she had an important story to tell. I agreed that it is just as important to understand the experiences of participants when the program is not effective or less effective for someone as it is to understand when it is effective. Kate had positive things to say about how the teachers in the LDAS Arrowsmith program treated Kayla and their honesty about Kayla's progress in the program. Kate was motivated to participate in the case study by her feeling that she would like to have heard more balanced information on the Arrowsmith program when she and her husband were deciding whether or not to try Kayla in the LDAS Arrowsmith program. Kate is a strong, independent woman who wants Kayla to be able to take care of herself when she grows up. She generously shared difficult emotions related to Kayla's learning disability and the experience of investing two years in a program that she had so much hope for and yet felt so disappointed with the results.

Before the LDAS Arrowsmith program.

Kayla was delayed somewhat in her speech but this did not worry her mother because this type of delay runs in the family and eventually corrects itself. Kayla started speech therapy and made good progress from age 4 years. There were no other problems noticed until Kayla was in

school. During kindergarten the speech pathologist noticed some difficulties in the speech therapy process that indicated a possible auditory processing disorder. Kayla showed other problems such as difficulty with the eye-hand coordination necessary to use scissors and learning how to count. She was born later in the year so the teacher and Kate believed that Kayla's younger age relative to her classmates was probably the main factor in her weaker skills. Kate did not allow her to use scissors before school so she believed that this factor could explain why Kayla was behind her classmates with this skill.

A mutual decision between the school and Kayla's parents was made to have Kayla repeat kindergarten so she could catch up to the class before she reached grade 1. Even after another year Kayla could count to 20 but still was not to the expected 25. She found the pre-reading sounds difficult and often got them jumbled. Kayla would often flip the outside letters in small words (ex. pam for map) and confuse the letters b, d, and p. Although Kayla's difficulties in this area were starting to concern Kate, she was reassured by a doctor that these types of errors are not uncommon in kindergarten.

Kate remembers the first time she was confronted with someone seeing Kayla as having a potentially permanent learning problem:

> In grade 1 the teacher came up to me and said, 'I think Kayla's got ADHD and I think she needs to be on Ritalin.'...I was just floored that a teacher would come up to me and say she needs to be on medication...when did you get your medical degree...I was really taken aback by that because Kayla had never been a hyper kid, she always sat still, she always listened.

Even though she found the teacher's observations confusing and upsetting, Kate took Kayla to be assessed by a psychiatrist. The experience felt inconclusive to Kate because an intern spent an hour with Kayla and did not see evidence of an attention problem but was overruled by the psychiatrist who spent a short time with Kayla at the end of the intern's assessment and determined that Kayla had ADHD and needed medication. Kate decided to take Kayla for a second opinion. This assessment indicated the possible presence of ADHD, Predominantly Inattentive Type and Kayla was tried on medication. Her teacher did not notice a difference in her school difficulties or ability to focus so the medication was discontinued.

In grade 2 Kayla continued to struggle with reading. She was still exhibiting the problems with phonemic awareness and jumbled/transposed letters despite intervention in the classroom and

resource room. Kayla was assessed at this time by a psychologist who diagnosed dyslexia and made a referral to an audiologist to check out possible auditory processing difficulties. The audiologist diagnosed a prosodic deficit in auditory processing. Kayla's reading problems persisted and despite being pulled out of class more and more for learning assistance with modifications and adaptations to her program, she was falling further and further behind her peers. "I know they don't like to see her stressed, as soon as they see any kind of stress that's when they start pulling things." By grade 5 Kayla was not taking the regular program in most of her classes. The Fast ForWord program had been implemented at her school but Kate does not feel that it was followed in the structured and systematic way that is necessary for success.

Kayla has many teacher comments on school progress reports that recognize her hard work, "dedication to her work," "strong work ethic," "commendable effort," "participates fully," "uses time wisely," and "willing to make improvements in assignments." Kayla is described as "respectful," has a "positive attitude," "kind," "polite," "thoughtful," and "is a pleasure to have in class." Kayla was seen showing independence through taking initiative, using suggestions to improve performance, and asking questions when she doesn't understand.

Kate became more and more worried about Kayla's future. "I think for her to get a grade 12 that means nothing is not going to get her into anything and they say there are certain classes she can get into through Kelsey with modified classes but when you look at it and there are so few...it's closing the doors on everything." Kate worried that Kayla would get a grade 12 that would not be recognized or not be able to finish high school. This possibility particularly affected her from the perspective of a woman who had been taught by her mother to do things on her own and not be dependent on anyone:

> Initially you get to a point where you think, ok if she can't make it through high school then what can she do...is she going to be able to support herself...is she always going to depend on a man for support...there were so many troubles with school, you just think, how are you going to live...I'm going to have to live forever then...I'll have to support and look after you forever.

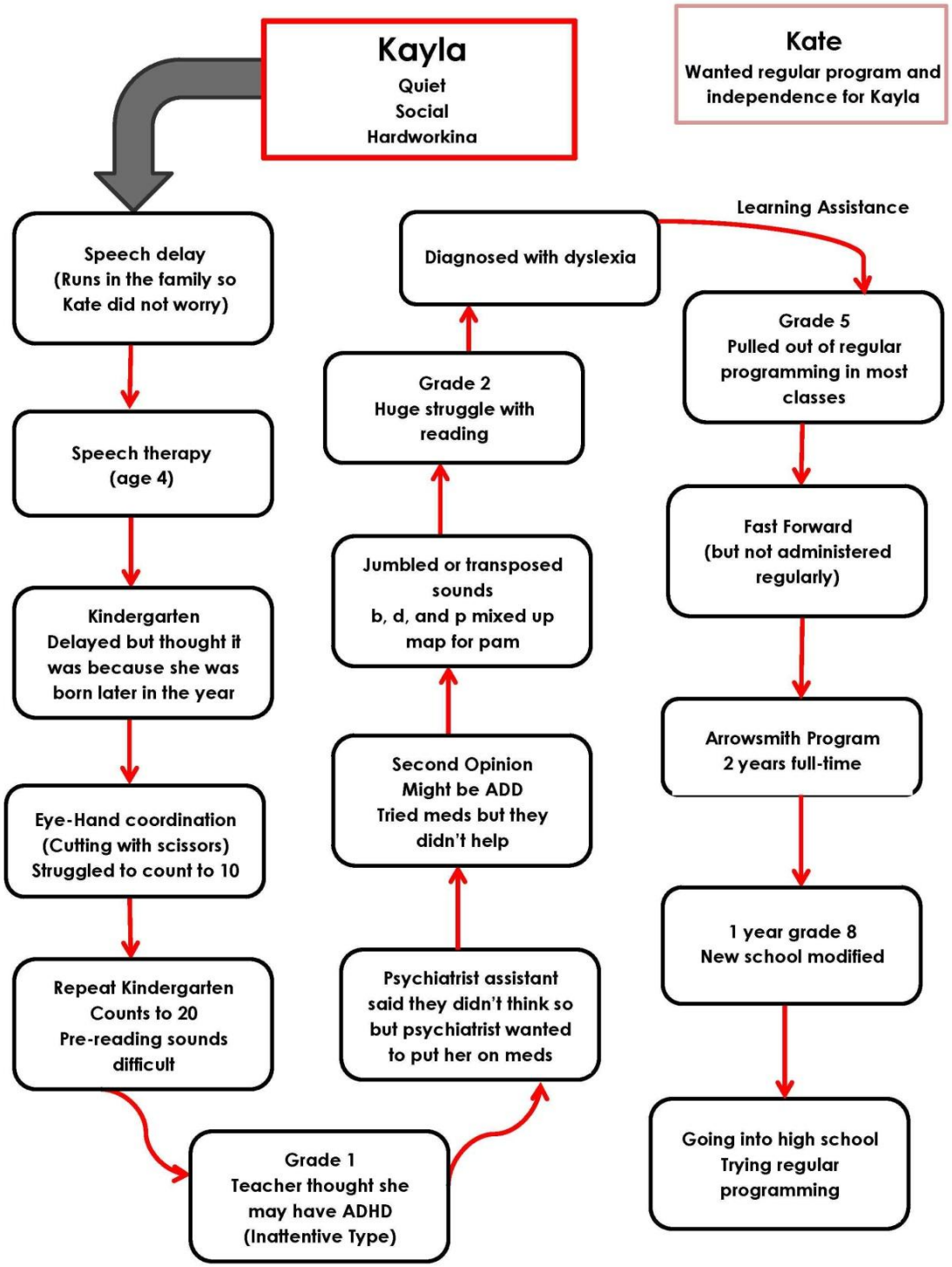

Figure 4.13. Kayla's Flowchart

During the LDAS Arrowsmith program.

Kayla's school had been talking about moving her to a different classroom that her friends were not in but the school felt that Kayla would be fine because of her strong social skills. Kate was still worried about this possibility, "Here they are breaking down her one strength." Kate and her husband heard about and attended the informational meeting in Saskatoon about the Arrowsmith program:

> Once you see the information and you're presented with the big slide show...it was all positive, there wasn't a negative in there...it did really make you think...well gosh if we don't do this...how can we not do this...really...how can we not do this...how could we deprive our child of a chance...you can't...we know Kayla, she's really hard working and she always has been...I think we can get somewhere with her and we thought we had found it with Arrowsmith...this is the answer, this is the miracle... when you go through that many years of just struggling with what to do, where to go...it seemed like...God if we don't do this we may be forever thinking that...this might have helped...but can we afford it...no, not really but...we were too optimistic I think...and in the back of your mind now...God it was too good to be true, it really was.

Kayla is not sure if hearing some negative information would have changed her mind back then but she feels that she would feel "less like she had been tricked" now if the presentation had been more balanced. "Maybe I would have looked at a paper that said that with this person it didn't work but with all these people it did work...I would never think I'm going to be the one of a small percentage that it didn't help." The lack of progress Kayla made in the LDAS Arrowsmith program caused some conflict between Kate and her husband because she really pushed for it and he felt that Kayla just had to work harder.

Kayla attended the LDAS Arrowsmith program full-time for two years, so she was pulled out of the regular school system during that time. The transportation problems associated with attending regular school and Arrowsmith half time each would have been very difficult for the family:

> My fear in putting her in it (Arrowsmith) was I was going to pull her away from her friends...but because she was strong socially I thought maybe she'll be able to be ok... we did have sleepovers almost every weekend so that she could keep up with her friends...but

> she would hear about the school trips they were going on...all those things that don't seem like a lot to us, was a lot to her...I think she was missing her friends...she was missing being part of the school atmosphere...and so my concern was that she was getting depressed...she started isolating herself more and after the first year the sleepovers started fading out...and then we thought, here we are and we're really not getting anywhere in the program and now we've got social issues that were never a problem before.

Another difficulty Kayla faced in the LDAS program was the lack of face validity in the cognitive tasks she was required to do:

> The exercises, because of the way they are...it's difficult for them even to understand how that's going to impact them...it's just not apparent...with the clocks she did get that, she could see, I can tell time and she was so excited, so that was one thing she could identify...now I can do something that I couldn't do before...I think if she could have recognized...what this was going to do for her so she could understand it better...maybe it would have made a difference, maybe not.

Kayla confirmed her confusion in her interview, "I don't know why they wanted me to do that, maybe to get faster at the writing, but the tracing I didn't quite understand what I would use that for."

The lack of variety to the tasks and activities in the Arrowsmith program also appeared to reduce Kayla's motivation. The things she liked the most about school were missing. "They need more field trips...they should have a little bit more things instead of the same things every single day...like maybe history and art...because I love history and art."

While the other students interviewed responded very positively to mastering a level and the celebration that ensued, Kayla found the tasks stressful and felt the pressure of increasingly more difficult items and levels. Kayla was used to highly modified materials so she found it difficult to cope with doing academic work through tutoring at LDAS and the intense cognitive tasks in Arrowsmith. "Math was a lot harder, it was a lot different, with flashcards going fast and memorizing...I would kind of forget. It's a lot different than the regular school where you just have them on paper." She described what the process of mastering a level in Arrowsmith programming was like for her, "They'd start short and then get really, really long...you'd have to memorize them and then say them to the teacher three times and I'd get all mixed up...I just felt (sighs)...Oh I'm

done...now I have to go on to the next level." Kayla knew the next level would be even harder for her than the last one.

As Kayla's motivation appeared to decrease due to her reduced connection to her friends from her former regular school, less variety of activities, and lack of understanding of how the cognitive tasks connected to school subjects, her effort and commitment to homework sometimes was affected. Kate related her feelings at the time:

> I think there were definitely times when I thought Kayla was not doing her part in it...beforehand we sat her down and explained to her how expensive it was and how important it was, that we needed her to work her little behind off and do the best she can so that someday she would be able to do what she wants to do...and the little things like hiding the word and tracing sheets...'they forgot to give me the sheets'... I'd look in her room and they'd be stuffed behind the dresser...it was obvious that she didn't want to do it, so she just didn't...so yeah there were definitely times when I was thinking what are we doing this for...she's not even trying, how do you make her try, how do you make someone do something they don't want to do...Kayla is usually really good if you make her work, she works really hard.

Kayla did make friends in the LDAS Arrowsmith program who were mostly younger than her, and she really liked one of her teachers in particular. However, since the other students lived in other parts of the city and because of the age differences it was hard to connect outside of school with the other Arrowsmith students. Kayla liked meeting other students who have learning disabilities. "You definitely get to meet a lot more friends that have the same kind of problem that you do...everyone has the same kind of problem, just in a different way."

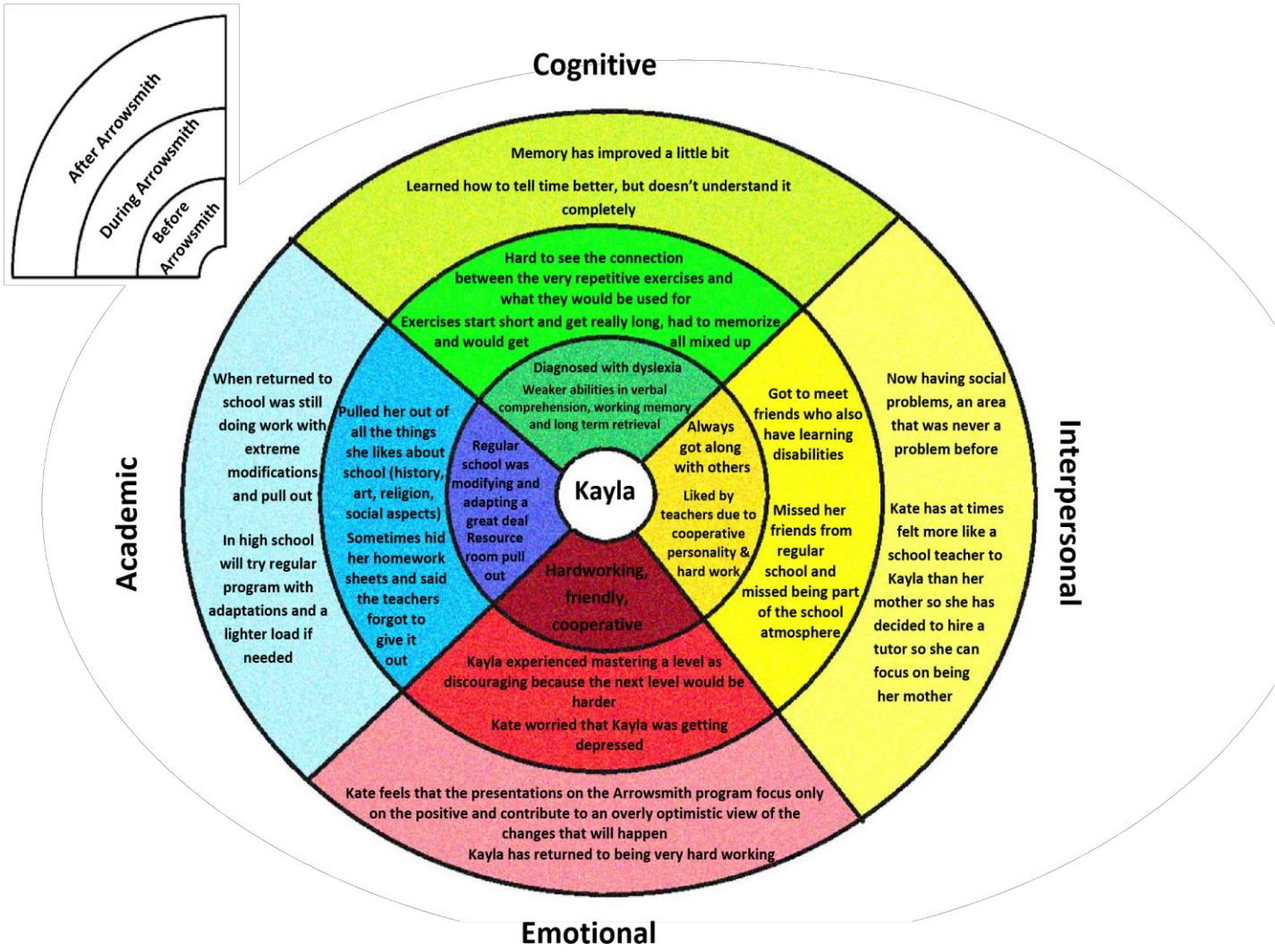

Figure 4.14. Kayla's Circle Graph.

Changes after the Arrowsmith program.

Kayla returned to elementary school after two years of Arrowsmith programming. Her parents moved her to a different school since she was no longer connected socially to her previous school and in the hopes to give her a fresh start. Kayla enjoyed the return to the social atmosphere and greater variety of the school system. However, she no longer fit so easily with the other girls her age since she wasn't interested in boys, hair, and clothes as much as they were. Kayla was put in highly modified programming with a great deal of pullout support. Kate was frustrated since she would have preferred it if Kayla was receiving lower marks with more regular programming.

Kayla believes that her reading skills and memory have improved. She is able to sing along to songs as a result of her increased memory. Kayla can tell the time from an analog clock but she doesn't always understand what it means. Kayla entered high school this year taking regular classes with accommodations such as notes provided and a reader/scribe for tests. Her elementary school had recommended that she take modified classes but Kate wanted to give Kayla a chance to get regular classes with the minimum amount of support to increase her academic options after high school. Kate hired a tutor so Kayla receives the extra support she needs and so she and Kayla can feel more like mother and daughter and less like a teacher and student. After the first semester of grade 9, Kayla has marks in the 60s in her core academic classes and a mark in the 80s in art. Standardized cognitive testing (Figure 4.15.) and achievement testing (Figure 4.16.) scores for Kayla compare her functioning before and after participation in the LDAS Arrowsmith program.

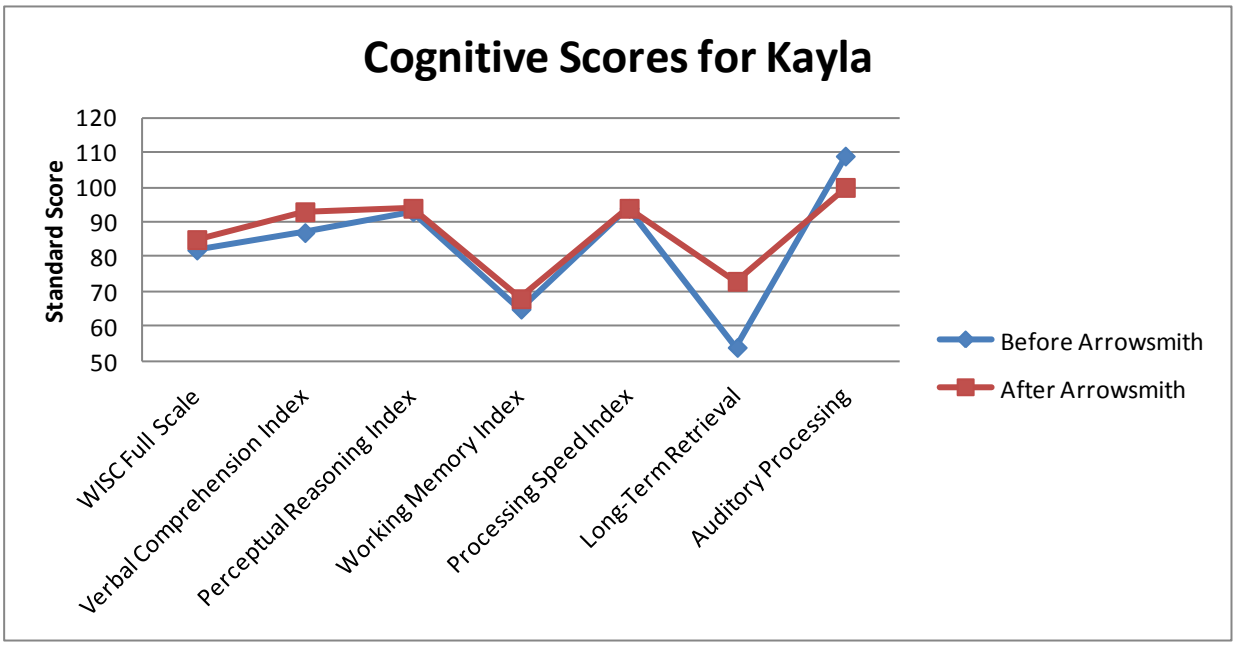

Figure 4.15. Standardized Cognitive Test Results for Kayla. Before Arrowsmith standard scores were obtained prior to September 2008. After Arrowsmith standard scores were obtained June 2010.

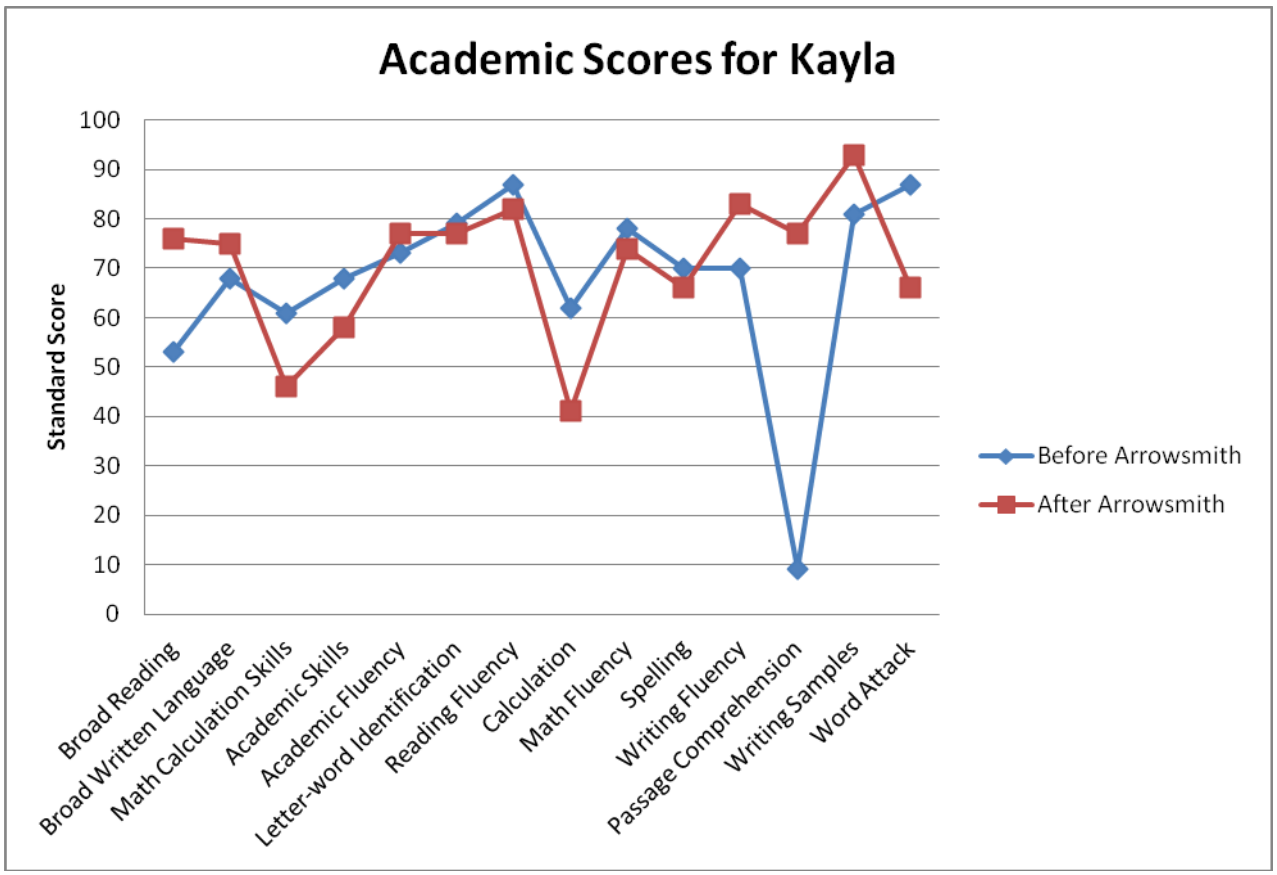

Figure 4.16. Standardized Achievement Test Results for Kayla. Before Arrowsmith standard scores were obtained in August 2008. After Arrowsmith standard scores were obtained in June 2010.

Brooklynn

Brooklynn was quiet and appeared somewhat shy in her first interview with me. She was described by her parents and teachers as being very hard working and kind to others. Her father described her as being especially drawn to helping other children who have special needs. Brooklynn had great difficulty with reading, spelling, writing, and math before she entered the LDAS Arrowsmith program. She disliked reading a great deal and she would have avoided it if her parents were not insistent on making sure she read. Brooklynn was described as lacking in self-confidence and trying to fade into the background. She seemed like a different person in my second interview with her. By this point, Brooklynn had returned to the K-12 school system full time and was attending a new school. She had made friends and was doing better at school. She seemed to be much happier and appeared to have a lot more confidence. A flowchart (Figure 4.17.) and circle graph (Figure 4.18.) depict information gathered on Brooklynn from the interviews and school records.

Brooklynn's parents Keith and Jennifer.

Brooklynn's mother Jennifer contacted me by email to indicate that she and Brooklynn's father Keith would like to volunteer for the study with their daughter Brooklynn. I interviewed Brooklynn first by herself, followed by her parents at my office. Keith and Jennifer are clearly devoted to their children and focus their lives around the well-being of their family. They saw volunteering for the study as a way to express their experiences with Brooklynn and their feeling of hope that a "platform had been built for future growth and development."

Before the LDAS Arrowsmith program.

Brooklynn described her learning disability in this way, "I used to never be able to read fluently...I used to make lots of stupid mistakes...I'd spell really little words wrong...I'd mix them up."

There is no history of learning disabilities in either Keith or Jennifer's families, so Brooklynn's continuing difficulties with reading and spelling caught them by surprise. Before school they had seen Brooklynn, their youngest child, as being their brightest child due to her keen observation abilities and strong visual memory. Keith and Jennifer noticed that Brooklynn was a busy kid but they were not concerned at this point that she may have difficulty in school.

Brooklynn entered kindergarten and she had trouble learning the letters of the alphabet. With assistance at home she knew them by the end of kindergarten. Brooklynn had a really good teacher for grade 1 that had an excellent reputation for teaching kids to read. Even with good instruction she struggled with the pre-primer words and Jennifer spent a great deal of time working on them with her at home. About half way through the year, the grade 1 teacher approached Keith and Jennifer with her concern that Brooklynn's delay in reading may be related to her difficulties with staying focused. She felt that an assessment for ADHD may be needed. An assessment wasn't done at this time because Keith and Jennifer did not want to put Brooklynn on medication. They wanted to try other strategies first and hoped that the problems with reading and focus would improve. At the end of the year, the teacher again discussed her observation that attention issues may be responsible for Brooklynn's falling behind in reading but Keith and Jennifer were not yet ready to go the medication route.

Near the beginning of grade two, the new teacher brought attention issues forward to Keith and Jennifer. This time they took Brooklynn to a doctor who put her on ADHD medication. To the surprise of the teacher and Brooklynn's parents, only a small improvement was made academically. At first they believed that it may be due to the learning she missed in grade 1 when she was not able to focus properly. Keith and Jennifer took Brooklynn for vision and hearing checks that confirmed that Brooklynn did not have problems in these areas. One of their other children had gone for vision therapy to improve their tracking when reading. Since this therapy had been very successful for this child, they took Brooklynn for vision therapy. She made small gains as with other changes but failed to make the big gains Keith and Jennifer hoped for.

In the spring of grade 2 Brooklynn was given her first psychoeducational assessment that put her in the average range on two of the four indexes of the WISC, low average in one, and borderline in another but no learning disability diagnosis was made. Confidence appears to have been a particular issue for Brooklynn prior to her participation in the LDAS Arrowsmith program. A teacher comment on a progress report describes her as trying to go unnoticed and not participating fully in classroom discussions. Brooklynn's file includes teacher comments that indicate she tends to rush, needs to use strategies more consistently, and show her work more. Brooklynn is also described as polite, cooperative, respectful, and showing sensitivity to her classmates.

In grade three, Keith and Jennifer were still searching for a solution to Brooklynn's continued problems with reading and spelling. She was falling further and further behind and required more and more effort to complete her work. Brooklynn was assessed by an audiologist who diagnosed an "Auditory Processing Disorder in the primary area of decoding". A sound field system was put into Brooklynn's classroom that resulted in small gains but again did not fully address her reading difficulties.

Keith and Jennifer described a particularly difficult meeting with the learning assistance teacher in grade three. Jennifer became choked up while telling the story and she asked Keith to take over with the story:

> I will never forget that day sitting across the desk from us, and her saying to us, 'you just basically have to come to the realization that she's going to be in modified programming for the rest of her life...but that's ok, she can still be successful...and I just remember those words...and I've played them through my mind many, many, many times...Brooklynn has got the work ethic and that's how she's got to where she is today...and for us to have categorized Brooklynn as probably our sharpest intellectually and all of a sudden one day...being told that she was going to be in modified programming for the rest of her life...that was difficult to take.

As Jennifer said, "I wasn't ready to pack it in at grade three." Keith concurred that this was not an option for them, "I don't think we portrayed anger at that time but certainly we've become angry and resentful." Jennifer agreed, "I lost a lot of respect for her...I would never say that to a parent."

Figure 4.17. Brooklynn's Flow Chart.

Jennifer was mobilized to do more, "well forget it, we're not quitting...and so we looked into Sylvan...she did a bit of assessment there but we didn't go through with it." They also checked out the Hope Centre (Michael had participated in this program for two months). Then Jennifer met a speech pathologist in Brooklynn's school division who offered to provide Brooklynn with Fast ForWord training on her own time. As Jennifer related, "We bought the program but she delivered it, taught me how to do it, and checked in on Brooklynn...again we saw some progress but it was still a challenge...but by now because she's worked so hard and so long (Jennifer getting choked up while she is speaking) and it's been such a battle for her...already then she wasn't liking reading, this was not anything fun". Keith adds, "And we still battle with her...still to this day she hates reading".

In grade four, Jennifer was spending time everyday reading with Brooklynn and spending lots of time studying for exams:

> She kept going and we kept working hard and we had to spend a lot of time...by grade 4 we're spending a lot of time studying for exams...working with her reading everyday and when studying for exams, we would start at least five to seven days ahead of an exam and we would study a couple of hours every night...she did well...but she had to work really hard.

After grade 4 Brooklynn was enrolled in the ABSee reading program through LDAS over the summer. It was through this program that they heard about the Arrowsmith program that was coming to LDAS as a pilot in the fall.

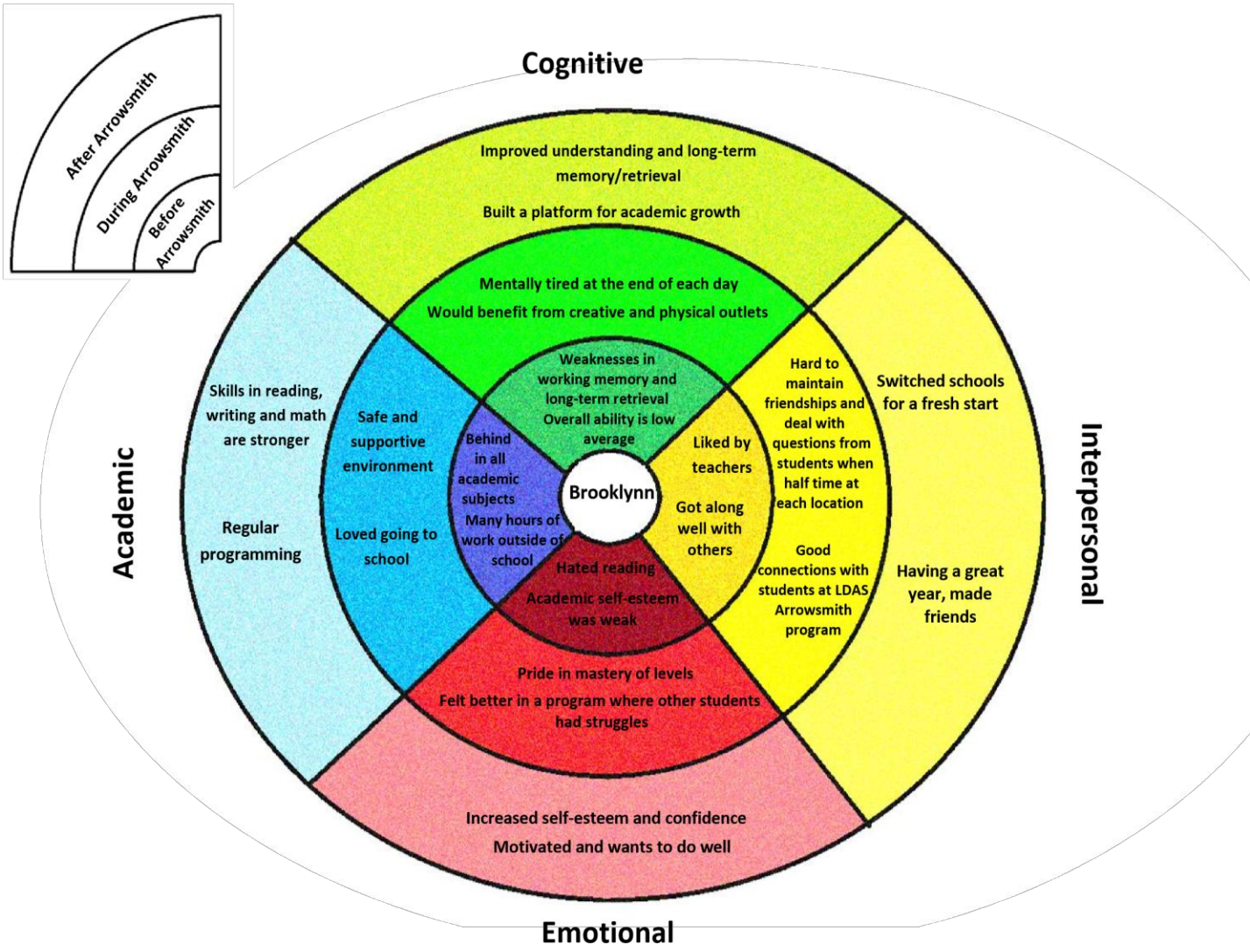

Figure 4.18. Brooklynn's Circle Graph.

During the LDAS Arrowsmith program.

Brooklynn started tutoring in the ABSee program at LDAS shortly before the informational session on the Arrowsmith program was scheduled. They attended the presentation, Jennifer researched the program online (and many others), and she talked to a parent of the Saskatchewan student who had attended Arrowsmith in Ontario. The main reason they chose to put Brooklynn in the Arrowsmith program was:

> Because it's the only program that offers a solution...everything else was just adaptations...you can have someone give an oral exam but that still means she's not doing it on her own and so this was the only thing through everything that I looked through and researched that offered any hope to advance...to help make it a lifelong change for her...(they hoped)...she would become stronger and be able to not need adaptations anymore so that as she progressed through the rest of her elementary school and into high school that she could function like an average student...like everyone else...we don't expect her to be a scholar but we were just hoping that we could just lose that stigma of the low average intelligence score and that she could progress through and go to university if she wants to...she wouldn't be limited.

The financial hardship of attending a privately funded school was not a major consideration for them because:

> There's no price that can be put to it...basically how I've looked at it is because we're frugal with our money...but I've justified it by thinking that the two of us have to work for one more year to recoup what we've spent on this...we retire one year later, big deal, what's one year...we're not socialisers, we don't do the entertainment scene, so yes, it's a hardship but basically everything we do is for our kids...our other kids haven't suffered at all.

Although they had researched the Arrowsmith program and were committed to Brooklynn attending this program, Keith and Jennifer did have reservations about their decision:

> We just decided that because we weren't sure and the program is just starting in Saskatchewan...even though I did know the family that had a child attend Arrowsmith in Ontario, and I knew after talking to them that it was good, there's still that hesitation, and do you pull them right out of school completely, so we thought that we would do just half time.

They were afraid, "that it would be a total flop," or that they might end up feeling "we've just made the problem worse rather than better." Given their reservations and not wanting to take Brooklynn completely away from her social ties to her regular school, they decided to have her attend the LDAS Arrowsmith half time and her regular school half time. This decision involved Keith driving her from one school to the other on his lunch hour. "A big part of it too is...we were fearful of her having no academic structure or training at all...that she would have gained nothing and lost two and a half years of academics."

After the first year, Brooklynn was pulled out of her regular school and she attended the LDAS Arrowsmith program full time. "In hindsight we wish we would have taken her out for the full year (right away)...it was really hard, that adjustment for her to have to come back in the afternoon...she came back during the lunch hour, the kids have already eaten and she ate in the car." Even harder for Brooklynn was the difficulty in maintaining friendships from her regular school when she was not there for the full day:

> Socially she struggled...even though we tried to keep in touch with some kids after school and on weekends and things like that... we had a tough time keeping connections...there weren't many girls that she could really stay connected with...and what didn't help either was in her particular class the group of girls in that room are very cliquey...she was on the outs... her teacher told us that she would come in and look very sad.

Even though socially it wasn't a good atmosphere for Brooklynn at her regular school, it was a very positive atmosphere for her in the LDAS Arrowsmith program. Keith and Jennifer indicated that the teachers treated her very well and Brooklynn made some good friends at Arrowsmith that also made it a safe environment that nurtured her confidence and self-esteem. In the second year, Brooklynn just did full cognitive exercises and "she made some good gains in math even though she wasn't taking it." Brooklynn was tired at the end of the Arrowsmith school day and she thinks it is important for prospective students to know that, "you need a lot of time because of all the homework...it's a lot to commit to." Brooklynn felt happy when she mastered a level in the Arrowsmith program. "Mastering gave her a lot of pride and when she would have her Arrowsmith friends over they would talk about mastering levels...being able to master something was maybe a big deal to those kids because maybe they hadn't been able to master anything before."

Changes after the Arrowsmith program.

Brooklynn's parents consulted her when they made the decision for her to return to school at a grade lower than her school peers. She had been out of the school system for two full years and a half year before that time. They wanted to try regular programming with no supports or accommodations to start with and felt that her skills better suited the early grade. Also, they wanted more time in elementary school before having to make decisions about high school programming. Brooklynn had lost most of the social connections she had to her previous school and returning to a lower grade in the same school would not provide a good atmosphere for her. Instead, they changed her schools and school divisions to separate her from the stigma of her previous school and social difficulties, to give her a fresh start.

Brooklynn is loving school. A friend she knew before starting at the new school took her under her wing and Brooklynn soon had a new group of friends. This improvement in her social situation has been very good for her self-esteem and Brooklynn has been doing well in regular programming. She is passing all of her classes with marks ranging from 50s to 80s in the core academic classes. Brooklynn is doing particularly well in math. Her reading and writing have improved. She is able to read material that she could not have attempted before. Her writing is neater and more expressive.

Brooklynn identifies her improved memory as being responsible for her ability to remember instructions, what things she needs to do, not having to go over material over and over as much, knowledge of times tables, and remembering how to spell words. She understands more with much less work. Her parents feel that the Arrowsmith program has helped Brooklynn build a platform for her to grow academically. She is more confident and has higher self-esteem. Her teacher commented on her progress report that she would like Brooklynn to participate more fully during instruction but she sees improvement in this area. She is described as fitting in well with her classmates, taking initiative to join in, and becoming more outgoing. Brooklynn is noted as having improved in following through and is "slowly learning to break her habit of rushing through her work." Brooklynn did not feel good about her reading and writing skills before she took the Arrowsmith program. She is motivated and wants to do well now that she believes she can. Standardized testing cognitive testing (Figure 4.19.) and achievement testing (Figure 4.20.) scores

for Brooklynn compare her functioning before and after participation in the LDAS Arrowsmith program.

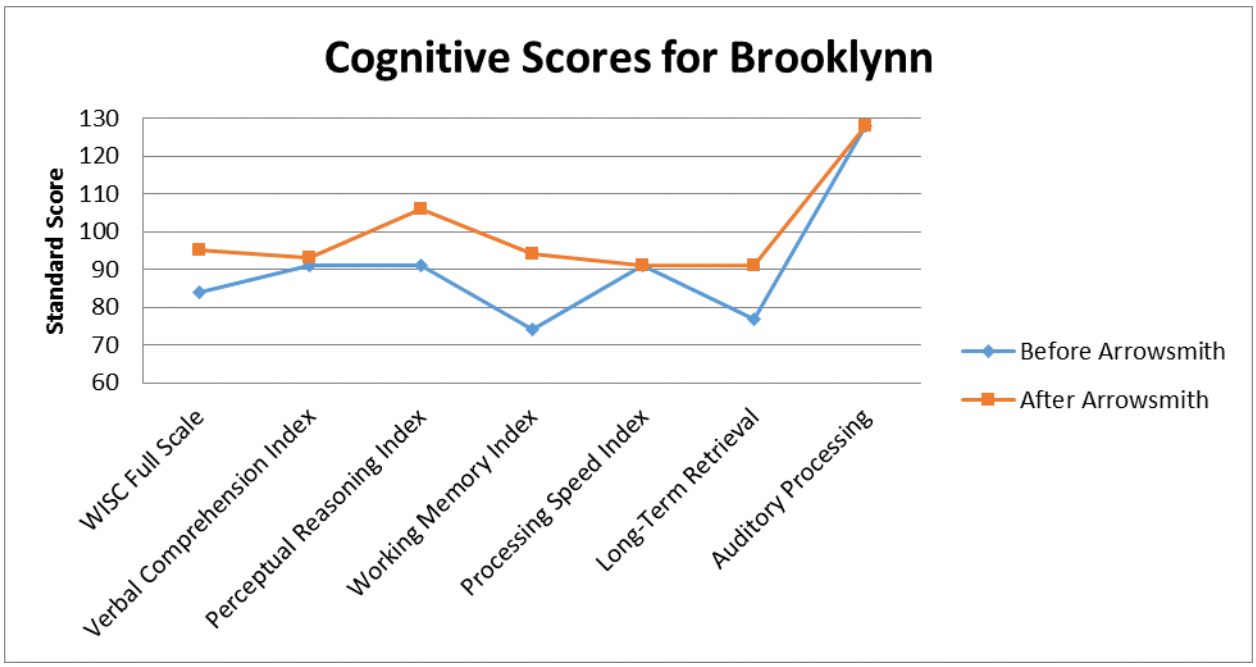

Figure 4.19. Standardized Cognitive Test Results for Brooklynn. Before Arrowsmith standard scores were obtained prior to September 2008. After Arrowsmith standard scores were obtained in June 2010.

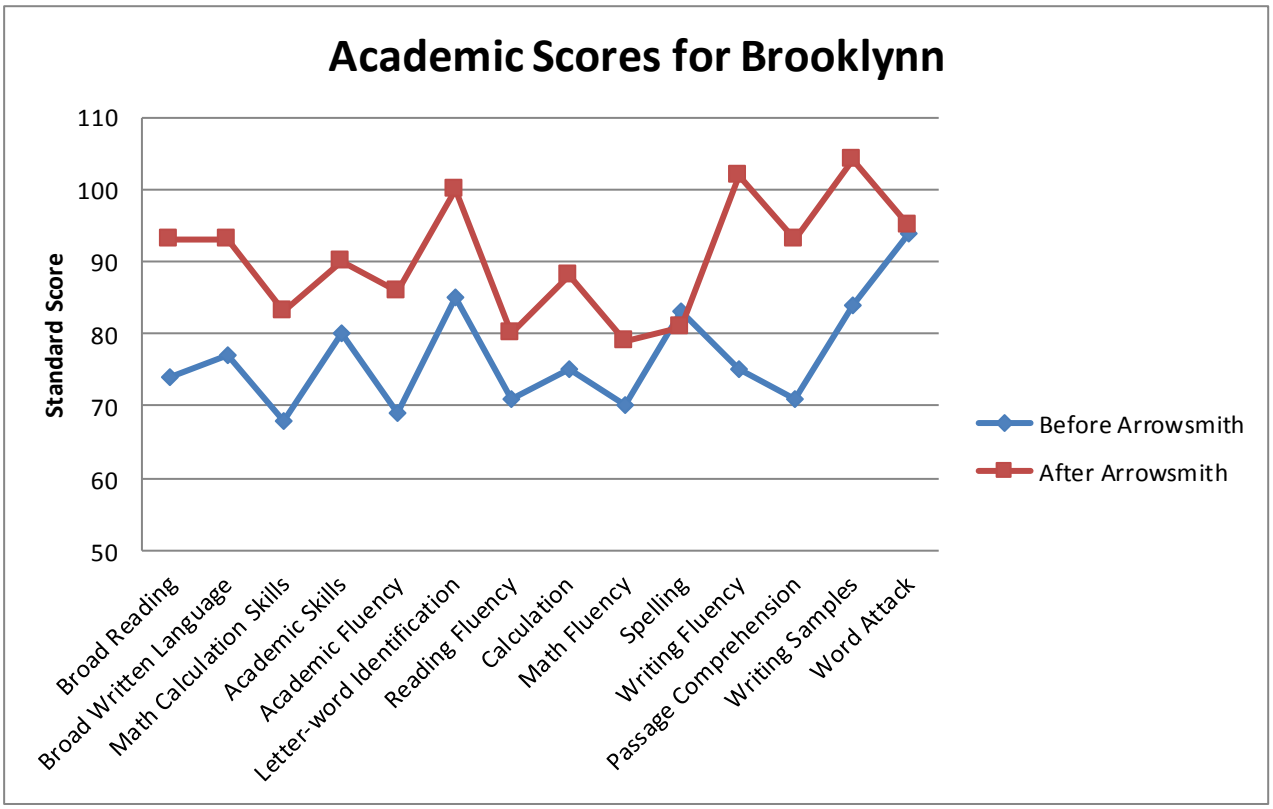

Figure 4.20. Standardized Achievement Test Results for Brooklynn. Before Arrowsmith standard scores were obtained in August 2008. After Arrowsmith standard scores were obtained in June 2011.

Table 4.1.
Comparison of Student Assessment/ Interventions/Treatment/Programming.

LDAS Arrowsmith Student	Speech/ Lanauage Assess/therapy	Assessments	ADHD	Repeated Grade	Resource/ Learning Assistance	Modified/ Adapted Program	Fast Forward	Tutoring	Other
Jim	Yes starting at age 2	Several psych-ed starting age 2 Kinsmen Children's Centre	No	K/1	resource E.A. PPP	Yes	Yes	Yes ABSee	Davis Dyslexia at home, vision therapy, occupational therapy
Michael	Yes starting age 2	Several psych-ed starting kindergarten, MRI, genetic, Autism	Yes (no meds)	K	resource E.A. (grade 4) PPP (grade 6)	Yes	Yes	Yes ABSee	Neurodevel-opmental program, Naturopath, social skills training
Evan	No	Psych-ed grade 2, occupational therapy	Yes (meds)	No	resource PPP (grade 2)	Yes	No	Yes Sylvan	Therapeutic riding, occupational therapy
Kayla	Yes starting age 4	Psych-ed grade 2	Possible (tried meds didn't help)	K	resource	Yes	Yes	Yes LDAS	No
Brooklynn	Audiologist diagnosed Auditory Processing Disorder grade 2	Psych-ed grade 2	Yes (meds)	7	resource	Yes	Yes	Yes ABSee	Vision therapy

Table 4.2.
Cognitive Test Results Before and After LDAS Arrowsmith Program.

Cognitive Processing Scores

Student		WISC Full Scale	Verbal Comprehension Index	Perceptual Reasoning Index	Working Memory Index	Processing Speed Index	Long-Term Retrieval	Auditory Processing
Jim	Before	58	75	60	62	65	59	81
	After	72	85	75	80	68	82	82
Michael	Before	70	73	75	80	75	58	77
	After	84	87	92	88	80	76	84
Evan	Before	96	116	97	81	80	80	91
	After	110	106	123	86	112	100	101
Kayla	Before	82	87	93	65	94	54	109
	After	85	93	94	68	94	73	100
Brooklynn	Before	84	91	91	74	91	77	128
	After	95	93	106	94	91	91	128

= significant increase in standard score = significant decrease in standard score

Note: Before standard scores were obtained prior to September 2008. After standard scores were obtained in June 2010.

Table 4.3.
Achievement Test Results (Composites) Before and After the LDAS Arrowsmith Program

Achievement Scores (Composites)

Student		Broad Reading	Broad Written Language	Math Calculation	Academic Skills	Academic Fluency
Jim	Before	63	53	30	47	56
	After	67	52	43	47	53
Michael	Before	81	66	66	79	59
	After	84	82	54	72	75
Evan	Before	95	75	85	92	88
	After	114	84	103	91	114
Kayla	Before	53	68	61	68	73
	After	76	75	46	58	77
Brooklynn	Before	74	77	68	80	69
	After	93	93	83	90	86

= significant increase in standard score = significant decrease in standard score

Note: Before standard scores were obtained in August 2008. After standard scores were obtained in June 2010 or 2011.

Table 4.4.
Achievement Test Results (Subtests) Before and After LDAS Arrowsmith Program

Achievement Scores (Subtests)

Student		Letter Word Identification	Reading Fluency	Calculation	Math Fluency	Spelling	Writing Fluency	Passage Comprehension	Writing Samples	Word Attack
Jim	Before	67	61	30	60	57	76	77	104	85
	After	79	47	37	68	44	91	58	59	66
Michael	Before	90	74	73	64	78	60	78	73	84
	After	92	75	46	82	84	77	84	98	94
Evan	Before	100	100	89	80	86	86	95	70	94
	After	99	93	75	113	100	88	121	108	103
Kayla	Before	79	87	62	78	70	70	9	81	87
	After	77	82	41	74	66	83	77	93	80
Brooklynn	Before	85	71	75	70	83	75	71	84	94
	After	100	80	88	79	81	102	93	104	95

= significant increase in standard score = significant decrease in standard score

Note: Before standard scores were obtained in August 2008. After standard scores were obtained in June 2010

Research Questions

I am reporting the results that are relevant for each research question (school records perspective, student perspective, parent perspective, and comparison of perspectives) and the themes that explicate these results. Some of the themes apply to all of the participants within the perspective while others apply to just some of the participants. During the analysis process, information from the interviews of Jim, Michael, Evan, Kayla, and Brooklynn were highlighted with a different colour for each student. Jim was given the colour purple, Michael was given the colour blue, Evan was given the colour green, Kayla was given the colour red, and Brooklynn was given the colour yellow. The file folders with the hard copies of the transcripts and other information were also organized with these colours. All of the quotations and important information from the student interviews were coded and organized into groupings of themes

Research Question 1: School Records Perspective.

Based on examination of archived school records and standardized testing information, how has participation in the LDAS Arrowsmith program affected the lives of the students cognitively, academically, emotionally, and interpersonally?

An examination of the school records for each of the five students included: a review of the information in the students' cumulative folders, standardized testing results from the LDAS Arrowsmith program, and any other assessment and progress reports that the parents provided (Figure 4.21). A comparison of this information is difficult because the volume and type of the available information varied between students in the two school divisions represented in the current study and procedures in place in different schools. For example, Kayla's cumulative folder went missing after she left the K-12 system to go the LDAS Arrowsmith program so there is no information on her in this file other than the year of elementary school that she took right after leaving the program. Evan's and Brooklynn's cumulative folders only include information from the last two to three years of attendance prior to entrance to the LDAS Arrowsmith program. Jim's and Michael's cumulative folders are very thick and include much information from kindergarten until the present time. All of the parents provided the progress reports for their children for the end of the first academic semester of 2011-12. All of the children have similar standardized test

results conducted through the LDAS Arrowsmith program and a WISC that was done shortly before entering the program.

Cognitive effects. The standardized test comparisons of the students' cognitive functioning before the LDAS Arrowsmith program and after two years of Arrowsmith programming (full or half time) indicate several statistically significant improvements (Table 4.2). Kayla made a significant improvement in only long term retrieval while the other students made improvements in more than one area. Several teachers comment on the students' improved focus, comprehension, and memory abilities through the progress report comments.

An improvement in cognitive functioning is implied by the increased level of programming and reduced supports that Jim, Michael, and Brooklynn had once they left the LDAS Arrowsmith program. Kayla returned to the same level of modified/adapted programming and supports for one year of elementary school but she was able to take regular classes in high school with resource room support, outside tutoring, and accommodations for her learning disability. Evan had not left his full-time attendance in the program at the time the information was gathered.

Academic effects. The school records and standardized test information (Tables 4.3 and 4.4) show improvements in some areas of academic functioning, academic skills that remained weak or continued to be problem areas, and mixed results through the years of participation in the Arrowsmith program. All four students who have returned to the regular school system are taking a higher level of academic programming with fewer supports.

Emotional effects. The emotional functioning of the students was not measured by testing but is evidenced through an examination of the student cumulative files from their regular schools. These descriptions relate to risk and resiliency factors for these students and are fairly stable throughout the school histories of each student. After participating in the LDAS Arrowsmith program, a shift to more positive comments about Michael's and Brooklynn's emotional functioning appears to occur. On Brooklynn's progress report, her teacher indicates that she is "becoming more outgoing and taking initiative to join in rather than go unnoticed."

Interpersonal effects. The interpersonal functioning of the students was not formally tested but progress reports and teacher comments provide information on this area. The progress report and teacher comment information on the interpersonal functioning of Jim, Kayla, and Brooklynn was consistently positive. Evan is seen as having strong social skills with his peers but weak

organizational and time management skills before and during his first two years of participation in the LDAS Arrowsmith program. Michael continues to have interpersonal and behavioural difficulties after having attended the LDAS Arrowsmith program but the teacher comments on his progress reports indicate an improvement in how his interpersonal skills are perceived.

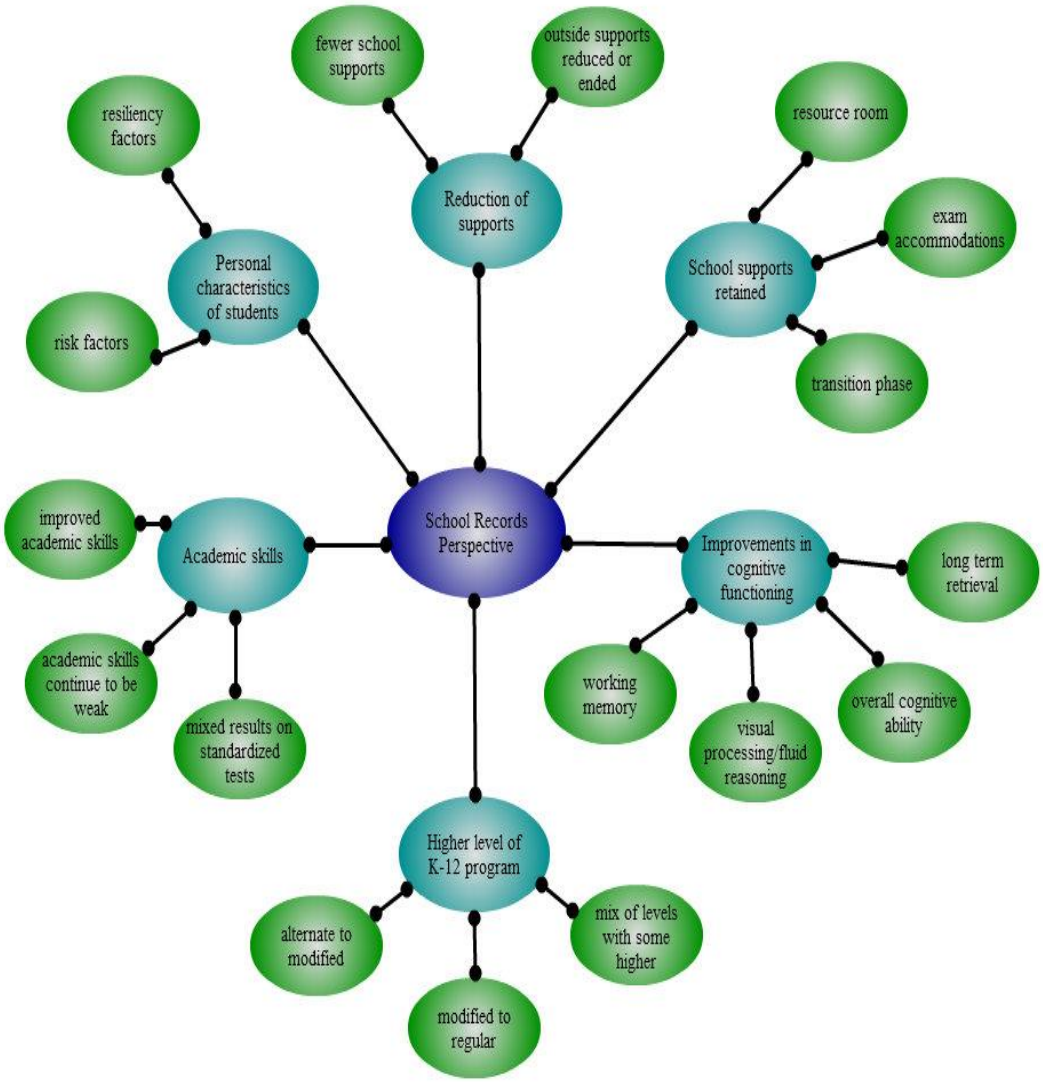

Figure 4.21. School Records Perspective Concept Map.

Theme 1: Improvements in cognitive functioning. Most of the information on cognitive functioning improvements comes from the standardized testing conducted at the LDAS Arrowsmith program after two years of programming when compared to the test results taken before the students entered and at the beginning of their program. The most commonly mentioned cognitive improvements mentioned in progress reports in the student cumulative files were focus and memory.

Given the small numbers for comparison, the differences in the before and after cognitive scores on the WISC and WJ-III (table 4.2) were judged to be significantly improved or decreased if the new score was outside of the confidence interval at the 95% confidence level (standard error of measurement). In other words, it is unlikely that the scores would be different from each other by chance alone.

Long Term Retrieval (ability to efficiently access information from long term memory), as measured by the WJ-III Tests of Cognitive Ability was the only area that significantly improved for all five of the students in the current study. In fact, this was the only cognitive area measured by standardized tests that improved for Kayla. This result appears to be consistent with Kate's feeling that Kayla was not making as much progress as many of the other students in the LDAS Arrowsmith program. All of the students, other than Kayla also increased in their Full Scale IQ scores and Perceptual Reasoning index scores on the WISC-IV. None of the students made significant gains in Auditory Processing as measured by the WJ-III Tests of Cognitive Ability.

Jim, Michael, and Brooklynn made significant gains on the Working Memory index of the WISC-IV. Jim and Michael also made significant gains on the Verbal Comprehension index of the WISC-IV. Evan actually had a significant decrease on this index. Perhaps this decrease is related to being less focused on reading and academic work for two years. Evan was the only student who made a significant increase on the Processing Speed index of the WISC-IV. This increase could be affected by Evan starting ADHD medication after he entered the LDAS Arrowsmith program. Of the seven comparisons being made, four of the five students made significant improvements in four to five of the areas. Brooklynn is the only student who now tests in the average range in all seven areas. The other students all have at least one area that is still below average.

Theme 2: Higher level of academic programming. When the students' level of program in the K-12 system is compared from before the students entered the LDAS Arrowsmith program to

when the students returned to the K-12 system full-time, all four of the students who have returned are now taking a higher level of studies than they previously had taken. Jim and Michael are taking a mix of regular and modified classes (with Jim taking an individualized alternate math). Kayla and Brooklynn are taking regular classes. Evan had not yet returned to academic programming.

Theme 3: Academic skills. Information on the academic skills of the students was gained by a combination of standardized test result information comparing the students' functioning at the start of their participation in the LDAS Arrowsmith program and after each year of participation in the program, marks on progress reports, and comments on progress reports.

Mixed results on standardized achievement tests. Michael and Kayla had a combination of increases and decreases in scores on the WJ-III (table 4.2 and table 4.3). They both scored lower on the math and overall basic academic skills composites. Michael scored higher on writing and academic fluency. Kayla scored higher on reading.

Improved academic skills. All of the students improved in at least one academic area based on an examination of the school records. Brooklynn scored higher on all of the WJ-III Achievement composites. Evan scored higher on all of the composites except for writing. Jim's teachers comment on his improvement in reading and ability to participate more fully in classroom discussions. They remark that he is able to read more independently. Jim's WJ-III Achievement scores did not significantly change even though his mother, his teacher, and Jim himself observe that his reading has improved.

Academic skills continue to be weak. All of the students have at least one academic area that continues to be below grade level. Jim, Michael, and Kayla are still below grade level in all areas. Brooklynn still has weak spelling and is somewhat weak in reading and writing. Evan continues to have weak spelling and writing skills.

Theme 4: Reduction of supports. All five students have reduced supports at the present time when compared to the level of supports they had before they entered the LDAS Arrowsmith program. In some cases, this reduction is due to the parents recognizing that they have done as much as they are able to change the cognitive and academic functioning of their children. The search for solutions has for the most part ended and the focus is more on acceptance and moving forward with the positive changes that have been made. Evan has continued in the LDAS

Arrowsmith program because his parents see the potential for further growth in the areas of written language, spelling, and working memory.

Fewer school supports. Brooklynn is the only student of the five that is not receiving any supports or accommodations in the K-12 system. Jim continues to be put in classrooms that have E.A. support but he does not have an E.A. specifically assigned to him anymore. All of the four students who have returned to the K-12 school system full time have reduced academic supports through the resource room and in their regular classrooms. None of the students are still participating in special programs such as Fast ForWord at school.

Outside supports reduced or ended. Parents are still providing support for their children outside of school for homework and studying but all of them are less involved than they previously were. In Kayla's case, Kate has hired a tutor so she can return to a parent role and not need to spend so much of her time as a teacher to Kayla. Michael's mother Sandy has experienced the greatest reduction of the support she provides. Other than tutoring and parent support, none of the students are involved in special programs outside of school to increase their cognitive or academic functioning.

Theme 5: School supports retained. Three of the four students that have returned to the regular school system have required some level of school supports to be retained. In Kayla's case, her school supports have been altered and she is receiving tutoring outside of school as well. The focus for her has switched from remediation to accommodation for her weak reading and this has worked well for her.

Transition phase. Most of the students who have returned to the K-12 system still have some supports or accommodations in place. Evan has not returned yet but his parents are anticipating that he may require some support or accommodations when he returns. Dave and Angelina feel that it is likely that a transition phase will be necessary to ease the change between the two programs. Brooklynn is currently not receiving any supports or accommodations at school. She did say though that it took a while to get used to doing the same thing as everyone else in the class and being in much larger classrooms again. Keith and Jennifer have asked the school to not intervene if she struggles so she can work it out on her own or with some assistance at home. They planned at the outset to keep an eye on things with Brooklynn's teacher in case she did need minimal supports.

All of the parents of the children who have returned to the K-12 system put a great deal of thought and consideration into the transition phase between the LDAS Arrowsmith program and the K-12 system with respect to the level of supports and accommodations that their child would need and should have. A common thread through all of the parents was their wish for their child to have less supports that they previously had. Emily was assisted by the counsellor to get Jim into classes with supportive friends and teachers who would be a good match for him. Michael was put in regular classes that in some cases were changed to modified when it was apparent that Michael needed some extra supports in place. The minimum level of change was made to reduce his stress and frustration. Kayla was started in high school with regular classes on a trial basis even though she had not taken regular programming in elementary school.

Resource room. The most common support still in place for the students is resource room support. Of the four students who have returned full time to the K-12 system, three of them started back to school with at least one period of resource room assistance per day. Kayla received much more pull out than the other students during her year of elementary school but since she has entered high school she has taken just one period of resource room assistance with regular classes. Jim and Michael also have one period of resource room assistance a day in high school. It is not known at this time if Evan will require resource room assistance but it is very possible that he will not need this support.

Exam accommodations. Three of the four students who have returned to the K-12 system have received some level of exam accommodations. Jim has access to educational assistant or resource room support for exams and needs a reader/scribe. Michael does fewer items and has shorter assignments. His exams have fewer items and he is given fewer options for multiple choice tests.

Kayla receives a reader/scribe for her exams in regular classes. Brooklynn is not receiving any exam accommodations. Evan may need a scribe if his writing skills do not improve after his fourth year in the Arrowsmith program.

Theme 6: Personal characteristics of students. The progress and assessment reports in the students' cumulative folders contain a great deal of information on personal characteristics of the students that mitigate their ability to progress academically and cope with their academic struggles. These personal characteristics can be placed overall under risk and resiliency factors.

Risk factors. All of the students in the current study have the obvious risk factor of having learning or cognitive disabilities and/or ADHD. All of the students other than Evan had speech or language difficulties. Significant struggles in school, as all five students have experienced, put individuals at risk for emotional, behavioural, interpersonal, and employment difficulties in addition to the obvious barriers in educational pursuits. The main categories of risk factors that were identified through the examination of the school records were issues related to: confidence, independence, focus/attention, effort/work habits, motor skills, social skills, and emotional/behavioural problems.

Resiliency factors. All of the students in the current study have resiliency factors that have helped to mitigate their learning difficulties. Some of the students have a greater level of innate or early developed resiliency and other students have gained strengths through their participation in the LDAS Arrowsmith program and experience of returning to the K-12 system with a higher level of participation. The key resiliency factors for the five students are: hard worker, cooperative, social skills, independence, focus, and attaching value to learning. Jim and Kayla have only positive personal characteristics noted on file. The only weaker areas mentioned for them have to do with academic skills and cognitive processing.

Research Question 2: Student Perspective.

The second research question focused on the information gathered from the two semi-structured interviews with each of the five students who participated in the case study (Figure 4.22).

> From the perspective of the students, how has participation in the LDAS Arrowsmith program affected the lives of the students cognitive, academically, emotionally, and interpersonally?

Cognitive effects. A review of student interview information indicates that all of the students identified an improvement in their memory. This improvement is substantiated through a comparison of the standardized test information that was gathered before they started the LDAS Arrowsmith program and after two years of participation. Jim, Michael, Evan, and Brooklynn made statistically significant gains in working memory. Jim, Michael, Evan, and Kayla made statistically significant gains in long term retrieval. Brooklynn was retested on long term retrieval after three years and had made a significant gain in this area at that time. Focus, comprehension,

telling time, and thinking speed were also mentioned as cognitive areas that improved by at least one of the students. These identified cognitive improvements were also consistent with the information gathered from standardized testing and school records.

Academic effects. All of the students identified at least one academic area that they felt had improved and all of them also identified at least one academic area that they felt had not improved or was still a problem area for them. The academic areas of reading, writing, spelling, and math were all mentioned by at least one student for improvements and continued difficulties and the area mentioned depended on the particular student.

Emotional effects. The interviews of the students gave some information on the emotional functioning of the students. Michael, Evan, and Kayla talked about the lack of variety or repetitiveness of the tasks. Evan felt bored at times and Kayla longed for other subjects such as art and history that she had enjoyed in her regular school. Jim, Michael, Evan, and Brooklynn talked about the feeling of pride and excitement when they mastered a level and got to move up to the next one. Kayla experienced mastering a level as stressful and discouraging.

Interpersonal effects. Several changes in interpersonal functioning were identified by the students. Several students mentioned that they felt comfortable in the LDAS Arrowsmith program and enjoyed meeting other students who also had learning disabilities. One of the students who attended the program half-time felt uncomfortable returning to their regular school in the afternoon and being asked questions about why they did not attend in the mornings. Some of the students missed having friends their own age or at their regular school.

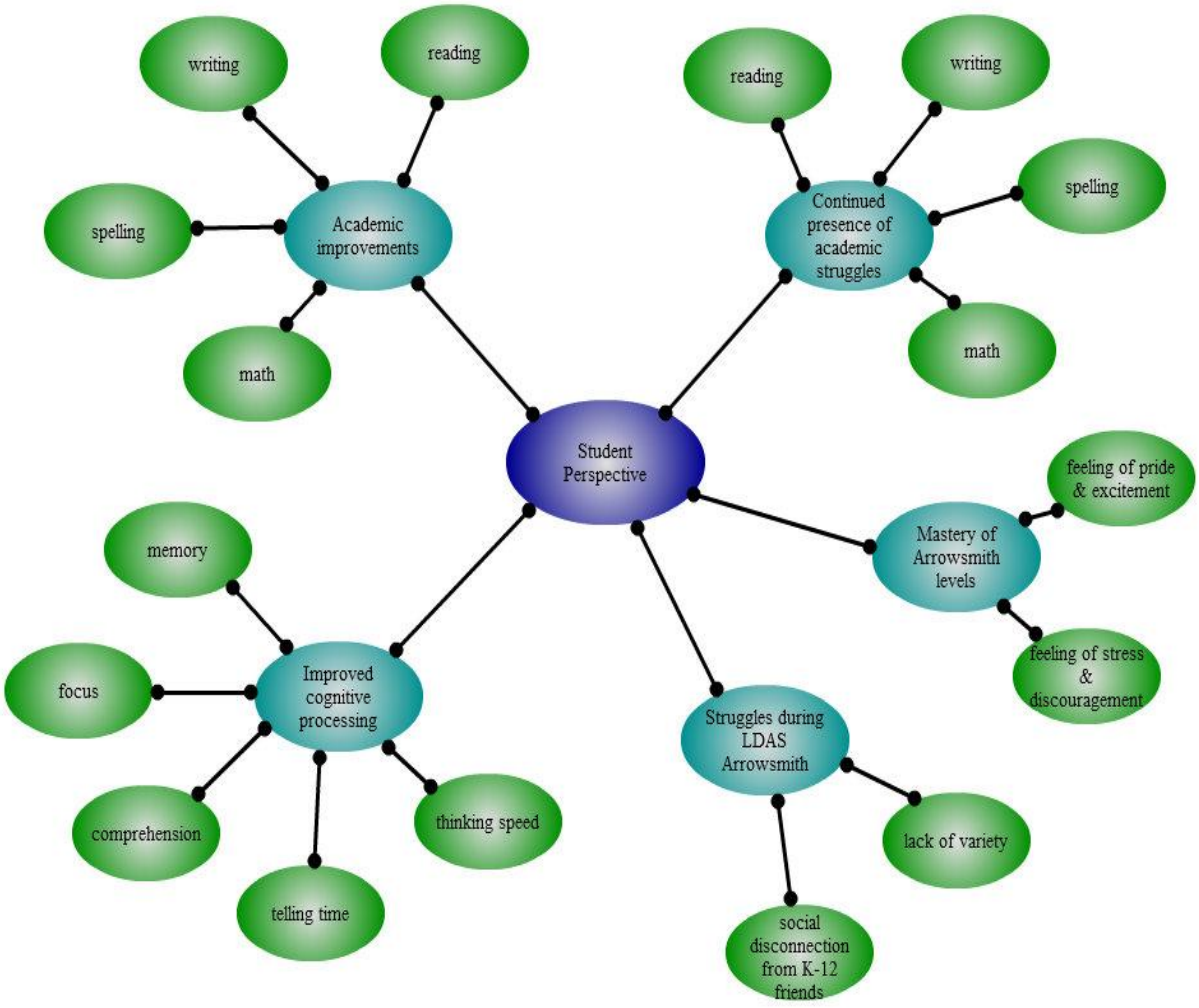

Figure 4.22. Student Perspective Concept Map.

Theme 1: Academic improvements. First, all five students identified academic areas that they felt improved through participation in the program. These academic areas varied between the students but regardless of these differences, every student believed that they had improved in at least one academic area.

Theme 2: Continued presence of academic struggles. Second, another common theme for all of the students was the continued presence of academic struggles in at least one important area. None of the students felt that their academic problems were entirely fixed. The areas that students continued to struggle in were different for the different students.

Theme 3: Improved cognitive processing. Third, all of the students identified at least one important cognitive functioning area that they felt they had improved. All of the students believed that their memory ability is now stronger than it was when they entered the LDAS Arrowsmith program. It is interesting that long term retrieval was the only cognitive processing area that all five students showed increased scores on standardized testing that was outside the standard error of measurement (beyond what might happen by chance alone). Some of the other areas that were mentioned by one or more of the students but not all of them were: focus, comprehension, telling time, and thinking speed.

Theme 4: Mastery of Arrowsmith levels. All of the students except for Kayla talked about the pride and excitement they felt when mastering a level in the Arrowsmith program. Kayla felt anxious and discouraged in relation to mastery of the levels.

Theme 5: Struggles during the LDAS Arrowsmith program. Three of the students talked about struggles related to participation in the LDAS Arrowsmith program. Two of these students found it very difficult to maintain the social connections from their previous school in the K-12 system. One of the students wished the Arrowsmith program had more creative and interactive tasks and another student sometimes found the exercises to be boring and repetitive. Three of the students discussed the safe environment of the LDAS Arrowsmith program and the friendships they made there with other students who has similar learning challenges to the ones they face.

Research Question 3: Parent Perspective.

The third research question focused on the information gathered from the two semi-structured interviews with the parents of the five students who participated in the case study (Figure 4.23).

> From the perspective of the parents, how has participation in the LDAS Arrowsmith program affected the lives of the students cognitive, academically, emotionally, and interpersonally?

The mothers of Jim, Michael, and Kayla were interviewed for the study. Both parents for Evan and Brooklynn participated in the interviews. The parent interviews were much longer than the student interviews. This difference is not surprising based on age, the students having learning disabilities that affect some aspect of language, and the time/expense/emotional investment of the parents. As well, the parents received the volunteer request and were likely the main driving force in the parent and student volunteer participation.

Cognitive effects. The parents identified a variety of cognitive processing improvements and persistent difficulties. Interestingly, the parents did not focus on the cognitive processing area when discussing their children's experience in the LDAS Arrowsmith program. They tended to describe an overall increase in their child's potential in life related to overall cognitive gains.

Academic effects. All of the parents other than Kayla's mom saw improvements in the reading ability of their children and some of them saw improvements in other academic areas. All of the parents identified one or more academic area(s) that continued to be weak or did not improve. The parents of the four students who had returned to the regular school system indicated that their children were now taking academic programming at a higher level with fewer supports.

Emotional effects. All of the parents described the emotional environment at the LDAS Arrowsmith program as safe and supportive. Most of the parents indicated that their children were more self-confident and happier after having participated in the LDAS Arrowsmith program. The parents were very concerned about the possible effects on the self-esteem of their children when choosing the LDAS Arrowsmith program. Besides improving the self-confidence and happiness of the participants, two of the students improved in emotional control. Two of the students experienced an emotionally difficult time when they became socially disconnected from their peers at their regular schools. One of the mothers worried that her daughter was getting depressed. In

most cases the parents chose to switch schools when their children returned to the K to 12 school system so their children could have a fresh start.

Interpersonal effects. The parents' observations concerning the interpersonal/behavioural functioning of their children included new difficulties related to attending a school separate from their regular school peers. Most of the parents felt that their children had social/behavioural strengths in areas such as cooperation, hard work, friendliness, kindness, and ability to mediate conflicts between friends before they entered the LDAS Arrowsmith program that stayed consistent during and after their participation. Several parents felt that the LDAS Arrowsmith program had helped their children improve their self-reliance and decision making ability.

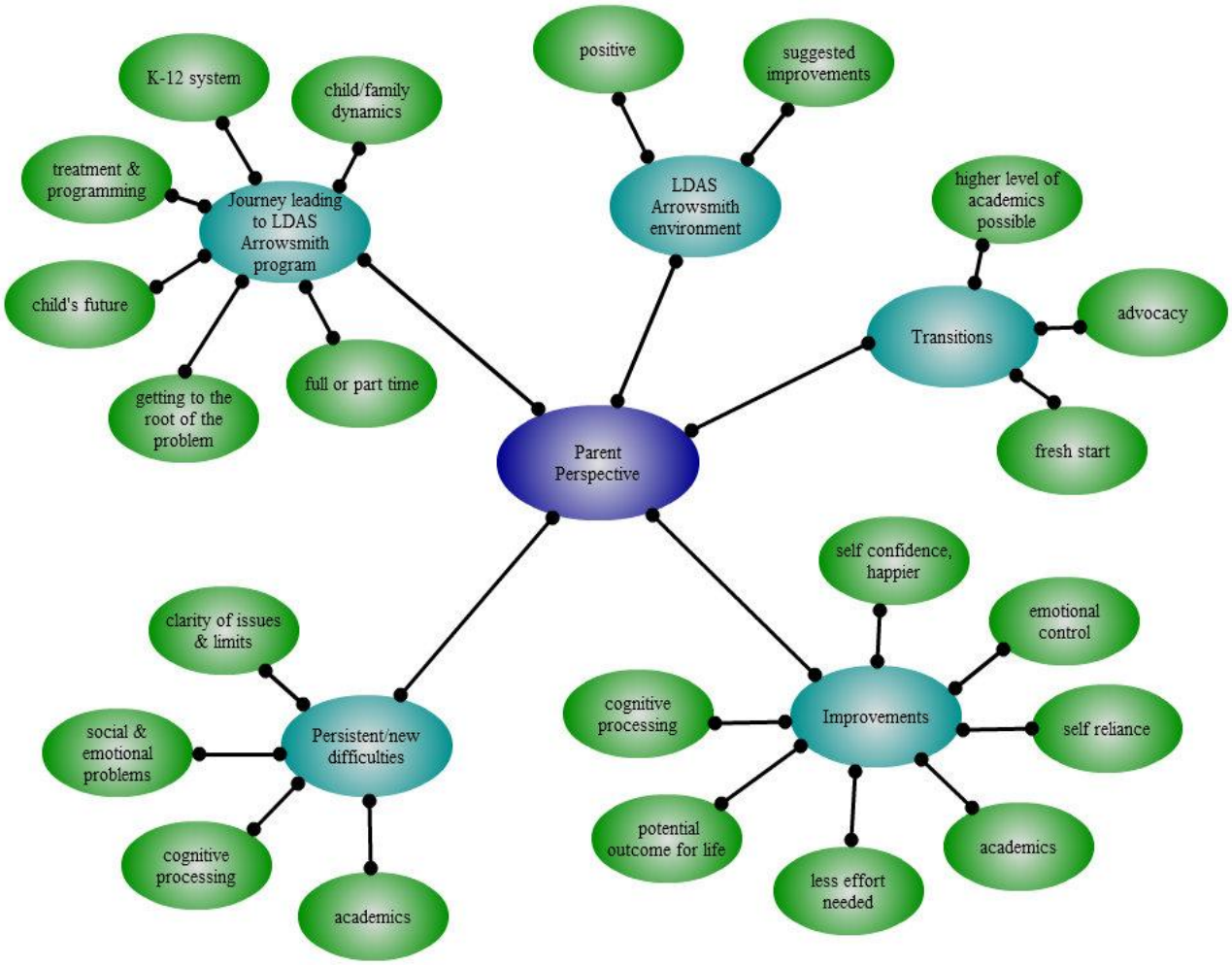

Figure 4.23. Parent Perspective Concept Map.

Theme 1: Journey leading to LDAS Arrowsmith program. First, the parents spoke of the journey they and their children have experienced that led them to choosing the Arrowsmith program. All of the parents discussed the struggles, stress, and difficulties related to being a student with a learning disability and/or ADHD in a mainstream classroom and parents of children with these struggles. All of the parents devoted a great deal of time outside of school to assisting with homework, studying for tests, and implementing or assisting with extra treatment programs to help their child improve their academic performance.

Child and family dynamics. The personal characteristics of each student and the parents, birth order, and family environment influence the impact of the learning disability on the family. The personal characteristics of the child with a learning disability or ADHD, their parents, and the family can be viewed as elements of resiliency as well as risk factors that influence outcomes in a dynamic way.

Risk factors. All of the children had significant struggles in school and had been diagnosed or identified as likely having a learning disability and/or ADHD that would be an obvious risk factor for each of them. These learning disabilities differed at least somewhat in type and severity which tempered the level of risk factor related to their disabilities.

Social difficulties are a major risk factor for children and probably even more so as children enter adolescence. The Arrowsmith program does not address social difficulties directly because it is a cognitive training program that focuses on strengthening weak cognitive functions. Increasing cognitive functions such as reasoning and focus may indirectly help the students improve their social functioning.

Resiliencyfactors. Resilience is a process where children make positive adjustments to adverse conditions (Luthar &Zelazo, 2003, p. 510). Four of the students had strong social ties to their K-12 schools before entering the LDAS Arrowsmith program and were well liked by teachers because of their polite, pleasant personalities, positive attitudes, and hard work.

Several parents described their children as “hard workers” and said that they “didn’t give up.” Jim continued to work hard despite how little progress he made in school and with his reading. His strong work ethic in the face of minimal progress is unusual. The high value he placed in doing his best and in reading compensated for the low expectancy of success that he must have had and that led to his frustration with his brain.

When their children wanted to avoid the work or give up, the parent's level of tenacity and commitment was put to the test. All of the parents were strong advocates for their children and were willing to spend a great deal of time providing academic support. All of these parents have experienced receiving recommendations or feedback from teachers or other school personnel that was difficult to hear or that they disagreed with. In some cases, they were able to work with the teachers to meet their child's needs but in other cases they needed to stand up for their child, potentially putting them in conflict with their child's teachers or other school staff.

Another resiliency factor that Jim and Michael were noted for is a "passion for reading." Even though they both struggled to do well in this area, they both wanted to read well. The other three students tended to avoid reading because it was difficult or boring.

'Getting to the root of the problem.' All of the parents experienced a stage of trying to 'get to the root of the problem.' The parents were often put in a role of being an explorer or researcher to get to the heart of the learning problems their child was having. At the start of their journey, one problem was identified and was initially seen to be the only issue their child had. This identification then led to other problems and contributing factors being identified when their child made minimal or no gains when changes were made to their programming or appropriate supports were put in place. Part of the reason for the several stages of identification involved the differences in the approaches or areas of assessment by professionals such as speech and language pathologist, audiologists, physicians, psychologists, psychiatrists, occupational therapists, teachers, etc. For example, when I was reading Brooklynn's audiologist report that identified an "Auditory Processing Disorder in the primary area of decoding", I felt that I likely would have likely diagnosed her with dyslexia (a reading disorder). Neither of these diagnoses is necessarily more or less correct and they do not include her other diagnosis of ADHD.

Dreams for their child's future. During the assessment process and the experience of participating in the LDAS Arrowsmith program, the parents embarked on a journey that increased their level of acceptance of their child's limitations. It is not easy for parents to modify the dreams they have for their children and they want to make sure that they have provided the tools or environment to maximize the potential and happiness for their children. The parents were concerned about the stigma that having a learning disability and needing special supports and accommodations would bring to their children. At the heart of this journey, the parents are

concerned for the future and options their children will have. From a practical standpoint, this will be difficult for students with moderate to severe learning disabilities to do in today's society where achievement of a grade 12 has become relatively standard and postsecondary education qualifications are not that unusual. A related issue to their child's future is a fear that ultimately their children will not be independent and they may have to care for or take care of their children for the rest of their life.

Treatment/intervention/programming. All of the parents in the current study put their children in multiple programs outside of school and their children received additional supports in the school system. All of the parents researched online and considered a variety of other programs in their search for answers. None of the programs and supports eliminated the problem entirely. Some of the programs helped significantly, some of them helped a little bit, and some of them did not help at all. The learning disabilities that their children were dealing with were severe and comprehensive enough to not allow a quick fix or clear-cut answer. The Arrowsmith program, seemed like that answer to many because it was global and promised a chance for their children to be "like other children" who did not need academic supports. All of the parents were willing to sacrifice a great deal to make this happen.

Kindergarten to grade 12 school system. The experiences of the parents through the K-12 system were varied. All of the parents talked about at least one teacher that was particularly helpful and positive and in many cases this teacher was their child's grade 1 teacher. This experience helped the parents see that the difficulties their children faced were not caused by poor or inadequate instruction. Despite these positive experiences, all of the parents felt that their child's ability and skill levels were higher than the standardized test scores indicated. Several of the parents related experiences when teachers used test results to indicate that their children could not take regular classes. The experiences of these parents indicate a need for more education for teachers and parents in the meaning and use of student test scores.

Decision to do full or part time in the LDAS Arrowsmith program. Some of the parents found it more difficult to decide on whether their child would attend the LDAS Arrowsmith program full or part time than whether or not they would put their child in the program. The major considerations appear to have been the potential social and self-esteem effects of taking their child away from their friends in the K-12 system, the inconvenience or possibility of transporting their

child back and forth between the two locations, some caution or skepticism for the program, and removing their child completely from academic programming. Two of the five students were in the LDAS Arrowsmith program full time in the first year and the other three attended half time with the other half of their time in the K-12 system. Two of the three students who started as half time switched to full time after one or two years in the LDAS Arrowsmith program.

Theme 2: LDAS Arrowsmith environment. All of the parents discussed the environment of the LDAS Arrowsmith program. The comments can be grouped into positive statements and suggestions for improvements.

Positive. All of the parents made positive comments about the LDAS Arrowsmith program environment and the teachers for the classroom. Even Kate was adamant in emphasizing that she felt the teachers at LDAS did everything they could to support Kayla. All of the parents felt that the program provided an emotionally safe program that was encouraging and that nurtured their child's self-esteem. Participating in a program that included students with similar programs to their own was helpful to many of the students. Having the tasks set at a level designed to be challenging but at each student's level was also helpful. The class size was very small and the teachers were very encouraging and positive. The structured nature of the program was also helpful to several of the students who struggled with focus. Direct instruction is helpful to most students with learning disabilities and was provided by the Arrowsmith cognitive tasks

Suggested improvements. Most of the suggested improvements for the program involved the location of the program that provided little opportunity for the children to play outside or engage in physical activity inside. Many of the parents feel that it would have been easier for their children socially if the program were offered in the K-12 school system so they didn't need to make a choice regarding full or part time participation that potentially cut their children off from their K-12 social group and involved the difficulty of transporting their children between two locations. The stigma of attending a special program within the school may have made things difficult as well. Of course, the financial hardship of having their child in a program with private fees would be removed or greatly lessened if it was offered in the K-12 school system. Two of the parents also discussed how they felt bad that they were able to afford the Arrowsmith program for their children but many others who could benefit could not afford it. Jim also had this concern for the children with learning disabilities who would not have the chance to take the Arrowsmith program like he

had. An increase of variety in the program through more physical activity, field trips, and creative pursuits such as art was also suggested to break up the intensity and potential boredom factors in the Arrowsmith program.

Theme 3: Improvements. The parents, like their children, saw improvements for their children as a result in their participation in the LDAS Arrowsmith program. The parents included a broader range of improvement areas than the students did and they often emphasized areas other than the cognitive and academic domains. Kate felt that Kayla had made small improvements in some areas but felt that the improvements did not match the negative impacts on Kayla and their family such as the social disconnection of Kayla from her K-12 friends, the financial burden, on their family, and the time invested in this intense program. However, the parents of the other four students felt that major improvements had been made in multiple areas. The Arrowsmith program had not proved to be a complete fix of their child's difficulties but significant progress had been made in the areas of: cognitive processing, academics, less effort being needed, self-reliance, emotional control, self-confidence or happiness level, and potential outcome for life.

Cognitive processing. Brooklynn's dad Keith expressed his feeling that Brooklynn's participation in the LDAS Arrowsmith program had cognitively built a platform for her future academic learning. The improved cognitive processing areas mentioned by parents were memory, focus, expressive language, ability to tell time, processing speed, decision making, and overall capacity for learning. Although all of the parents mentioned at least one cognitive processing area that had improved, this was not particularly an area that parents focused on.

Academic skills. The improvements in academic skills that parents saw were varied. Kate did not mention any academic skill as having improved for Kayla. The other parents all mentioned reading as an area of academic improvement. Some saw improvements in math. Neatness of writing was often mentioned and some saw an improvement in written expression. Spelling appeared to be an area that had made little to no progress in most cases.

Less effort needed. Several of the parents mentioned that their child needed to expend less effort to do their academic work since they have participated in the LDAS Arrowsmith program. The parents in these cases have also required less effort to provide academic support and make their children do their school work. It was a huge relief to have more time for other activities and it reduced the tension and conflict in some of the families that noticed this change.

Emotional control. Emily was the parent who identified emotional control as a major area of improvement for Jim. He exhibited a greater level of maturity and ability to think things through. This change resulted in his being less reactive and making better decisions.

Self-reliance. Emily and Sandy both felt that participation in the LDAS Arrowsmith program had increased Jim and Michael's level of self-reliance or independence. Although self-reliance was a trait that Jim previously had, it is more developed now that he had the cognitive focus and increased processing speed to formulate a plan of action. Michael started the LDAS Arrowsmith program highly dependent on his mom Sandy. He made the largest gains in self-reliance and these gains alter the potential for his life.

Self-confidence/happier. Four of the five students made improvements in self-confidence and are happier now that they have participated in the LDAS Arrowsmith program. Kayla appeared to be less happy than she was previously due to the social problems she experienced. All four of the students who experienced an improvement in their self-confidence and their happiness, reacted favourably to mastering the various levels of the individualized cognitive tasks they were working on. Kayla was the only one of the five students who experienced this mastery in a negative way. All of the students saw improvements in their cognitive and academic skills that led to increases in their self-confidence. The increase in self-confidence then improved these students' motivation which led to more success and progress.

Another factor that likely contributed to an improvement in happiness was that the stress and pressure of keeping up with homework that the student was not able to do without a great deal of parent intervention was substantially removed. Although the Arrowsmith program has approximately one to one and a half hours of homework a night, it does not require parental intervention other than making sure the students do it.

Potential outcome for life. Given the improvements that the parents saw in their children in cognitive, academic, emotional, and interpersonal areas, it is not surprising that all of the parents except for Kate saw a greater potential outcome for the life options for their children. This is not to say the Kate was settling on less for her daughter. Instead, she pushed for accommodations and supports so that Kayla could take regular programming in high school. After her first semester of high school, Kayla was successfully taking regular classes with supports at school and outside of

school. The other three students who had returned to the K-12 system were taking higher levels of programs than they had previously been recommended to take.

Theme 4: Persistent/New difficulties. It was clear from the interviews with the parents that although most of them felt that their children's lives had been changed for the better, none of them felt that their children's difficulties had been completely eliminated.

Clarity of issues and limits. For several of the parents, their child's participation in the LDAS Arrowsmith program helped them to clarify issues with their child's learning difficulties or their child's limits. Emily has accepted that Jim's academic skills are now as strong as they are likely to get. Kate has turned her focus on providing tutoring outside of school and advocating for exam accommodations such as a reader/scribe for Kayla. The areas that the parents saw as having continuing or new problems included: cognitive processing, academic skills, and social/emotional functioning.

Cognitive processing. All of the students made gains in some cognitive processing areas but the parents recognized that their children still had difficulties in some or many areas. Jim's overall cognitive ability was greatly improved but it is still very weak, particularly in the areas of memory and processing speed. Michael has improved in most areas but he still has difficulties with focus. Evan still has below average working memory ability but his other processing abilities are average or higher. Kayla's mom Kate acknowledged that Kayla had made improvements in some areas but her processing speed and memory abilities were still very weak. Brooklynn's parents asked for the long term retrieval area to be retested after three years because this was the cognitive processing area that was still below average after two years. Keith and Jennifer noticed improvements in Brooklynn's memory that showed in her ability to remember verbal directions and these observations were confirmed when she was retested in this area. She was the only student who did not have a below average cognitive processing area after three years.

Academic skills. All of the parents related academic areas that their children were still below grade level in. The students in the LDAS Arrowsmith program have been out of the academic stream, other than some English and math tutoring in some cases, for two to three years so some lag in academic skills is likely. Jim and Michael both have some modifications to their current academic studies and Kayla receives accommodations to go around her reading and spelling

problems. Keith and Jennifer fought to have Brooklynn re-enter school one grade below her age peers because this grade more closely matches where her academic skills are in most areas.

Social and emotional problems.

Two of the students experienced social disconnection from their peers at their regular school. In one case the difficulties have persisted, while the other student is doing well socially now. Another student is friendly but has difficulty with social skills and maintaining friendships that have persisted. The LDAS Arrowsmith program is quite small (under 15 students) and has students of many ages, including adults. The students in the program are supportive of each other but some students miss having friends of the same age and gender.

Theme 5: Transitions. All of the parent interviews addressed the theme of transitions. The parents conceptualized transitions at several levels.

Transition to the LDAS Arrowsmith program. Parents were concerned about the transition of their children into the Arrowsmith program. In fact, for Emily it was the major issue to contend with. She had no hesitation with the Arrowsmith program itself but did not want Jim's social standing at his K-12 school to be affected and was concerned about how the transition to the LDAS Arrowsmith program would affect his self-esteem. Kayla's and Brooklynn's parents also were concerned about the social ramifications of the transition to the LDAS Arrowsmith program and made a plan at the beginning to have frequent sleepovers on the weekends to keep their children in touch with their K-12 friends. In these two cases, their best efforts did not prevent social disconnection from their K-12 peers even though Kayla was strong socially. Michael did not have a strong connection to his peers from his K-12 school and was experiencing difficulty there socially so the main consideration in this case was not overloading Michael's ability to focus with the demanding cognitive exercises. Evan does not appear to have experienced social disruption in his first two years attending the LDAS Arrowsmith program part-time and he was comfortable with the switch to full time in his third year.

Transition back to full time kindergarten to grade 12 studies. All of the parents, of course, wanted their children to take academic programming at a higher level than they were previously taking. Emily and Sandy met with some resistance because their sons had been labelled as having cognitive disabilities through at least some intelligence tests prior to entering the LDAS Arrowsmith program. Many of the parents wanted a 'fresh start' for their child that did not have

the stigma attached to their previous school difficulties and social disconnection from their former peers. Most of the parents opted to send their children to different schools or school divisions when they returned to the K to 12 school system. Jim and Michael automatically changed schools because their transition out of the LDAS Arrowsmith program coincided with their entry into high school. Brooklynn's parents Keith and Jennifer changed to the other school division to give Brooklynn a fresh start away from the peer group that she was now disconnected from. They also advocated (with Brooklynn's support) for Brooklynn to re-enter a year lower than her age peers to better match where she was at academically and to give her more time to prepare for the transition to high school. Evan has not yet returned to the K-12 system but his parents are worried about putting him back in. They expect that there will be a transition period where some supports may be necessary at least to start with. Dave and Angelina are considering a change to the other school division to give Evan a fresh start.

Advocacy. Advocacy became a significant role for each of the parents of the five participants studied here. How successful their attempts at advocacy were played a role in the parents' decisions to put their children in the LDAS program. Without parent advocacy, Jim and Michael would definitely be in alternate studies in high school and would have likely taken functional academic programs in elementary school. Without parent advocacy, Kayla and Brooklynn would both be taking modified or greatly adapted programs in the K-12 system. Evan's parents realize that they will need to advocate for some supports for Evan when he returns to the K-12 system. In the past, they found that accommodations such as a scribe for exams was not consistently given and they are worried that the schools want to help but are not organized enough to make it happen on a regular basis. The parents interviewed in the current study were strong advocates for their children. There are many parents who have children with learning disabilities and/or ADHD who do not have the resources, assertive personalities, or knowledge to similarly advocate for their children.

Research Question 4: Comparison of Perspectives.

The fourth research question focused on comparisons of the information gathered from the school records/standardized test results and interviews with the students and the parents.

How does the information on the perspectives of the students and parents compare and contrast with each other and with the information from the archived school records and standardized test results with respect to cognitive, academic, emotional, and interpersonal areas?

Cognitive effects. There are several consistencies and differences among the perspectives related to how cognitive functioning was affected by participation in the LDAS Arrowsmith program. All of the students identified memory as an area that they felt had improved and the standardized test results indicate that all five students made significant improvements in long term retrieval. Jim, Michael, and Brooklynn also significantly improved in working memory. Only Kayla and Brooklynn's parents mentioned memory as an improved cognitive area for their children.

The parents of Jim, Michael, Evan, and Brooklynn identified overall cognitive ability or capacity to learn as an area their children improved in and the standardized test results show significant improvements in the Full Scale intelligence scores on the WISC-IV for all four of these students. The students did not mention overall cognitive ability in their interviews. All of the students who had returned to regular schools were taking a higher level of academic classes than they were able to before participating in the LDAS Arrowsmith program. Kayla required an increased level of accommodations and tutoring in order to do so.

Several other cognitive processing improvements were mentioned in the interviews. Jim and Michael both mentioned that their ability to focus had improved. Michael's mother also indicated that Michael's ability to focus had improved. Jim and Michael's significantly improved working memory ability on the standardized tests best reflects this improvement. Jim and Michael's mothers identified decision making as a cognitive improvement but Jim and Michael did not mention this area. Both of these students had significant increases in all of the cognitive processing areas measured by the standardized tests except for processing speed. Decision making involves the use of executive functioning and fluid reasoning in particular. Jim and Michael's increased focus, memory, verbal comprehension, and fluid reasoning abilities are related to their improved decision making that their mothers observed. Jim identified comprehension as an area of cognitive improvement for him but his mother did not mention comprehension. Jim did score significantly higher on the Verbal Comprehension index of the WISC-IV and was now in a higher level of programming at school with fewer supports.

Academic effects. All of the students identified at least one academic area of functioning they felt they had improved in through participation in the LDAS Arrowsmith program. Jim identified reading and writing as areas of improvement but only the writing area shows a significant improvement on the standardized testing after three years of participation. Teacher comments from the school records though, refer to Jim's improvement in reading and Jim's mother strongly believes that Jim has improved in his reading ability. Jim identified math as an area he still has major difficulties in and this observation is consistent with the standardized tests and school records. Jim's mother has come to the conclusion after his participation in the LDAS Arrowsmith program that Jim will never progress beyond his current level in math. Jim is now taking an individualized, alternate math class in the resource room.

Michael identified an improvement in writing and continued difficulties in math that are consistent with the standardized test results and school records. He made significant improvements on standardized achievement tests on overall written language and academic fluency and his calculation skills decreased. Before participating in the LDAS Arrowsmith program, Jim and Michael would have been placed in alternate programming in high school. They are both taking a combination of regular and modified classes other than the individualized math at an alternate level that Jim is taking.

Evan identified math, spelling, and neatness of writing as areas of improvement but he also mentioned spelling and writing as areas he still has difficulties with. On the standardized tests, Evan showed significant improvements after three years in overall reading and math and in academic fluency. His scores in spelling and writing did not improve significantly but neatness is not a factor in the scoring.

Kayla identified an improvement in her reading that is substantiated by significant improvements in reading comprehension and overall reading on the standardized testing. Her mother did not identify any improvements in Kayla's academic skills. When Kayla returned to a regular school after two years of participation in the LDAS Arrowsmith program the level of supports she received and the level of modification/adaptation to her programming was similar to what she had prior to her participation. When she entered high school a year later though, she was able to take regular classes with appropriate accommodations such as having notes provided, a reader/scribe, resource room support, and outside tutoring.

Brooklynn identified an improvement in reading and writing but was not sure if her skills in these areas were strong enough for regular classes. She felt confident that she was ready for regular studies in math but felt that her spelling had not improved as much. The standardized test results show significant improvement after three years in overall reading, overall writing, and academic fluency. The areas of math and spelling had not improved significantly. Brooklynn's parent felt that she had improved academically in all areas but spelling. They saw the LDAS Arrowsmith program as having provided Brooklynn with a platform for learning. Nevertheless, they knew that her academic skills were at least one grade below her age peers and she would need supports if she entered at their grade level. Given the current trend discouraging retention, her parents needed to convince the school board that Brooklynn's situation justified an exception to this trend. Brooklynn was ready to work very hard so she could take regular studies without supports in the school and was successful in doing so.

After the two years of participation for Michael and Kayla and three years of participation for Jim, Evan, and Brooklynn, every student improved significantly relative to their age peers in at least one academic area. Jim and Kayla made the fewest significant increases on the standardized achievement tests. Evan and Brooklynn made the most significant increases on the standardized achievement tests. Michael increased in several areas but was the only student to show a significant decrease relative to his age peers (on the calculation subtest of the WJ-III).

Emotional effects. The student, parent, and school records/standardized testing perspectives were compared and contrasted to gain insight on how participation in the LDAS Arrowsmith program affected the emotional functioning of the students. Jim, Michael, Evan, and Brooklynn all felt their self-esteem and self-confidence were increased as a result of their participation. The experience of mastering levels for the cognitive tasks led to a feeling of pride and accomplishment. The parents of these students also felt that participation in the program had increased the happiness, self-esteem, and self-confidence of their children. There was no formal testing of emotional functioning to compare but the student cumulative files of Jim, Michael, and Brooklynn all have comments from teachers on progress reports that indicate observed improvements in self-confidence. Kayla and Kayla's mother Kate both mention that participation in the LDAS Arrowsmith program was stressful for Kayla. The experience of having made a small amount of progress relative to the time and money investments and hopes of success was a stressful

one for Kayla and her parents. Kayla's school cumulative file does not mention emotional functioning that is different from before she entered the LDAS Arrowsmith program.

Interpersonal effects. The student, parent, and school records/standardized testing perspectives were compared and contrasted to gain insight on how participation in the LDAS Arrowsmith program affected the interpersonal functioning of the students. Jim, Evan, and Kayla were described by themselves, their parents, and through the teacher comments on the student cumulative files as being friendly, respectful, and socially skilled. Kayla and Brooklynn were described by their parents and the school records as being kind and caring. These interpersonal characteristics were maintained after participation in the LDAS Arrowsmith program. A major consideration for most of the parents when choosing to put their children in the program was the potential impact this change would have on the social connections their children had with their peers from their regular school and the possible effect on their self- esteem. Michael's mother was not concerned about this issue because Michael was having social difficulties at his regular school and was more accepted in the emotionally safe environment of the LDAS Arrowsmith program. Kayla and Brooklynn experienced disruption to the social connections they had at their regular schools that affected their happiness and self-esteem. Kayla's situation improved a year after leaving the LDAS Arrowsmith program while Brooklynn's situation improved after moving from half-time to full-time Arrowsmith programming and then once she re-entered the school system to a different school.

Michael, Kayla, and Brooklynn's parents chose to change schools so their children could get a fresh start with a new peer group after they left the LDAS Arrowsmith program. Evan's parents were considering the same change when he returned to school. Jim continued with his supportive peer group throughout his Arrowsmith programming so he had no reason for a fresh start since he would continue to need supports at school as well.

Common theme (all perspectives) 1: Improvements. All of the perspectives indicate the presence of at least one improvement related to participation in the LDAS Arrowsmith program, including Kayla for whom the experience of participation was not overall a positive one.

Cognitive processing. The student, parent, and school records perspectives all discuss improvements in the area of cognitive functioning. Some improvement is noted for every student

but some of the students appear to have made much larger gains than others. Every student mentioned that they believed they had improved in their memory ability. All five students made standard score gains in long term retrieval ability beyond the standard error of measurement. Many, but not all of the parents mentioned memory as an area of cognitive improvement in their interviews.

Other cognitive processing areas that were identified as having improved by the students were thinking speed, focus, and comprehension. Several students mentioned that they can now tell time. The parents discussed specific cognitive functioning improvements less than the other two perspectives. They often pointed to the benefits of improved focus, memory, and comprehension such as the ability to make better decisions and be less emotionally reactive. The parents emphasized the overall improvement of cognitive functioning and the positive feeling they have that a permanent change has been made to the brain that provides a platform for further learning and development and ultimately changes the potential outcome for their child's life. The standardized cognitive processing tests are varied for each student but the areas that improved for at least some of the students were overall cognitive functioning, visual processing/fluid reasoning, working memory, and processing speed. The student cumulative folders in some cases mention some of these cognitive processing areas. Memory, focus, and comprehension are mentioned most often.

Academic skills/performance/programming. Academic improvements are a common subtheme of the student, parent, and school records perspectives but the specific improvements noted depend on the particular student. The Arrowsmith program itself does not include academic instruction so all of the students were reduced in their exposure to academic instruction for two to four years. Many of the students felt that their reading had improved and some of them indicated an improvement in writing and/or math. Only one of the students felt that their spelling had improved. The parents saw improvements in some academic areas as well but none of them noted an improvement in spelling. The parents variously saw improvements in reading, writing, and/or math.

Improvements in academic skills were evidenced through standardized achievement tests for all of the students except for Jim. The most common academic improvements on standardized achievement tests were overall reading, overall written language, and academic fluency of basic

skills. All of the students are now taking studies at a higher level than they previously had been. All of the students have fewer academic supports or programming in place than they previously had. The only outside support in place for most of the students was parent support. Kayla has tutoring outside of school to reduce the demands of parent support. Many of the students and their parents now expend less effort but gain more results academically.

Other improvements. The parents were more likely than any other perspective to mention improvements other than those related to cognitive functioning and academic skills/programming/supports. The students did not mention this area at all other than to say that the improvements in their academic skills made them "feel good." The school records information in the student cumulative files contain only two occasions where improvements not directly related to cognitive processing and academics are mentioned. Jim is described as being more joyful and gaining in independence now and Brooklynn is described as becoming more outgoing and more comfortable with group participation.

Parents put a great deal of emphasis on the self-confidence and happiness improvements they saw in their children. They often related this change to the structure and individualization of the Arrowsmith cognitive tasks that were designed to push the limits of the students' capabilities and then celebrate the successes they accomplished through hard work and persistence. The safe and encouraging environment at LDAS was also seen as a major factor related to the improvements they saw in their child's self-confidence and happiness. Most of the children experienced less stress and pressure while in the Arrowsmith program than they did in the K-12 system. Most of the parents emphasized the importance to them that the changes were to the brain and therefore permanent. In all cases except Kate, they saw changes that have changed the potential outcome of their child's life.

Common theme (all perspectives) 2: Persistent/new difficulties. The student, parent, and school records perspectives all indicated that some of the difficulties that were present prior to the students' participation in the LDAS Arrowsmith program were still present after re-entering the K-12 system or after 3 years of Arrowsmith programming. Some of these persistent difficulties were reduced in their level and others had not significantly changed. In some cases, the social disconnection from the student's friends from their former or part time K-12 system school led to new social problems that were not a concern previously.

Academic skills. The only area that all three perspectives mentioned as having persistent difficulties was that of academic skills. Although all of the students identified at least one academic skill that they felt had improved, they all had some skills that they knew had not improved at all or that they were still not confident and fully competent in even though the area was stronger than it formerly was. The area that parents were most often concerned with was spelling as they in most cases felt this area had improved the least. In educational interventions such as phonics programs, spelling is also the last skill to improve and it often remains impaired at some level. A comparison of the standardized achievement test results from the start of the LDAS Arrowsmith program and the point at which the student finished this program (2 or 3 years) or the end of three years for Evan, shows below grade level achievement for every student in at least one area.

Cognitive functioning. Their child's participation in the LDAS Arrowsmith program helped many parents clarify the issues present for their child and the limits of their child's skills in some areas. Many of these parents 'came to terms' with their child's persistent difficulties, knowing that they had done everything possible to increase the cognitive processing of their child. These parents have shifted their focus to advocating for the presence of accommodations and supports at school and home to maximize the potential their child has.

Social/Emotional difficulties. The area that some parents and students identified as a new difficulty area was related to the social disconnection that some of the students experienced when they left their K-12 school completely or attended this school half time only. These parents tried to maintain the social connections with their children's friends through sleepovers but this tactic was ultimately unsuccessful. It was hard to build connections with the LDAS Arrowsmith students outside of class because of the different ages and areas of the city that students lived in. The inclusion of more interactive, creative, and physical activities may lessen the social isolation that some of the students felt. Many of the parents believe that having the Arrowsmith program part of the K-12 schools would reduce the social disconnection some of the children experienced. Friendships and social relationships with one's peer group are particularly important in later elementary school and high school. One of the students wanted to return to their regular school after three years in the LDAS Arrowsmith program which made it difficult for his parents to make the decision to have him continue for another year.

Common theme (parent and school record perspectives) 3: Risk/Resiliency factors. The parents and the school records, through assessment and progress reports, both identify risk and resiliency factors in the personal characteristic of the students and their environment that influenced the experiences and progress of their children in the LDAS Arrowsmith program and in many cases, the other areas of their lives.

Risk factors. An examination of the student cumulative folders was enlightening relative to student risk factors. In many cases, the risk factors identified in the files were very similar to the risk factors identified by the parents in their interview. All of the students had risk factors related to their learning disabilities, speech problems, motor skill problems, and/or ADHD that they were born with. These difficulties resulted in academic skill deficits and struggles that set them apart from the other students in their classes and increased the level of supports and modifications/adaptations they required that most of the other students did not. By the end of grade 1, three of the five students had repeated a grade and had experienced being left behind by their age peers.

Other risk factors identified through the parent interviews and school records include a lack of confidence or frustration with one's learning ability, poor work habits/organizational skills, weak social skills (only for Michael), and difficulties with attention and focus. Birth order may have played a role in how long it took to identify that a learning disability existed. The eldest child in a family does not have a readily available reference point until they reach school while later born children will stand out more when they exhibit learning difficulties. The difficulties of a child who is a different gender than the first born child may be identified later because the parents might place too much emphasis on gender to explain the difference. Being the only child in the family with learning difficulties presents a risk factor for many children, this risk can be magnified when the other sibling(s) have stronger than average learning ability and academic skills. Several of the children in current study were passed in some skills by their several years younger sibling before they reached school.

Several of the parents felt that when their children were stressed, the teachers would respond by increasing the modifications to their programs. Although they realized that their children were functioning below grade level, they did not want their children to leave elementary school without the skills to be able to take regular classes in high school.

Resiliency factors. The parents and school records identified several significant resiliency factors that improve their child's experience in school and in other aspects of their life. Four of the students had good social skills and personal characteristics that led to other people liking them. Several of the students were described by their parents and teacher comments in the cumulative folders as being hard workers. This characteristic appeared to be a major resiliency factor for these students. Other student resiliency factors given by the parents or the student records included independence, ability to focus, and attaching value to learning. A major asset for the students in the current study is having parents who are strong supports and advocates for their children. These parents maintained high level of support for their children in the face of little gain and in some cases, discouragement from some teachers in the schools or lack of cooperation in providing accommodations to improve the academic success of these students. All of the students came from families who had enough financial resources to pay for their child's participation in the LDAS Arrowsmith program and for many other supports outside the school system to help their children succeed.

Chapter 5: Discussion

In this chapter I will propose reasons why one student in the case study experienced much smaller cognitive and academic achievement gains and had a less positive experience as a result of participation in the LDAS Arrowsmith program than the other four students in the case study who experienced much larger cognitive and academic achievement gains and had a more positive experience as a result of participation in the LDAS Arrowsmith program. Rival explanations for the case study results and limitations of the research will then be discussed The current case study confirms some of the research in the areas of cognitive development theories, neuroplasticity and brain-based education, CHC theory, and the Arrowsmith program. I will connect the findings of my research that confirm previous research in these areas. Given that very little research in neuroplasticity and brain-based education uses qualitative methods to gather evidence, some of the findings that I obtained are new or unexpected. The implications of the current case study for individuals and programs working with children/young adults with learning disabilities and their parents and recommendations for teachers, school psychologists, schools/school divisions, parents, and the Arrowsmith program will then be discussed. As well, I will recommend future directions for research based both on the findings and limitations of my research. I will conclude with a personal reflection of my research findings and conclusions.

Reasons for Differences in Outcomes

Results indicated that four of the five students had overall positive experiences in the LDAS Arrowsmith program and attributed their participation in this program as leading to improved cognitive, academic, emotional, and interpersonal functioning. Jim, Michael, Evan, and Brooklynn's parents were happy their children had participated in the LDAS Arrowsmith program and felt that their children had made permanent changes that would potentially change the course of their lives in a positive direction. They all felt that their children now had more options to have a happy, successful life.

For Kayla, smaller changes were observed and her mother felt that the time and money investment did not match the level of improvements Kayla made. Although the experience of participation in the LDAS Arrowsmith program was not entirely negative, the overall experience was not seen as a positive one in this situation. Kemp-Koo's (2010) research provides confirmatory

evidence of the perceived difference in changes between Kayla and the other students. Kayla made a significant improvement in long term retrieval after two years of participation in the LDAS Arrowsmith program (that was outside the standard error of measurement) but the other students made more improvements than she did. Kayla did significantly increase in the achievement areas of passage comprehension and overall reading after two years of participation but she made no other significant changes in achievement scores. The limited change in academic skills is not surprising given that Kayla was attending the LDAS Arrowsmith program full-time and this program focuses on cognitive training and not academic instruction. What is concerning is that Kayla's cognitive functioning, using recognized standardized tests, showed only one cognitive processing area with a statistically significant gain after two full-time years of cognitive training. Kayla experienced new emotional and interpersonal difficulties as a result of her participation as well that contributed to her mother feeling that the experience was overall not positive.

Why did Jim, Michael, Evan, and Brooklynn have much more positive experiences through their participation in the LDAS Arrowsmith program than did Kayla? This was a question that Kayla's mother Kate has wrestled with, as did I. What were the differences between Kayla and the other students that might explain their different outcomes and allow future parents and individuals with learning disabilities to make more informed choices on whether or not the Arrowsmith program is right for them or how to avoid the difficulties that Kayla and some of the other students had?

Kate wondered if Kayla had a different learning disability than the other students that might explain why she didn't make the same level of progress. This explanation does not match the available information on the students who participated. Brooklynn had a similar learning disability to that of Kayla but her progress was much stronger. Kayla's overall cognitive ability was also similar to Brooklynn's and much higher than Jim or Michael's. Age and maturation do not appear to be factors because Kayla was similar in age to Jim and Michael. Kayla, like the other students in the LDAS Arrowsmith program found the environment to be safe and supportive and she enjoyed interacting with other students who had learning disabilities like herself.

Experience of mastering cognitive task levels.

One of the major differences between Kayla and the other students in the LDAS Arrowsmith program was her experience of mastering levels with the cognitive training tasks. The other four students enjoyed the feeling of accomplishment and the special attention they received when they attained mastery of a level. These students had rarely felt successful and responded positively to programming that was individualized to be at a challenging level based on their own functioning and not that of their peers. Kayla experienced mastery of the cognitive tasks as a stressful process where her memory problems resulted in anxiety and confusion as the tasks increased in difficulty level. She knew that mastering a level would lead to moving on to even more difficult tasks. She did not see the completion of a level and the recognition she received as a positive event as a result. The tasks themselves and the rate at which they were progressing appeared to be at a higher arousal level than optimal for her. It is possible that this higher than optimal arousal level and lack of perceived positive reinforcement resulted in the program having less impact for Kayla. Monitoring student anxiety levels and adjusting the tasks accordingly may reduce the chances that another student responds negatively to mastery.

Social disconnection experiences.

Kayla's anxiety level was likely increased as well by the disruption in her social connections with her peers at her regular school. Her parents had hoped to gain the most amount of benefit in the shortest amount of time and would have found the transportation logistics between the two schools to be very difficult with their family circumstances. Their plan was to maintain Kayla's connection to her peers through sleepovers but this plan did not stop the disconnection from happening and seemed to increase Kayla's distress over what she was missing out on socially at school. Michael was the only other student of the five that was pulled out of the regular school system full-time during the first year of participation in the LDAS Arrowsmith program. However, Michael had social problems at his former school so leaving this school full-time was not the same hardship for him. In fact, a student like Michael is well suited to the safe, supportive atmosphere of the Arrowsmith program.

Starting Kayla half-time in the Arrowsmith program may not have ameliorated her social disconnection from her peers at her regular school because Brooklynn experienced the same

disconnection through attending half-time in the Arrowsmith program. Her parents had also made plans for lots of sleepovers to maintain the connections and they also found that the social disconnection still happened. Brooklynn also found it very awkward to answer the questions concerning what she was doing the other half of the day. Brooklynn changed to full-time in the Arrowsmith program the following year.

Not all of the students experienced social disruption as a result of their participation in the LDAS Arrowsmith program. Jim attended half-time at his regular school and half-time in the Arrowsmith program and did not appear to have social difficulties with his peers as a result. Jim had an educational assistant throughout school so it was not a surprise to the other students that he had learning difficulties. Evan and his parents did not mention social disconnection as a problem. The first two years of Evan's participation were half-time in the Arrowsmith program while his second two years of participation were full-time in the Arrowsmith program. By the end of the third year though, Evan was missing his friends and wanted to return to his regular school.

The two students who experienced disconnection from their peers at their regular schools were both girls and the students who did not particularly experience this difficulty were all boys. There may be a gender difference related to the importance of school participation for the maintenance of friendships but this difference could also be due to the small numbers for comparison. The other girls in the LDAS Arrowsmith program were younger or older than Kayla and they came from different parts of the city so a connection inside and outside of school would be difficult and likely less meaningful than the previous friendships she had with peers from her regular school. Kayla's mother Kate observed that participation in the LDAS Arrowsmith program broke down the one strength that Kayla had. There were other girls the same age as Brooklynn in the LDAS Arrowsmith program and she had well established social connections through extracurricular activities outside of school. These factors may have mitigated the disconnection that occurred between Brooklynn and her regular school peers. Moving Brooklynn from half-time participation in the LDAS Arrowsmith program to full-time also appeared to help.

The social considerations of attending a program outside of the regular school system full or part-time were mentioned as a major part of the decision making and planning process when the parents considered putting their children in the LDAS Arrowsmith program. Many of the parents and some of the students felt that it would be easier both financially and socially if the Arrowsmith

program was offered in the regular school system. However, most of the parents wanted to avoid the stigma of special programming and may have experienced this difficulty when their children attended Arrowsmith programming in their regular schools.

Motivation.

There were several other differences between the experience of Kayla and the other students in the LDAS Arrowsmith program. Kayla had difficulty understanding how the cognitive training tasks would connect to academic skills or other practical skills. Her motivation appeared to be affected by this lack of understanding. It was reported that Kayla was the only student who hid her homework sheets. This action seemed inconsistent with all of the other information on Kayla that described her as a cooperative, hard worker. Perhaps if the purpose of the tasks was explained more fully or less homework was assigned, Kayla would have felt more successful in the program. It is also possible that for whatever reason, the cognitive tasks were not effective for Kayla or did not address the processing issues that she has.

Factors that led to success.

Several factors appear to have led to Jim, Michael, Evan, and Brooklynn's experiences in the LDAS Arrowsmith program being positive overall. These factors illustrate the differences between Kayla's experience and the experiences of Jim, Michael, Evan, and Brooklynn. The students other than Kayla showed significant improvements on most of the cognitive processing areas after two years of participation in the program. Given the focus of the Arrowsmith program is on improving the cognitive functioning of individuals with learning disabilities, the main measure of success should be significant improvements in this area. Participation in the LDAS Arrowsmith program appears to have produced significant changes to the cognitive functioning of these students in many different areas that should result in improved academic skills and achievement once these students have received the academic instruction to advance.

The individualized programming that met the students at a challenging level with tasks of gradually increasing difficulty and immediate and frequent feedback appears to have been experienced by Jim, Michael, Evan, and Brooklynn as being very positive. Their arousal level appears to have been at an optimal level in most cases. The feelings of success and accomplishment resulted in increased work effort and persistence towards mastery of each level. The smaller

teacher to student ratio and safe emotional environment were likely helpful as well but Kayla also experienced these conditions and did not make the same level of improvements. The students and parents appeared to accept the tasks as being beneficial and did not appear to be concerned that they lacked face validity with the cognitive functions they were targeting at times. The significant increases that Jim, Michael, Evan, and Brooklynn obtained on standardized cognitive tests support the claims of the Arrowsmith program that the cognitive tasks reduce the cognitive processing deficits related to learning disabilities.

Rival Explanations

The case study research has several possible rival explanations that will be addressed in this section. The possible craft and real-life or substantive rivals for the current case study are considered. Craft rivals include threats to the validity of the research. As mentioned in the methodology chapter, the craft rival inherent in all research, including qualitative research, is that the results were due to chance alone. Although this possibility exists, it is not particularly likely that all five of the students would experience significant increases in at least one cognitive processing area and one achievement area, as measured by standardized tests when these students were falling farther and farther behind their peers prior to taking the LDAS Arrowsmith program. Most of the students increased in many cognitive processing areas. The triangulating information from the interviews with the parents and the students and school student cumulative folders is consistent with the standardized test results in most cases.

Other possible craft rivals to the case study results include maturation, problems with the standardized testing process, generalizability of the results, investigator bias, a placebo effect, personality differences, differences in level of learned helplessness, or a combination of these factors. Maturation does not appear to be a likely explanation for the case study results because all of the students spent at least two years in the LDAS Arrowsmith program and all of the students started at the same time but did not improve in the same areas or at the same level. Kayla, in particular, had the same amount of time for maturation but she did not make as many changes as the other students.

There could be some problems with the standardized testing information because the administration of the testing before and after participation in the program was completed by

different psychologists. The standardization of the testing procedures though should provide some protection to this craft rival. The test results available in Jim and Michael's student cumulative folders show inconsistencies and these inconsistencies may have affected how large the improvements in their scores actually were but the other three students showed consistent test results and still made changes. If standardization of the testing process was a major issue, the standardized test results should not have been consistent with the results from the other sources of information to the degree that they were.

Generalization of the results is a potential problem in case study research. Having several students to represent the case of participation in the LDAS Arrowsmith program and several sources of information for each of these students helps increase the generalizability of the results. It is not known for sure whether or not the results in the current case study reflect what would have been found if different students would have volunteered. Kayla is the most different from the other students in the case study in terms of results so replication of the case study with other students who have made smaller cognitive and academic gains will be helpful to understand if Kayla's experience is similar to other students with less improvement. Research with other students in the LDAS Arrowsmith program who have completed studies in other years and who have taken the Arrowsmith program in other locations would also be helpful to understanding the experience of participation in the Arrowsmith program.

Another craft rival that could have affected the results of the case study is the presence of investigator bias. Several measures were taken to mitigate the effect of this rival explanation. Since it is not possible to eliminate investigator bias, I attempted to provide as much transparency as possible with my own experiences and beliefs and the context of each of the students. The parents and students were interviewed on two occasions each and verbatim transcripts were produced from the audio taped interviews. The parents were given a copy of the transcripts with the possible quotations for use in the case study highlighted to review and change as they wished. I was the psychologist who administered the cognitive tests at the end of two years of participation but I administered these tests before looking at the previous test results and they were administered in a standardized manner.

It is possible that a placebo effect could account for some of the perceived positive effects reported by the students and parents. Investing a great deal of money and time would be strong

motivators to see these investments as having been useful. Kayla's mother Kate was one of the most optimistic parents at the outset of the program but she was still able to see that the program was not particularly effective for Kayla. A placebo effect though cannot easily account for the significant increases in cognitive processing on standardized tests, higher level of academic programming, and lower level of supports once the students left the LDAS Arrowsmith program.

Differences in personality factors or level of learned helplessness could account for some of the differences between Kayla and the other students. These areas were not formally measured and should be considered for evaluation on a before and after basis in future studies. The personalities of the students were described to some degree through the parent interviews and school records. Kayla is described as a hard worker, cooperative, and having a positive attitude. There are no indications from the information available that she had personality characteristics that could minimize her benefit from the Arrowsmith program other than Kate indicating that Kayla's school would routinely increase modifications and adaptations to Kayla's programming when she became stressed. Michael's school responded to his stress in the same way.

Several real-life or substantive rivals or other explanations that may fully or partially account for the case study results are considered. A lower teacher to student ratio, supportive environment, individualized programming, and frequent reinforcement are all part of the Arrowsmith program and could explain part of the benefit experienced by the students. However, it seems unlikely that these parts of the program are responsible for all of the improvements the students made. Kayla, like the other students, experienced these same features of the program but they did not result in the same improvements that the other students made. Her mother talked in her interview about how supportive the teachers and the environment were in the program.

The different types of learning disabilities could be responsible but Kayla and Brooklynn had similar learning disabilities. The severity level of the learning disabilities could be responsible for the differences in improvement, but Jim and Michael had more severe learning disabilities than Kayla and they made larger improvements. Social disconnection alone did not account for Kayla's lack of progress as Brooklynn experienced this social disconnection as well. For most of the students, mastering a level was experienced as positive, so Kayla's stressful experience with this feature of the program, while probably explaining at least partly why she made smaller gains, is likely not the only reason.

Some may argue that since some of these students were enrolled in regular school classes half time for all or part of their participation in the LDAS Arrowsmith program, the cognitive and academic gains were due to the instruction they received at their regular schools. This explanation seems highly unlikely given that these students had spent several years in regular schools, and were falling farther and farther behind their peers. A similar argument that it was the support at home that accounted for the increased functioning is similarly flawed because the parents in the case study had been helping their children at home a great deal and were still not able to prevent the serious learning problems their children experience. Participation in the LDAS Arrowsmith program reduced the amount of time the parents needed to spend with homework and specialized programming support.

Limitations of Research

The purpose of this explanatory case study was to understand how participation in the LDAS Arrowsmith program affected the cognitive, academic, emotional, and interpersonal functioning of the participants and why participation in this program had the impact that it did. The case study was able to answer both of these questions to some degree through interviews with five of the students and their parents and examination of the school records and standardized testing information for each of the students. A comparative analysis of the different sources of information provided triangulating evidence of commonalities and exposed differences in the experiences of these students.

However, this case study is limited by several factors. The moderate level of control available when studying a multifaceted program in a real life setting reduces the ability to determine what factors led to the observed changes. Were the changes due to the cognitive tasks themselves or to the method with which they were delivered, or a combination, or something else entirely. Were only some of the cognitive tasks responsible for the increases in cognitive functioning? Were different cognitive tasks responsible for the changes for different students or was it the combination of tasks that led to the changes?

Most case studies, including this one, focus on a small number of individuals and it is not known if these students represent the group of LDAS Arrowsmith students as a whole. The students are of different ages and have different learning disabilities. These students started at the

same time when the Arrowsmith program was brand new at LDAS so it is not known whether they are similar or different from the subsequent students in this location or whether their experiences are similar to those of Arrowsmith students in other locations. Three of the five students who participated in the LDAS Arrowsmith program were males even though only four of the original twelve students were males. This change in the percentage of gender representation may have affected the results since as a group the male students had a greater number and larger sized significant increases in cognitive processing measured by standardized tests.

The inclusion of formal testing in the areas of emotional and interpersonal/behavioural functioning before and after participation in the LDAS Arrowsmith program would have provided triangulating evidence related to possible changes in these areas of functioning. Measures of personality, social skills, learned helplessness, internalizing problems (e.g. anxiety), and externalizing problems (e.g. conduct problems) could be added to the analysis. Interviews with the teachers in the regular school system or school observations, while difficult to achieve, would have provided additional information on the emotional and interpersonal functioning of the students that would have added to a deeper understanding.

Kayla was not the only student in the LDAS Arrowsmith program who made smaller changes in cognitive functioning after two years but she is the only student who made smaller gains to participate in the case study. The lack of replication of this type of experience reduces the explanatory value it provides because it is not known if her experiences were similar or different from the other students who made smaller gains. It is possible that other students who made smaller cognitive and academic gains felt very positively about the impact of the LDAS Arrowsmith program on their lives. It is also possible, though less likely, that some of the students who had larger cognitive and academic gains left the LDAS Arrowsmith program with an overall feeling of disappointment in the experience either through the social/emotional problems of disconnection with their peer group or the lingering presence of some cognitive and academic difficulties.

A longer period of time to follow the students after they left the LDAS Arrowsmith program would have provided more ecological validity or real life evidence of the impact of participation in the LDAS Arrowsmith program. Since the students had reduced academic instruction during their participation in the program, it may take some time for the students to benefit from their cognitive

processing improvements in their academic skills and within the school environment. Evan had not returned to the regular school system during the period of time when the information was gathered for the case study so the impact of participation in the school setting has not been observed at this time for him. It is also possible that the benefits of participation are of a transitory nature.

There were adult students in the LDAS Arrowsmith program but none of these students volunteered for the case study. The recruitment letters for the study went out at the start of summer holidays and may have influenced who chose to participate. The stipulation that both the student and parent (unless the student was an adult) reduced the participation pool by at least two because two parents who wanted to participated were not included because their children did not want to be interviewed. Given the differences in the students, their inclusion may have changed some of the information that was gathered.

All of the students who participated in the LDAS Arrowsmith program come from affluent or middle class neighbourhoods and all of the students had at least one parent with some university education. Since most of the schools or organizations offering the Arrowsmith program have private fees, this does not particularly limit the generalizability of the results to the case of participation in the LDAS Arrowsmith program or to other Arrowsmith programs. However, it is not known if potential students from different backgrounds would have the same experiences.

Confirming Findings

The validity of case study research is enhanced through comparisons and confirmation of findings related to theory and research (Merriam, 2009; Yin, 2009; 2011; 2012). Several findings in the current case study and aspects of the Arrowsmith program provide confirmation of several sources in the research literature including: the cognitive development theories of Piaget, Vygotsky, and Feuerstein; neuroplasticity; the Cattell-Horn-Carroll theory of cognitive processing; and previous research on the Arrowsmith program. These sources will be compared to the findings in the case study that provide confirmation.

Cognitive Development Theories.

Several findings of the case study appear to confirm the propositions of the cognitive development theories of Piaget, Vygotsky, and Feuerstein. All three of these theories emphasize the individual's ability to construct learning through interactions with some aspect of the

environment. Piaget emphasizes the need for cognitive readiness and exploration. Although the Arrowsmith program is very directed and regimented, it does in some ways address Piaget's contention that individuals need to be ready to make cognitive changes. The Arrowsmith program has cognitive tasks that are individualized to a level that is challenging but within the range the student is able to do. The student is not moved up to the next level until they are "ready" or have demonstrated mastery of the previous level. The introduction of the cognitive tasks could be seen as providing the environment through which the students can learn or construct their learning. The Arrowsmith program provides immediate feedback so the student can adjust their performance and learn from their mistakes. Piaget believed that learning is a trial and error process and that mistakes are essential to learning. However, the Arrowsmith program is lacking in the discovery learning format that Piaget's theory can be most directly connected to. This reduced level of creativity appears to have been related to Kayla's lower level of cognitive and academic improvements as a result of participation in the LDAS Arrowsmith program.

Vygotsky emphasized the role of social experiences and believed that directed learning with the support of a more competent person contributed to increased skills and learning. He felt that mistakes should be avoided when possible. Scaffolding or supports allow the individual to perform tasks that they would not be able to do on their own and they reduce mistakes. Although the Arrowsmith program has limited social experiences within the classroom, this program is directed and the teachers are involved in setting up the tasks for the students, testing and assessing their skill levels, and providing them with feedback. The cognitive tasks provide more support at the beginning of a new level than is provided as the student gains proficiency at the task in their current level.

Feuerstein extended the theory and applications of Vygotsky's theory to develop his own theory of cognitive modifiability, instructional materials, and dynamic assessment techniques to measure cognitive potential. He argues that cognitive functioning is not static and can be changed through structured and directed tasks that allow the individual to think at a higher cognitive level than they are able to do on their own. The Arrowsmith program was based on the premise of neuroplasticity and claims to increase the cognitive functioning of the individuals who participate in this program. The cognitive modifiability theory of Feuerstein is consistent with research evidence of neuroplasticity. The results of the current case study confirm the presence of increases

in several cognitive processing areas after structured and directed cognitive exercises. These results also confirm Feuerstein's belief that standardized tests measure the individual's current functioning and not necessarily their potential. All of the students in the case study increased in at least one cognitive processing area, indicating that their previous score did not reflect their potential.

Neuroplasticity.

Research on neuroplasticity confirms the brain is able to change in response to the environment. The Arrowsmith program is based on the concept of neuroplasticity, so if participation in this program leads to increases in cognitive functioning, then the concept of neuroplasticity is confirmed. The Arrowsmith program provides structured and directed cognitive tasks and a supportive environment with a lower student to teacher ratio. In the current case study, participation in the LDAS Arrowsmith program led to an increase in at least one cognitive processing area for all five of the students. All but one of these students increased in most of the cognitive processing areas that were measured.

Green and Bavelier (2008) in their review of neuroplasticity and training-induced learning discuss the characteristics of programs that lead to cognitive changes that generalize to tasks and environments beyond the cognitive training tasks themselves. They argue that based on research evidence, cognitive training programs that are varied and have many different cognitive tasks are more likely to generalize. The Arrowsmith program provides nineteen different cognitive tasks with many different levels of difficulty. The tasks vary in presentation and include paper-pencil, computer, and verbal tasks. This variability of the Arrowsmith program may be responsible for the generalization the five students show to at least one academic area and the increased level of academic programming, reduced academic supports, and increased feelings of self-confidence the students showed. The level of variability was experienced by Evan and Kayla as being lower than they would have preferred so reducing the repetitive nature of the tasks to make them more fun might help to increase the engagement in learning of some students.

Green and Bavelier (2008) also indicate that an optimal level of emotional and/or cognitive arousal is needed for neuroplasticity to generalize to other tasks and environments. All of the students in the case study had been quite stressed by their studies prior to participation in the LDAS Arrowsmith program. Jim and Evan and their parents talked about how attending the LDAS

Arrowsmith program reduced Jim and Evan's stress level. Their previously high stress levels likely contributed to their lack of academic progress just as the reduction of their stress to a more optimal level led to an increase in cognitive functioning that generalized to higher achievement scores on standardized tests and an increased level of academic programming with decreased supports for Jim.

Michael and Kayla were the least stressed of the five students before they started the program. Michael had been very stressed in grade 4 but his academic program was greatly modified after this grade and he was eventually provided with an educational assistant, reducing his stress level. Kayla's academic programming was also greatly modified and adapted to reduce her stress level. Michael was taken out of his regular school full-time for the first year of his participation in the LDAS Arrowsmith program but in this first year he took only half-time Arrowsmith programming and received tutorial assistance with math and English for the other half of the school day. Even with this level of programming he had headaches at the end of the day until he became acclimatized to this increased stress. Kayla was in full-time Arrowsmith programming for two years and appears to have experienced a higher than optimal level of stress during that time. She experienced the process of mastering levels as very stressful and she was the only one of the five students to experience mastery in this way. Her social disconnection to her regular school peers contributed to her having a higher than optimal stress or arousal level that may have led to smaller cognitive gains that generalized less to her academic performance on standardized tests and in school.

The other characteristics of cognitive training programs that generalize to other tasks and environments include those that start at a challenging but obtainable level and progress gradually, provide immediate and frequent feedback (particularly at the beginning of participation), and where the participant is highly motivated. The Arrowsmith program individualizes the tasks to start at a challenging level for each person and gradually increase the level of difficulty. The feedback is immediate and frequent with mastery of each level being celebrated. This component of the program was highly motivating to Jim, Michael, Evan, and Brooklynn. The success of mastery was a positive experience that contributed to how hard they worked and their increase in self-confidence. Kayla found this process stressful. She may have needed a reduction in level and a more gradual approach to the increase in difficulty level. Kayla was known to be a hard worker but

was hiding her homework sheets, an uncharacteristic behaviour for her. She did not believe that she would be successful as the difficulty level increased. This factor in combination with her higher than optimal emotional arousal led to a decrease in her motivation and an increase in avoidance.

CHC theory.

The Cattell-Horn-Carroll (CHC) theory of cognitive processing indicates relationships between cognitive processing areas and academic achievement areas. Some cognitive processing areas affect specific academic skills more than others while other cognitive processing areas affect many academic skills. For example, the broad cognitive processing areas of crystallized intelligence and auditory processing tend to affect language-related academic skills the most. The broad cognitive processing areas of short term memory and long term memory tend to affect most academic areas. It should be noted that academic achievement in most areas are affected by multiple cognitive processing areas so an increase in one area may not always lead to global increases in skills or the increase may not be large enough to produce a large change in academic skills.

CHC theory received confirmatory evidence given that the increase in cognitive processing that all of the students showed affected at least one achievement area on the standardized testing. Most of the students obtained significantly higher cognitive processing scores relative to their age peers in several areas. These students who had several increased cognitive processing scores, except for Jim, scored higher on several achievement areas and were able to be successful in a higher level of academic programming with fewer academic supports. Jim scored significantly higher on most of the cognitive processing areas measured after two years of participation in the LDAS program, but he scored significantly higher on only one of the achievement measures. He was able to take a higher level of academic programming with fewer supports. Kayla obtained a significant increase in the cognitive processing area of long term retrieval and the achievement areas of overall reading and reading comprehension. She was not able to take a higher level of academic programming until she was given a greater level of accommodations and outside tutorial support.

Arrowsmith Research.

Previous research on the Arrowsmith program indicates an improvement in academic skills on standardized tests (Eaton, 2011; Kemp-Koo, 2010; Lancee, 2003; 2005; St. Patrick Catholic Secondary School and Arrowsmith program pilot project, 1998; Report on the Arrowsmith program in the Toronto Catholic District Secondary School Board, 2007; Young &Burrill, 2000). Only three of these studies include statistical analysis of significance and the use of either percentiles or standard scores in the analysis (Kemp-Koo, 2010; Lancee, 2005; Young & Burrill, 2000). The comparisons of standardized achievement test results for each of the five students in the current case study show confirmatory evidence of increased scores on standardized achievement tests through participation in the LDAS Arrowsmith program. All five students obtained a significant improvement in at least one achievement subtest after two or three years of participation in the program and most of the students obtained several significantly improved scores.

The St. Patrick Catholic Secondary School and Arrowsmith program pilot project (1998) and Report on the Arrowsmith program in the TCDSB (2007) studies made comparisons related to academic functioning at school. Unfortunately, neither of these reports included statistical analyses of the comparisons. The St. Patrick study indicated an improvement in overall percent average of the students taking the Arrowsmith program half-time with half-time academic classes from term 1 to term 2. The TCDSB study reported that the students who completed Arrowsmith programming in elementary school had less resource room support in high school when compared to their use of resource room support in elementary school before taking the Arrowsmith program. Eaton (2011) reports case studies for individuals who obtained higher marks, took a higher level of academic programming, and required less academic supports such as resource room after completing the Arrowsmith program. The current case study provides confirmation of these results. The four students in the case study who had re-entered the regular school system were taking classes at a more advanced level. Three of these four students were receiving fewer supports for their studies such as less resource room support, less effort required, less parental support needed, and no additional programming.

Several studies found improvements in measures of cognitive functioning before and after participation in the LDAS Arrowsmith program (Eaton, 2011; Kemp-Koo, 2010; Lancee, 2003; Young & Burrill, 2000). Kemp-Koo (2010) identified statistically significant gains for the group of

twelve students overall on the Full Scale intelligence score, Perceptual Reasoning index, and Working Memory index of the WISC-IV and Long Term Retrieval composite of the WJ-III. The five students in the current case study were included in the analysis and all five of these students obtained a significant increase in at least one cognitive area. Most of the students obtained significantly higher scores in many of the areas after two years of participation in the LDAS Arrowsmith program.

Emotional and interpersonal functioning has been addressed by some of the research on the Arrowsmith program (Eaton, 2011; Kemp-Koo, 2010; St. Patrick Secondary School and Arrowsmith program pilot project, 1998; Report on the Arrowsmith program in the TCDSB, 2007). Eaton (2011) provides in-depth information on the background of eight individuals who successfully completed the Arrowsmith program at his schools in Vancouver and Victoria, British Columbia. The information in his case studies indicates improvements in emotional and interpersonal functioning for these individuals in addition to the cognitive and academic gains they made. The St. Patrick Secondary School and Arrowsmith program pilot project (1998) study asked parents of the students in the program to rate the level of change they had observed in their children through their participation in the Arrowsmith program. The parent feedback from this questionnaire was very positive. The current case study confirms reports of positive emotional and interpersonal benefits after participation in the LDAS Arrowsmith program from both parents and students. For many of the students, it was the first time that they had successfully achieved and been acknowledged for achieving an academic goal based on their own cognitive processing levels. The case study also reports emotional and interpersonal difficulties experienced by some of the LDAS Arrowsmith students related to social disconnection from their peers from their regular schools.

New and Unexpected Findings

The current case study resulted in several new and unexpected findings related to the documentation through parent and student interviews and examination of school records/standardized test scores. The journeys students and their parents experienced prior to their decision to enter the LDAS Arrowsmith program, during their participation, and after their participation were examined in more depth than previously documented. This examination

involved a more holistic view of the students' experiences of participation in the LDAS Arrowsmith program as the areas of cognitive, academic, emotional, and interpersonal functioning were all discussed. The comparison of the results with the theoretical perspectives of Piaget, Vygotsky, Feuerstein, and the CHC model of cognitive processing had not been previously documented. The case study documents the experiences of a student who did not overall have a satisfactory experience through participation in the LDAS Arrowsmith program and compared the experience of this student with the experiences of the other four students who did have overall positive experiences through their participation. As well, the examination of the school records of two of the students in the case study revealed troubling inconsistencies with test results that will be considered in this section and again in the implications for assessment practices section.

Depth and breadth of information gathered from interviews and school records.

Semi-structured interviews with the students and the parents allowed for a deeper understanding of the journeys that led these students to their participation in the LDAS Arrowsmith program. More information related to the contexts these parents and students experienced changes allowed for clearer comparisons of their results and the different types of individuals who can benefit from cognitive training programs or who will benefit less from such program.

Parents as explorers/vulnerability. Particularly interesting to me was the experience parents identified as being explorers trying to "get to the root of the problem" for their children. Many of the parents experienced a feeling of being alone in an area they had little expertise in but needed to navigate for the sake of their child. This quest for answers to explain their child's learning difficulties and how to help their child succeed became a very time consuming and emotionally draining endeavour. By the time these parents reached the LDAS Arrowsmith program, many of them were very worried about the potential options for their child to be successful in a society that increasingly requires academic success to achieve career success and personal independence. The level of desperation experienced by parents presents a moral obligation to present as balanced and complete a picture of the Arrowsmith program as possible.

Experiences with interpretation of test scores. It should not have been surprising to me when several of the parents described at least one interaction with a teacher who used low average

full scale intelligence scores to indicate the need for modified programming in high school. In all of these cases there were significant discrepancies in the index scores that would indicate great caution in reporting and/or interpreting the full scale scores. As a psychologist who has worked in an adult upgrading program for many years, I am aware of many individuals who took modified or alternate programming in the regular school system who were able to complete a regular grade 12 as adults. I am also aware of many individuals with full scale intelligence scores in the low average range who were able to graduate with an academic grade 12. This finding through the case study interviews supports the more recent practice of not reporting full scale scores when the indexes are significantly varied and in not providing the actual scores on intelligence tests.

Social disconnection from regular school peers. Parents indicated in their interviews that one of their main concerns when choosing to put their children in the LDAS Arrowsmith program was the possible disruption to their child's social connections with their peers at their regular school and the impact this disruption might have on their child's self-esteem. These parents intuitively knew an important consideration that has not been previously documented concerning participation in the LDAS Arrowsmith program. Two of the students in the current case study in particular experienced disconnection from their peers despite their parents' attempts to maintain the connection through sleepovers on weekends. It is possible but not known for sure if this social disconnection was related to gender. The two students who struggled in this area were both girls and the other three students who did not report major problems in this area were all boys. For at least one of the girls who experienced social disconnection, this experience may have led to participation in the LDAS Arrowsmith program being less effective.

Increased level of academic programming. The examination of student cumulative files documented a change in level of academic programming for all five students that had not been previously reported other than in the Eaton case studies (Eaton, 2011). Two of the students were taking greatly modified studies in elementary school and were to take alternate programming in high school. These two students were able to take a mix of regular and modified credits in high school successfully (other than an individualized, alternate math arrangement for one of these students) with fewer academic supports inside and outside of school, and less effort needed from the student. Two of the students were recommended for modified programming but were able to

take regular programming. One of these students did so without supports and the other student who did not make large cognitive gains through participation in the LDAS Arrowsmith program, did so with more accommodations and supports. The fifth student had not re-entered the school system when the information was gathered but it seems likely based on this students's improved scores that he may be able to take regular programming with no supports or very minimal test and notetaking accommodations.

The current case study gained holistic information that reflected functioning in cognitive, academic, emotional, and interpersonal functioning. Most of the previous research on the LDAS Arrowsmith program focused on academic achievement alone or on academic and cognitive functioning. I argue that the inclusion of information on emotional and interpersonal functioning was very important to understanding why the LDAS Arrowsmith program was less effective for one of the five students in the case study.

Comparisons to Theoretical Perspectives.

Comparing the case study findings to theoretical perspectives provided an anchor to previous knowledge and research related to cognitive development and neuroplasticity that has not been documented in the literature previously. Conducting semi-structured interviews from a constructivist perspective increased the level of understanding of what participation in the LDAS Arrowsmith program is like for a variety of students and parents.

Comparison of Student who made Smaller Gains to those with Larger Gains.

The current case study provided in-depth documentation of the experience of a student who made smaller cognitive and academic gains in the LDAS Arrowsmith program after two years of participation. While it has been mentioned in the literature previously that some students made smaller gains, the case study was the first study that attempted to understand why this student did not have an overall positive experience in the LDAS Arrowsmith program. Comparing the differences in this student's experiences and those of the students who made larger cognitive and academic gains provided information that may explain why some students benefit more than others from participation in the Arrowsmith program. Struggling with accepting the cognitive tasks in the Arrowsmith program as being important or connected to real life outcomes and experiencing the mastery of levels as stressful and confusing rather than exciting and satisfying were two of the main

differences experienced by this student when compared to the other students. These factors in combination with her social disconnection from her peers at her regular school likely combined to produce a less satisfying result.

Inconsistent test results in school records.

Finally, I discovered widely varied test results and many different diagnoses for two of the students in the case study when examining their student cumulative files and standardized test results. This discovery is not completely new to my experience but it greatly concerns me. While working on the case study research I was contracted to undertake cognitive testing in the public school system with students who had been labelled intellectually disabled or developmentally delayed prior to entering school. An update of testing was needed to make sure these students were receiving appropriate resources. Some of these assessments confirmed the previous results while some revealed the probable presence of learning disabilities and much higher academic potential.

Assessments of Jim's cognitive functioning were completed as early as age 3 where he is described as "developmentally delayed." Most of his overall cognitive scores were extremely low to borderline but some of the index areas were at times in the low average range. A variety of diagnoses are evidenced in assessment reports for Jim and include: developmentally delayed, mild intellectual disability, visual processing learning disability, acquired brain injury due to rheumatic fever, borderline intellectual functioning, auditory processing disorder, and expressive/receptive language disorder. Many of these reports indicate the view that the test results represent a low estimate of Jim's cognitive potential. After two years of participation in the LDAS Arrowsmith program, Jim's Full Scale intelligence score was in the borderline range but should be considered invalid because of the large discrepancy between the indexes. Two of his indexes are low average (with one of them being potentially average when the confidence interval is considered), one index is borderline and one of them is extremely low. Standardized testing did not appear to be effective in identifying the improvement in reading that Jim, his mother, and his teacher observed. Jim's extremely low processing speed interferes with the measurement of his skills and abilities. For some individuals like Jim it may be important to include dynamic assessment tools (that provide some level of scaffolding) such as the Learning Potential Assessment Device (LPAD) or real life

situation assessment through observation to get a full picture of functioning and potential (Feuerstein, Feuerstein, & Gross, 1997).

Michael's test results were extremely varied. In kindergarten his overall intelligence was assessed as being average. In grade 1 another intelligence test indicated average nonverbal ability and borderline verbal ability. In grade 4, after a period of great stress and Michael talking of suicide, his intellectual ability was assessed as being extremely low. He was diagnosed with a cognitive disability and placed in a special program consistent with this diagnosis. Later his intelligence was assessed as being in the borderline to low average ranges. After participation in the LDAS Arrowsmith program, Michael's Full Scale intelligence score was in the low average range with three of the four indexes low average and one of them average. Michael was successful in a mix of regular and modified classes in high school with minimal supports.

To me, Michael's case in particular, is deeply troubling. Michael has a mother who is very involved in providing educational supports and advocating for him. What about the other students like Michael with parents who do not have the time, energy, or knowledge level to advocate for their children? Something has gone very askew in the assessment process of Michael. In some cases it would be better to not continue with an assessment if there is a concern that the individual's ability is not being fairly portrayed. His case speaks to the need to review the past assessment results and explain why the results are now different. Michael's case also illustrates how standardized tests measure where the individual is at the moment and are influenced by the skill level of the assessor. When a variety of standardized test results are obtained, the use of dynamic assessment tools, extended interactions, observation, and interviews with parents and teachers will be important to understand the individual's potential.

Implications

The current case study research on the LDAS Arrowsmith program has several implications for individuals and programs working with children/young adults with learning disabilities and their parents. Interviewing the parents for the case study research illustrated how much parents are willing to sacrifice for their children. I am a parent and I am not surprised at this result but sometimes I think it is important in education for us to be reminded how important the outcomes are. When parents are trying desperately to help their children succeed, there is a high level of

vulnerability that can develop that could be potentially exploited. Therefore, I believe there is a moral imperative to gain full information on a program's effectiveness and fully disclose the positive and negative outcomes so parents can make an informed decision. Not all parents are able or willing to sacrifice for their children at the level the parents in the case study were. The Arrowsmith program, including the LDAS Arrowsmith program, involves paying private fees that are out of reach for some parents. If this program is able to change the educational outcome for some students, there needs to be a way for children from all socioeconomic backgrounds to benefit. Several of the parents and one of the students commented in their interviews that it bothered them that other children would never have the opportunity they did.

Recommendations for Practice

The current case study research identifies several strengths and limitations of the LDAS Arrowsmith program. The strengths of the program are: students have obtained increased scores on standardized tests of cognitive processing that have led to higher levels of academic programming and a reduction of supports; the safe, encouraging atmosphere; for most students there is less stress and pressure; students are given tasks at the appropriate level of difficulty; scaffolding is provided; students are given frequent and immediate feedback; class sizes are small; and students achieve mastery before moving on to more difficult tasks. The limitations of the program are: a lack of independent research that clearly identifies which cognitive tasks lead to which improvements in functioning; lack of flexibility in delivery; time consuming; requires private fees that are out of reach to many parents; students must leave their regular school at least half of the day; social disconnection from the student's peer group is difficult to prevent; academic skills may not be attended to; lack of creative and physical outlets; lack of discovery learning; social skills are not addressed; socialization and group work is limited; the tasks can be tedious and boring for some students; and the connection of the tasks to real life outcomes is not apparent. Based on these strengths and limitations, recommendations for practice can be made to the stakeholders related to the Arrowsmith program.

Parents.

Parents with children or young adults who have learning disabilities need to aware of the vulnerability they experience when their children are struggling so they fully think through the

choices they need to make. A comprehensive assessment with a good understanding of the relevant issues is a good starting point. Learning advocacy strategies that promote a team approach for their child that includes them is advised. It is important to consider what your child's teacher is observing because teachers interact with many children and often know what normative behaviour and academic functioning is. At the same time, it is important to trust your own knowledge of your child and their needs.

When a child is struggling academically, it is difficult to maintain a balance between school work and other important activities that promote well-being such as fun, family time, and engaging in extracurricular activities such as sports and music. It is important to find out what your child is good at and enjoys doing so they gain a sense of self-efficacy. Vocabulary and knowledge levels can fall behind when basic skills are focused on so accommodations such as presenting information verbally or in some other way may be needed to minimize this potential.

Your child's characteristics, including the severity of their learning disability and personality, need to be considered when deciding if the Arrowsmith program is an appropriate choice. You may not be able to stop the social disconnection that your child may experience from their peers at their regular school regardless of whether your child attends full-time or part-time. Consider how you can provide alternative for social connection if this happens. Cognitive training programs such as Cogmed and Lumosity do not require taking your child out of school and might be a good idea to try first to see if they make a difference. If your child responds positively to these programs, they may be more likely to improve in a more comprehensive way through the Arrowsmith program. If your child does not make improvements in cognitive functioning, you need to focus on advocating for accommodations and the use of technology so your child can take the highest level of academic programming that they are able to.

Parents with children in the Arrowsmith program should consider creating a support network for children attending Arrowsmith and to provide information to parents considering the Arrowsmith program. I believe that caution should be employed when giving advice to other parents since their child may not experience the program in the same way. It is important to address both positive and negative aspects of the program and tell your story as you see it.

School Psychologists.

The emergence of the RTI model of assessment is an important development for the field of learning disabilities. The role of school psychologists could evolve to include consultation and intervention functions and a team approach with teachers and other assessment professionals in addition to the assessment role. Baseline levels with measures that are tied to the curriculum would more effectively capture how students are coping with their studies and what accommodations need to be in place. The report could then be written after these observations and measurements had taken place so students are receiving the minimal level of modifications and adaptations to enable them to be successful.

The case study research really brought home to me how difficult it is to truly measure the cognitive and academic potential of some individuals. As psychologists, we need to be willing to not report scores when they may not be valid. The impact of these scores can be very serious. It is very important that we communicate to parents what the test results mean and what they don't mean. Although it is also very important that we convey this information to teachers as well, students will get different teachers every year and their test results will follow them. The parents will stay with their children and can be the advocate for a correct interpretation of the information if they fully understand it. Psychologists will need to play an advocate role for students who do not have parents who are strong advocates.

I think that the inclusion of dynamic assessment practices should be encouraged and taught in educational programs for psychologists. That doesn't mean that I advocate throwing out quantitative and standardized testing procedures but I believe that we should recognize that standardized tests do not fully capture an individual's potential (Feuerstein & Feuerstein, 2001; Feuerstein, Feuerstein, & Gross, 1997). Research on neuroplasticity and the current case study research indicate that scores on cognitive tests can change significantly even when they are administered in a standardized way. I have always maintained that assessment is as much an art as it is a science. Direct observations of a student reading and discussing the material with them, interviews of parents, students, and teachers, scaffolding or "testing the limits" of standardized tests, or introducing dynamic assessment techniques or testing will provide additional information to more fully understand potential.

Low average and Full Scale scores on intelligence tests appear to be misunderstood by many people, including teachers. Through my work for 28 years as a counsellor in an adult upgrading program, I have observed many adults who took modified or alternate programming in high school, complete a regular grade 12 and postsecondary studies as adults. Obviously many factors may be involved when such situations occur but it is important to know that individuals with low average ability can often take regular classes. Accommodations such as a reader/scribe for tests and instructional support can make a huge difference in the performance of some students. As psychologists we need to advocate for appropriate accommodations and programming, not just on reports, but as an active part of the team following up from assessments whenever possible.

I have started talking to parents and teachers about neuroplasticity and the possible programs available that might change the cognitive processing deficits of the students I assess. I am careful to inform parents and teachers that cognitive training programs are not guarantees of change and they often do not completely ameliorate cognitive processing difficulties. Nevertheless, the knowledge I have gained through my experience with the pilot research on the LDAS Arrowsmith program, current case study research, and attendance at a conference on neuroplasticity have informed my practice as a psychologist. School psychologists should pass this information on to the individuals they assess and the educational programs they are involved with.

Cognitive training programs should be one of the first considerations for students when a cognitive processing problem is identified. In my work as a psychologist, the most common cognitive processing weakness is in the area of working memory and it is an area that can greatly impact achievement in many academic subjects. Programs such as the Arrowsmith program are costly and very time consuming. The Cogmed Working Memory training program has a great deal of research support, is less costly, and takes less time to complete. As such, it would make sense as a first step to potentially ameliorating learning and academic difficulties and identifying the students who will benefit from cognitive training. Other cognitive training programs may emerge that address working memory and other cognitive processing areas. For some students with learning disabilities, the Cogmed Working Memory program is too narrow in its focus and will not address the severity level of their difficulties and/or other cognitive processing difficulties they have. In these cases, the Arrowsmith program or another more global cognitive training program

may be a better choice. For some students, like Kayla in the current case study research, using exam and other accommodations may be the most effective approach.

Teachers.

Teachers play a vital role in the outcomes for children with learning disabilities. Learn everything you can about learning disabilities and how to help these students achieve at the highest level they are able to. Sometimes a learning disability can look like an attention issue or lower ability. Although it is important to assist students in improving their academic skills, it is also important to be aware of accommodations, scaffolding, and technology that can help students get around their learning disability. If students are only given materials at their current level of academic functioning, they can fall further and further behind in vocabulary and general knowledge.

Your students with learning disabilities may have strengths in visual processing, creativity, and kinesthetic learning that you can emphasize through your instruction. Differentiated instruction will allow you to play to your student's strengths. Your classroom should know that children learn in different ways and that all of these ways are valuable. Incorporate the strengths of the Arrowsmith program in your classroom.

Whenever possible, enlist the help of the student's parents, the special education teacher, and the psychologist or other professionals who are working with your student. Together you will provide stronger support to the student with learning disabilities. Make sure you understand the strengths and limitations of test results so you can exercise the appropriate caution when discussing results with parents. Don't hesitate to ask questions during the feedback session if you are not sure what the results mean in practical terms.

Schools/School Divisions.

Schools and school divisions need to seriously consider adding cognitive training programs to assist students with learning disabilities. The Fast ForWord and Cogmed Working Memory Training programs are already being used or are starting to be used in Saskatchewan school divisions. These programs target important areas of functioning but may not be comprehensive enough for many students with learning disabilities. Sending key individuals within the school division to conferences such as the Learning and the Brain conferences in the United States could

identify other cognitive training programs to consider. Perhaps negotiations could be undertaken with the Arrowsmith program or LDAS to provide parts of this program. The positives of the Arrowsmith program should be incorporated into regular classrooms as much as possible.

The case study research on the LDAS Arrowsmith program identifies four students who are currently taking a higher level of academic programming than was recommended for them in the school system. Prior to taking the LDAS Arrowsmith program, these students had been receiving increasing levels of support such as resource room and adaptations to their academic studies. The successful students in the LDAS Arrowsmith program were able to take an increased level of programming with fewer supports. The student who was less successful in the program was still able to take regular classes when appropriate accommodations and tutoring were provided. The focus of education should be on allowing children with learning disabilities to function at the highest possible level.

The RTI model has many advantages for working with students who have learning disabilities. Screening, early intervention, the use of evidence-based instructional approaches, and data-based decision making should help to identify students who need additional assessment of their cognitive processing. When students continue to fall behind their peers, differentiated instruction should be combined with assessment to determine what is causing the continuing difficulties. Students with cognitive processing and social skills deficits could then be given programming to reduce the deficits that are leading to academic difficulties as soon as possible.

A team approach is important to assessment and meeting the needs of students with learning disabilities. Assigning a case worker or someone to follow students with learning disabilities throughout their education would help provide the team with a comprehensive view of the student. Teachers are the front line professionals and they should be provided with training in reading and interpreting test results and providing feedback to parents. School psychologists could play a consultative role and be more involved in the planning and monitoring of interventions. Parents should be part of the team whenever possible. They have valuable knowledge of their children and can provide useful support outside of school. It is often difficult to be the parent of a student with learning disabilities. Providing a support group or parent mentor may assist parents with this sometimes difficult role.

Arrowsmith program.

The Arrowsmith program is an innovative program that appears to increase cognitive functioning and academic outcomes for some students with learning disabilities. However, taking a more holistic view of the students as learners and increasing flexibility would enhance the Arrowsmith program. It is important for any effective program to understand the limitations of the program and try to mitigate these limitations. Taking children out of school has social consequences that can lead to difficulties that may reduce the impact of the program. Providing part-time options that parents could access outside of school or that may be more attractive to school systems should be seriously considered. Even though some students will still need a more comprehensive program, parents who feel that taking their children out of school will have seriously adverse effects and/or are not financially able to afford full-time or part-time fees may be able to provide their children with some change in cognitive functioning.

The Arrowsmith program should consider identifying and monitoring the optimal stress/arousal levels for their students knowing that high levels of anxiety could interfere with a positive outcome in the program. Additional scaffolding could be provided when a student is experiencing a higher than optimal level of stress when doing cognitive tasks until they are more comfortable. Reducing the level of tasks, progressing more slowly, or reducing the frequency of the tasks may be more effective than continuing at the prescribed rate or increasing the intensity. Factors such as social disconnection from one's peer group, personality differences, and previous levels of programming modification could affect the stress levels of the students and effectiveness of the program. Social interactions are very important to most children and should be integrated into programming. Physical activity and creative outlets can be helpful in reducing stress levels of students and providing more variety. Not all learning needs to be structured, a balance of discovery and directed learning may be more effective.

It is not clear to parents what process is in place to gain acceptance into the Arrowsmith program. Several parents were worried that their child's below average cognitive scores would exempt their child from the program. There is no evidence that I observed that cognitive scores were reviewed by the program or played any role in gaining acceptance into the Arrowsmith program. Two of the participants in the case study had recent cognitive testing that was more consistent with some level of overall cognitive disability than a learning disability. It is important

to note though, that both of these students had a positive experience through the LDAS Arrowsmith program and now have cognitive profiles that are more consistent with a learning disability.

Recommendations for Future Research

Research related to removing or reducing the cognitive functioning/processing deficits of individuals with learning disabilities is very important. A great deal of research is still needed on the Arrowsmith program and the application of neuroplasticity research to educational programs for individuals with learning disabilities. More information is needed on what types of individuals and/or what types of conditions lead to different cognitive and academic outcomes through participation in the Arrowsmith program and other cognitive training programs. In my view, it is just as important to understand who the program is less effective for and why; as it is to understand who it is effective for and why. Replication of the current case study research with other Arrowsmith students at LDAS and other locations will be helpful in expanding this knowledge.

Further research needs to identify the differences between individuals who programming works for and those it doesn't work for. For example, the current case study research appears to suggest that higher than optimal stress levels decrease the effectiveness of the Arrowsmith program. If future case studies replicate this difference, a research design using an RTI model would be very helpful to providing additional individualization to see if changes to reduce the student's stress level to their optimal level will help these students who are not responding to the Arrowsmith program intervention. Educational programs designed to help students with learning disabilities often respond to a lack of progress by increasing the frequency or intensity of the program. In some cases, it may be a reduction in the frequency or intensity of a program that leads to positive gains. Baseline measures of stress level and estimates of individual optimal stress levels with monitoring could, for example, inform a modification to the program that may lead to a better outcome. Single case designs for measuring response to interventions to optimize stress levels, for example, could advance the utility of the Arrowsmith program and other cognitive training programs (Riley-Tillman & Burns, 2009).

Comparison studies are needed to more fully understand the Arrowsmith program and evaluate its effectiveness. A control group of individuals with learning disabilities who are matched on as many relevant characteristics as possible would provide needed information on the

effectiveness of the Arrowsmith program generally and in comparison to other intervention choices specifically. One of the most important control groups for comparisons to the Arrowsmith group would be students with learning disabilities who are receiving the typical supports within the school system. A randomized, controlled design is not possible given the ethical considerations of letting chance determine whether or not someone receives programming that may potentially change their cognitive potential for the better. This difficulty could be ameliorated to some degree by offering a delayed entry to those individuals who are not randomly selected for the Arrowsmith program. A double blind study is not generally possible given that the Arrowsmith program is a privately funded program in most cases. The Arrowsmith program has many components and the level of control of the relevant variables needed for a true experiment is not possible. This situation is often the case in real life educational programs unless they have a narrow focus and time such as the Cogmed Working Memory Training program.

The individual cognitive tasks within the Arrowsmith program could be studied with double blind studies but it is possible that it is the combination of tasks that leads to changes and not the tasks individually. Nevertheless, research to identify which of the cognitive tasks individually or in combination will make the most amount of difference in reducing the cognitive functioning deficits of individuals with learning disabilities may allow the program to be streamlined to reduce the time commitment needed. This change would make the most important elements of the program more accessible to more people.

More research of the emotional and interpersonal/behavioural functioning of individuals who are attending the Arrowsmith program is needed. Formal and informal measures of these areas will lead to a better understanding of how participation in the Arrowsmith program affects emotional and interpersonal functioning and vice versa. Longitudinal studies to understand the long term effects of participation in the Arrowsmith program are needed, particularly those studies that provide comparisons with similar students with learning disabilities who received the typical supports in school or some other specialized program.

Conclusion

Participation in the LDAS Arrowsmith program was an overall positive experience for four of the five students and their parents included in this explanatory case study research. Nevertheless,

all of the students who participated in the research had significantly higher cognitive functioning/processing in at least one broad area measured by standardized tests after two years of participation in the LDAS Arrowsmith program. All of the students improved in some aspect of memory (working memory and/or long term retrieval). As well, all of the students had at least one broad cognitive functioning/processing area that had not significantly changed on standardized tests after participating in the program. Most of the students obtained significantly higher cognitive processing scores in many areas but the particular areas depended on the students. Information from the interviews identified areas such as memory, focus, decision making, and comprehension as having improved.

Similar to cognitive functioning, all of the students had at least one standardized achievement test result that had significantly increased after participation in the LDAS Arrowsmith program and at least one standardized achievement test result that had not significantly increased. The particular areas that increased or stayed the same depended on the students but the most common areas to increase were writing and academic fluency and the area that increased the least often was spelling. All four of the students who had returned to regular schools were taking academic programming at a higher level than they were previously. Two of the students moved from alternate/modified programming to a mix of regular and modified classes. One of these students took an individualized, alternate math class. The student who had the least positive experience through participation in the LDAS Arrowsmith program returned to modified/adapted programming in elementary school but was able to successfully take regular classes in high school with appropriate accommodations such as having notes provided, resource room assistance, a reader/scribe for exams, and outside tutoring. The remaining student who returned to a regular school successfully took regular classes with no supports but re-entered the school system a grade lower than her age peers.

Semi-structured interviews with the students and their parents revealed that all but one of the students increased in self-confidence and happiness after participation in the LDAS Arrowsmith program. Some of the students became less emotionally reactive and better decision makers as a result. Some of the students became more self-reliant. Most of the students were quite strong in their emotional and interpersonal functioning prior to participation in the LDAS Arrowsmith program. Two of these students though, experienced social disconnection from their peers from

their regular schools that adversely affected their stress and anxiety levels, at least temporarily. The student who experienced social skills difficulties prior to entering the LDAS Arrowsmith program benefitted from the safe and supportive atmosphere in the program. The interview with his mother and teacher comments on progress reports indicates that he became more independent and self-reliant.

Why did four of the five students make more significant improvements in cognitive and academic functioning? The main difference between the student who made fewer changes and the other students was in her experience of mastering levels for the cognitive tasks as stressful and not exciting and positive. This student experienced significant social disconnection from her peers at her regular school. Her social skills were her main strength prior to entering the LDAS Arrowsmith program. This student was the only one who talked about her motivation being affected by her lack of understanding of how the cognitive tasks would connect to real life situations. She had liked art, history, and religious studies at school and participating in field trips. She missed these subjects in the LDAS Arrowsmith program. This student's emotional stress level was above the optimal level for learning and development. This factor appeared to be the main reason she had less success in the program.

More research is needed to further understand how participation in the LDAS Arrowsmith program affects cognitive, academic, emotional, and interpersonal functioning. Replication of the case study research with more individuals who had positive experiences and less positive or negative experiences will assist in indentifying factors related to the success of the program and possibly intervening to increase the success of individuals who are making minimal or no cognitive changes in the program. Of particular importance for further study are the effects of higher than optimal stress levels and social disconnection factors in affecting the outcome of participation in the program. Studies to identify the key cognitive tasks and levels needed to make the most important cognitive changes related to academic, emotional, and interpersonal success would help to streamline the Arrowsmith program and make it more accessible to more students with learning disabilities. It could be also argued that the Arrowsmith program as a whole produces the benefits for the students and not the individual components. Research to examine this possibility would need to be conducted with the consent of Barbara Arrowsmith-Young, the developer of the

Arrowsmith program. Further longitudinal research will identify how participation in the LDAS Arrowsmith program affects the students long term.

Personal Reflection

I started my dissertation with a strong connection to research that might positively affect the life outcomes for individuals with learning disabilities. I knew through my previous research experience with the LDAS Arrowsmith study that many of the students had made large and significant increases in many areas of their cognitive processing scores on standardized tests after two years of participation in the program and that some of the students had made much smaller increases that were in fewer areas. This result surprised me as I have typically been skeptical of programs that claim to reduce or remove the cognitive processing difficulties associated with learning disabilities. I decided to do more research with this group of students for my dissertation to find out how participation in the LDAS Arrowsmith program had affected the cognitive, academic, emotional, and interpersonal functioning of the students. Given how little research was available to evaluate the Arrowsmith program and the lack of independent and peer-reviewed research, I felt that it was especially important to rectify this situation.

Initially I planned to approach four of the students who had made the largest cognitive gains; thinking that in-depth information on these students would best answer my research questions. In the end, I am so happy that my committee insisted that I send a recruitment letter to all of the participants and leave it up to the students and their parents to decide who wanted to tell their stories. Every one of the students and parents helped me gain valuable information on the experience of participation in the LDAS Arrowsmith program, what changes happen as a result, why these change do or do not happen, and how these changes or lack of changes affect school functioning and everyday life. I gained just as much information and insight from the participation of a student who left the program after two years with smaller cognitive and academic improvements who had experienced emotional and interpersonal struggles as a result of their participation in the LDAS Arrowsmith program.

I started my research with some experience with qualitative information and observations from my work as a counsellor and school psychologist. However, I realized that I had little understanding of qualitative research and did not have a true appreciation for the depth of

knowledge to be gained through this research. I had a tendency to value "the truth" or observable, controllable facts more than what I perceived as fallible opinions. Through my research, my respect for the qualitative research process has grown. My bias towards quantitative evidence has not been entirely removed but it has been altered in important ways. Data analysis of qualitative information has been messy, time consuming, frustrating, and at times, paralyzing. It has also ultimately been amazingly rewarding, informative, enriching, and has forced me to become more creative than I thought I could be. I found that I am still terrible at keeping a journal...although I valiantly tried to do so whenever I could. I have changed some of my practices as a psychologist and my thinking about numbers. I also found out that I love qualitative research!

In conclusion, I want to end with a quote from Martin Luther King Jr., "Injustice anywhere, affects justice everywhere." This quotation is engraved on the monument to his memory in Washington, D.C. I visited this monument when I attended the Learning and the Brain Conference in Arlington, Virginia in May 2012 for a poster presentation of my case study research on the LDAS Arrowsmith program. The quote resonated with my work with individuals with learning disabilities. Research and education related to neuroplasticity offer the chance for individuals with learning disabilities to have more options for their lives. Children and adults with learning disabilities from a variety of backgrounds should have the opportunity to maximize their potential and options. The justice available for individuals with disabilities should concern us all.

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Appendix A

Learning disabilities result from impairments in one or more processes related to perceiving, thinking, remembering or learning. These include, but are not limited to: language processing; phonological processing; visual spatial processing; processing speed; memory and attention; and executive functions (e.g. planning and decision-making).

Learning disabilities range in severity and may interfere with the acquisition and use of one or more of the following: oral language; reading; written language; and mathematics. Learning disabilities may also involve difficulties with organizational skills, social perception, social interaction and perspective taking.

Learning disabilities are life-long. The way in which they are expressed may vary over an individual's lifetime, depending on the interaction between the demands of the environment and the individual's strengths and needs. Learning disabilities are suggested by unexpected academic under-achievement or achievement which is maintained only by unusually high levels of effort and support.

Learning disabilities are due to genetic and/or neurobiological factors or injury that alters brain functioning in a manner which affects one or more processes related to learning. These disorders are not due primarily to hearing, and/or vision problems, socio-economic factors, cultural or linguistic differences, lack of motivation or ineffective teaching, although these factors may further complicate the challenges faced by individuals with learning disabilities.

Learning disabilities may co-exist with various conditions including attention, behavioural, and emotional disorders, sensory impairments or other medical conditions (http://ldac.ca).

Appendix B

Table B1. Arrowsmith Cognitive Function Descriptions and Features of Difficulties

Arrowsmith Cognitive Function	Features of Difficulties
1. Motor Symbol Sequencing Ability to learn and produce a written sequence of symbols	Messy handwriting, miscopying, misreading, irregular spelling, speech rambling, careless written errors in mathematics, poor written performance
2. Symbolic Relations Ability to understand the relationships among two or more ideas or concepts	Reversals of b-d: p-q, difficulty reading a clock, needing to reread material to comprehend it, problem understanding cause and effect, trouble with mathematical reasoning
3. Memory for Information/Instructions Ability to remember chunks of auditory information	Trouble remembering oral instructions, difficulty following lectures or extended conversations, problem acquiring information through listening
4. Predicative Speech Ability to see how words and numbers interconnect sequentially into fluent sentences and procedures	Problem putting information into one's own words, speaking in incomplete sentences, difficulty using internal speech to work out consequences, trouble following long sentences, breakdown of steps in mathematical procedures
5. Broca's Speech Pronunciation Ability to learn to pronounce syllables and then integrate them into the stable and consistent pronunciation of a word	Mispronouncing words, avoiding using words because of uncertainty of pronunciation, difficulty thinking and talking at the same time, flat and monotone speech with lack of rhythm and intonation, limited ability to learn and use phonics
6. Auditory Speech Discrimination Ability to hear the difference between similar speech sounds, (e.g., hear and fear and clothe and clove)	Mishearing words and thus misinterpreting information, difficulty understanding someone with an accent, extra effort required to listen to speech

7. Symbolic Thinking Ability to develop and maintain plans and strategies through the use of language	Problem being self-directed and self-organized in learning, limited mental initiative, difficulty keeping attention focused on task to completion, trouble seeing the main point and limited problem solving ability
8. Symbol Recognition Ability to visually recognize and remember a word or symbol that has been seen before	Poor word recognition, slow reading, difficulty with spelling, trouble remembering symbol patterns such as mathematical or chemical equations
9. Lexical Memory Ability to remember several unrelated words	Problems with associative memory, trouble learning how to read due to difficulty associating the word with its sound, trouble following auditory information
10. Kinesthetic Perception Ability to know where one's body is in space and to recognize objects by touch	Awkward body movements, bumping into objects due to not knowing where body is in space relative to objects, uneven handwriting with variable pressure
11. Kinesthetic Speech An awareness of the position of the lips and tongue	Lack of clear articulation of speech, some speech slurring
12. Artifactual Thinking Ability to register and interpret nonverbal information	Problem interpreting nonverbal information such as body language, facial expression and voice tone, difficulty registering and interpreting one's own emotions, weak social skills
13. Narrow Visual Span Ability to see a large number of symbols or objects in one visual fixation	Slow, jerky reading with errors, eyes fatigue when reading, problem navigating in the dark
14. Object Recognition Ability to visually recognize and remember the details of objects	Trouble finding objects, problem remembering visual cues such as landmarks, difficulty remembering faces and recalling the visual details of pictures
15. Spatial Reasoning Ability to imagine a series of moves through space inside	Frequently getting lost, losing objects, messy, disorganized workspace, trouble constructing geometric figures

one's head before executing them	
16. Mechanical Reasoning Ability to understand how machines operate and effectively handle and use tools	Difficulty understanding the mechanical properties of objects, problems constructing or repairing machinery such as taking apart and putting together a bicycle or repairing a car
17. Abstract Reasoning Ability to carry out a task in the proper sequence of steps	Trouble understanding the proper sequence of steps in a task such as sewing, cooking, or computer programming
18. Primary Motor Ability with the speed, strength, and control of muscle movements on one side of the body or the other	Poor muscle tone which results in some degree of awkwardness and slowness of body movement
19. Supplementary Motor Ability to carry out internal sequential mental operations, such as mental mathematics	Finger counting, trouble retaining numbers in one's head, difficulty making change, problem learning math facts, poor sense of time management

Retrieved from http://www.arrowsmithschool.org

Appendix C

ARROWSMITH PROGRAM
245 St. Clair Avenue West, Toronto, Ontario M4V 1R3
Telephone: 416 963-4962 Facsimile: 416 963-8464

July 8, 2010

Sent by email to dlk094@mail.usask.ca

Ms. Debra Kemp-Koo
Box 1284
Saskatoon, Saskatchewan
S7K 3N9

Dear Ms. Kemp-Koo,

It was a pleasure speaking with you and hearing about your research as well as discussing the Arrowsmith Research Report you completed on April 22, 2010.

1. Arrowsmith Program and my company, Brainex Corporation that owns the Arrowsmith Program intellectual property, give their consent to you as follows:

   (a) to gather data on the academic and cognitive progress and academic and cognitive changes of students enrolled in the Arrowsmith Program at the Learning Disabilities Association of Saskatchewan in Saskatoon;

   (b) to analyzing this data including conducting independent research and preparing a report in connection with your doctoral thesis at the University of Saskatchewan

   (c) to publishing this report as part of your Ph.D. thesis and

   (d) to submitting the report for publication and having it published in academic journals in either print or electronic form

2. This consent is subject to the following terms and conditions:

   (a) you will not describe the methodology of the Arrowsmith cognitive exercises in your report or what the exercises involve. 'Cognitive exercise' here refers to an exercise that is used in the Arrowsmith Program which may be provided in any form of media and is designed to address the cognitive function of one of the learning dysfunctions described in the publicly available material published by Arrowsmith on its website and in printed materials;

   (b) you will not refer to or disclose any of the confidential information contained in the Arrowsmith Program reference manual or that that may have been disclosed to you in the course of your research study

_____
(Debra Kemp-Koo)

(c) you may refer by name to the cognitive areas that are addressed by the Arrowsmith Program and describe them as described in the Arrowsmith literature and on its website and in its publicly available printed materials.

I would also be grateful if you could provide me with a copy of your report when completed and give me your permission to publish it on the Arrowsmith website with appropriate attribution.

If this is satisfactory, could you please acknowledge your consent by signing at the bottom of the first page, signing and dating the acknowledgment at the bottom of this page and returning a copy of this letter to me by facsimile or email.

Thank-you for your interest in the work of the Arrowsmith Program and I look forward to reading the final report.

Sincerely,

Barbara Arrowsmith-Young
Director, Arrowsmith Program

July 8 , 2010

I have read and agree to the terms and conditions contained in this letter.

Dated at Saskatoon, Saskatchewan on July _____ , 2010

(Debra Kemp-Koo)

Appendix D

Case Study Protocol

A. Overview of the Case Study Project

The main purpose of this study is to explore the experiences and perceptions related to participation in the Learning Disabilities Association of Saskatchewan (LDAS) Arrowsmith program. Another purpose is to identify what changes have occurred for the students participating in the LDAS Arrowsmith program that can be discerned from their school records such as: marks, standardized test results, progress reports, teacher comments, and use of resource room and other academic supports in the schools. The Arrowsmith program is a cognitive training program that aims to decrease the cognitive functioning deficits of individuals with learning disabilities, thereby allowing these individuals to perform academic, social, and other tasks independently or with reduced support (http://www.arrowsmithschool.org).

Research questions

How has participation in the LDAS Arrowsmith Program affected the lives of the students cognitively, academically, emotionally, and interpersonally from the examination of archived school documents and standardized test data?

How has participation in the LDAS Arrowsmith Program affected the lives of the students cognitively, academically, emotionally, and interpersonally from the perspective of the students?

How has participation in the LDAS Arrowsmith Program affected the lives of the students cognitively, academically, emotionally, and interpersonally from the perspective of the parents?

How do the perspectives on participation in the LDAS Arrowsmith program of the students, parents, and school documents compare and contrast with each other with respect to cognitive, academic, emotional, and interpersonal areas?

B. Field Procedures

The participants in the proposed study will be five of the twelve students who enrolled in the LDAS Arrowsmith program in 2008-2009 and one or both of their parents. The parent participants will decide if one or both of the parents will attend the interviews. Adult students will choose whether or not one or both of their parents participate. Interviews will take place in the location that the parents and children or youth are most comfortable with that is in a private and quiet setting.

A case study approach will be undertaken with interviews of five students and their parents (for child or youth participants and for adult students who choose to have their parents participate) and

examination of progress reports, teacher comments on progress reports, standardized test scores, and use of resource room and other academic supports that are included in the student cumulative files in the Kindergarten to grade 12 school they are attending or last attended. Although some of the information gathered for the proposed study will be quantitative, the majority of the information will qualitative and gathered through interviews with students and parents.

A constructivist perspective will be adopted to gain insight into the experiences of participation in the LDAS Arrowsmith program from the perspective of the individuals being interviewed. As such, semi-structured interviews using open-ended questions with each participant individually (parents can choose one parent as the participant or they can choose to be interviewed together) will be the main information gathering tool for the proposed study. The interviews will be audio taped with the permission of the participants to allow the researcher to fully take in all of the information from the interview while being focused on the participant being interviewed.

Permission from the school division, principals of the schools, and the parents of student participants to access the student cumulative folder to examine: progress report marks, teacher comments on progress reports, standardized test scores, and information concerning resource room and other academic support usage from before, during, and after participation in the LDAS Arrowsmith program.

Materials for the First Interview

Quiet, private room with a table and two chairs
Digital recorder with extra batteries
Tablet of paper and pens
Appropriate consent or assent forms
Do not disturb sign
Research journal
Appointment book

Prior to the second interview, a copy of the transcript would have been provided to the participants to review. If the participant has a reading disability, the researcher will offer to read the transcript out loud to the participant. The participant can contact the researcher by phone or email to make changes to the transcript prior to the second interview or bring their changes for discussion at the second interview.

Materials for the Second Interview

Quiet, private room with a table and two chairs
Digital recorder with extra batteries
Tablet of paper and pens
Transcript of first interview
Do not disturb sign
Research journal
Appointment book

After the second interview, the participants will be provided with a draft transcript of the second interview to review. If the participant has a reading disability, the researcher will offer to read the transcript to the participant. The participants will be given the choice to contact the researcher by phone or email to make changes or to arrange a meeting to make them in person. A meeting will be arranged to sign the transcript release when the participant is comfortable with the transcript.

C. Case Study Questions

Researcher questions

What does participation in the LDAS Arrowsmith program mean in practical terms?

What are the similarities and differences in the experiences and perspectives among the student participants in the LDAS Arrowsmith research study?

What are the similarities and differences in the experiences and perspectives among the parent participants in the LDAS Arrowsmith research study?

What are the similarities and differences in the experiences and perspectives between the student and parent participants in the LDAS Arrowsmith research study?

What factors did the students see as most important concerning participation in the LDAS Arrowsmith program?

What factors did the parents see as most important concerning participation in the LDAS Arrowsmith program?

What aspects of the LDAS Arrowsmith program did the students feel could be improved?

What aspects of the LDAS Arrowsmith program did the parents feel could be improved?

What changes occurred in the school records of the student participants after participation in the LDAS Arrowsmith program?

Questions for first interview (parents)

1. Tell me about the journey you experienced with your child before and during the identification of their learning disability.

2. Tell me how your child's participation in the LDAS Arrowsmith program has affected the cognitive, academic, emotional, and interpersonal functioning of your child.

3. What do you see as being the most important changes in your child since participating in the Arrowsmith program?

4. What aspects of the LDAS Arrowsmith program do you feel helped your child the most?

5. What changes to the LDAS Arrowsmith program do you feel would benefit your child or other children who are participating in the program?

Questions for first interview (students)

1. Tell me what it has been like having a learning disability and how you came to understand your learning disability.

2. Tell me how your participation in the LDAS Arrowsmith program has affected your ability to think.

3. Tell me how your participation in the LDAS Arrowsmith program has affected your performance in school and academic areas such as reading, writing, spelling, and math.

4. Tell me how your participation in the LDAS Arrowsmith program has affected how you feel about yourself and your ability to understand and express your emotions.

5. Tell me how your participation in the LDAS Arrowsmith program has affected you ability to get along with other people such as teachers, parents, siblings, and friends.

6. What do you see as being the most important changes you have made since participating in the LDAS Arrowsmith program?

7. What things in the LDAS Arrowsmith program do you feel helped the most?

8. What things in the LDAS Arrowsmith program do you feel could be improved to make it better?

D. Case Study Report Guidelines

The information generated for each participant will be labelled by the pseudonym of the participant and whether the participant is a student or a parent. The information will be placed in file folders that will be colour coded to pair the appropriate student and parent combinations. All of the interviews will be audio taped by a digital recorder (unless the participant objects to the taping of their interview) and transcripts will be made of the interviews. After changes have been made to the transcripts, a line will be placed through the pages to indicate this transcript is a version that will not be used in the research report. Once the transcript release form has been signed, the final transcript will be clearly labelled for each participant. The school record information will be labelled by the student pseudonym and divided by the type of record in different file folders in the appropriate colour for this student.

After the transcripts have been finalized, highlighter pens will be used in different colours to represent the areas of cognitive, academic, emotional, and interpersonal with regards to the participant statements. A spreadsheet for each participant will be developed to group the statements they have made in each of these areas and a process of coding and grouping the items into larger categories will be undertaken. The quantitative and qualitative information from the school records will be similarly grouped but the analysis of the quantitative information will be done on a nonparametric basis because of the low numbers.

A cross case analysis among the student participants, among the parent participants, between the student and parent participants, and between the interview and school record sources of information will be undertaken with care taken to tell the story of each participant, particularly that of the students in the LDAS Arrowsmith program.

Appendix E

Recruitment Letter

UNIVERSITY OF SASKATCHEWAN

June ___, 2011

Name of Parents or Adult Student
Address of Parents or Adult student

Dear _____:

You and your child are being invited to participate in a research study titled, **A Case Study of the Learning Disabilities Association of Saskatchewan (LDAS) Arrowsmith Program.** If you are a student of the program who is an adult, you can choose whether or not you want your parent(s) to participate in the research. This study is the dissertation research of Debra Kemp-Koo. A brief summary of the results will be written for the participants and others interested in the LDAS Arrowsmith program.

The main purpose of this study is to explore the experiences and perceptions related to participation in the LDAS Arrowsmith program through interviews of the students, parents of the students, and review of school records. Although your participation in the research would be greatly appreciated, it is entirely voluntary and will not affect current or future participation in the LDAS Arrowsmith program or any other LDAS program in any way.

Four students and their parents will be selected from the volunteers to maximize variety of experiences in the program. Debra Kemp-Koo will interview each participant individually on two occasions for approximately one hour each time from May to July 2011. If you are interested in volunteering for the study or would like to get more information without any obligation contact Debra Kemp-Koo by phone at (306) 290-7912 or email at dlk094@mail.usask.ca

Thank you for your consideration of this research project,

Tim Claypool, Ph.D., R.D. Psych.

for:

Debra Kemp-Koo, M.Ed., R.Psych., Ph.D. Candidate

Appendix F

Letter to School Division/Principal

UNIVERSITY OF SASKATCHEWAN

May __, 2011

Saskatoon Public Schools
310 – 21st. Street East
Saskatoon, SK
Canada S7K 1M7

and

Greater Saskatoon Catholic Schools
420-22nd Street East
Saskatoon, SK
Canada S7K 1X3

Dear _____:

I am a Ph.D. candidate at the University of Saskatchewan in the Educational Psychology and Special Education department. I am writing to request permission to access records from the student cumulative folders for: _____. Of interest to my research are the report progress marks and teacher comments, standardized testing information, and use of resource room and other academic supports for the each student's school history. In reports and presentations that may result from this research, the students will be given pseudonyms and the particular schools or the school division will not be named with respect to individual student results. The parents of this (these) child (children) have given permission for their child's participation in a research study titled, **A Case Study of the Learning Disabilities Association of Saskatchewan (LDAS) Arrowsmith Program**.

The purpose of the dissertation research is to understand the experiences and perceptions related to participation in the LDAS Arrowsmith program. A combination of interviews of the students and parents and study of the school records of the students will be used to answer the research questions. The Arrowsmith program is an intense cognitive training program that aims to remove or reduce the cognitive processing deficits of individuals with learning disabilities so they can function academically, interpersonally, and cognitively without supports or with reduced supports. In my research, I want to understand what participation in the LDAS Arrowsmith program has meant in practical terms for the students and their families. An examination of the school records would help to understand this issue. I

would greatly appreciate permission from the school division and the principals of the schools _____ attend to look at their cumulative folders and speak to the resource room teachers (if possible) to determine academic support usage. I will not photocopy any information from the files but I would like permission to write information down that will be labelled with the student's pseudonym for the study.

Thank you for considering my request. I you need any further information, don't hesitate to call me at (306) 290-7912 or email me at dlk094@mail.usask.ca.

Sincerely,

Debra Kemp-Koo, M.Ed. R. Psych., Ph.D. Candidate

Appendix G

Parent Consent Form

UNIVERSITY OF SASKATCHEWAN

Behavioural Research Ethics Board (Beh-REB)

PARENT CONSENT FORM

You are invited to participate in a research project entitled **A Case Study of the Learning Disabilities Association of Saskatchewan (LDAS) Arrowsmith Program**. Please read this form carefully, and feel free to ask questions you might have.

Researcher(s):

Debra Kemp-Koo (Ph.D. Candidate, Registered Psychologist) and Dr. Tim Claypool (Assistant Professor, Registered Doctoral Psychologist)

Department of Educational Psychology and Special Education

University of Saskatchewan

Contact information: phone: (306) 290-7912, email: dlk094@mail.usask.ca

Purpose and Procedure:

Purpose: The main purpose of this study is to explore the experiences and perceptions related to participation in the Arrowsmith program. Another purpose is to identify what changes have occurred for the students participating in the Arrowsmith program that can be discerned from their school records such as: marks, standardized test results, progress reports, teacher comments, and use of resource room and other academic supports in the schools.

Procedures: This research project will run from June to August 2011 with participation of four students who started the LDAS Arrowsmith program in 2008-2009 and their parents. Each

participant will be interviewed separately by Debra Kemp-Koo on two occasions. Each interview will be approximately one hour in length and will take place in a location away from LDAS that provides quiet and privacy, that will be chosen by the participants. The parents of the student participants can choose one parent to be interviewed or attend the interviews together. The interviews will be audio taped and transcribed. After each of your interviews, and prior to the data being included in the final report, you will be given an opportunity to review the transcript of your interviews, and to add, alter, or delete information from the transcripts as you see fit.

Also, school records in the cumulative folder in the Kindergarten to grade 12 school that your child currently attends or last attended will be examined for use of resource room and other academic supports, marks, and teacher comments, before participation in the LDAS Arrowsmith program and after each year of participation in the LDAS Arrowsmith program.

The research findings will be reported in the dissertation of Debra Kemp-Koo and will be submitted for possible publication as journal article(s) and posters or presentations at conferences or training sessions. Direct quotations may be used in any or all of the reporting formats and will be review for approval by the participants before being reported to others.

Potential Benefits: While there is no guarantee that you or your child will receive personal benefits from participation in the study, you may experience greater awareness through participation in the interviews and examination of the school records. You may receive clarification of the progress of your child. Also, you will contribute to the independent research that is currently lacking on the Arrowsmith program in general. You will contribute to information on the LDAS Arrowsmith program for LDAS to use in explaining their program, deciding on the future of the program, and/or improving the program.

Potential Risks: The interviews or school records may cause or contribute to doubt in your mind about the present or future participation of your child in the LDAS Arrowsmith program. A loss of anonymity is potentially present since the LDAS Arrowsmith program involves a small number of students and parents who are all known to each other. There is a risk you may feel that your perceptions are misrepresented. You will be given a transcript of the interviews and possible quotations that may be used to reduce this risk and your information will be attributed to a pseudonym.

Storage of Data: The information that is gathered throughout this project will be kept in a locked filing cabinet in Dr. Tim Claypool's research office for five years. The consent forms and master list of students and parents will be stored separately from the data that is identified by pseudonyms. The master list will be destroyed as soon as the data has been collected and pooled. When the data is not needed anymore, it will be destroyed beyond recovery.

Confidentiality: The data from this research will be published and possibly be presented at conferences; however, your identity and that of your child will be kept confidential. Although direct quotations may be reported from the interview, you will be given a pseudonym of your choosing, and specifically identifying information such as exact age, school, and parent's occupation will be removed from the report. Information concerning number of years and full or part time participation in the LDAS Arrowsmith program, type and severity of the learning disability may be included in reports to enhance the informational value of the research.

Debra Kemp-Koo is a board member at LDAS and she conducted previous research on the LDAS Arrowsmith program. The current research is independent of her role at LDAS and the previous research she conducted. Therefore, she will endeavour to keep these roles completely separate. To accomplish this goal, Debra Kemp-Koo will not release the names of parents who choose to participate or not participate in the current research to LDAS and she will conduct the research away from the LDAS location. She will audiotape the interviews and have the participants review transcripts of the interviews to ensure that the experiences described in the study are those of the participants and not her own experiences or the experiences of staff at LDAS.

Because the participants for this research project have been selected from a small group of people, all of whom are known to each other, it is possible that you may be identifiable to other people on the basis of what you said or the type of learning disability and cognitive processing difficulties attributed to each student.

Right to Withdraw: Your participation is voluntary, and you can answer only those questions that you are comfortable with. There is no guarantee that you will personally benefit from your involvement. The information that is shared will be held in strict confidence and discussed only with the research team. You may withdraw from the research project for any reason, at any time, without penalty of any sort. Your participation or choice to withdraw from the study will not affect your participation in the LDAS Arrowsmith program. Your right to withdraw data from the

study will apply until the data has been pooled. After this it is possible that some form of research dissemination will have already occurred and it may not be possible to withdraw your data.

Questions: If you have any questions concerning the research project, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided if you have other questions. This research project has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on May 20, 2011. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Out of town participants may call collect.

Follow-Up or Debriefing: A brief written summary of the results will be available to participants and others interested in the experiences of participants in the LDAS Arrowsmith program specifically and the Arrowsmith program generally. The brief written summary results will be reported as a group.

Consent to Participate:

Written Consent

I have read and understood the description provided; I have had an opportunity to ask questions and my/our questions have been answered. I consent to participate in the research project and have my child participate in the research project, understanding that I may withdraw my consent at any time. I understand that my child will be asked to give their own assent to the research project. A copy of this Consent Form has been given to me for my records.

_____ _____

(Name of Participant) (Date)

_____ _____

(Signature of Participant) (Signature of Researcher)

Appendix H

Child/Youth Assent Form

UNIVERSITY OF SASKATCHEWAN

Behavioural Research Ethics Board (Beh-REB)

CHILD/YOUTH ASSENT FORM

You are invited to participate in a research project entitled **A Case Study of the Learning Disabilities Association of Saskatchewan (LDAS) Arrowsmith Program**. Please read this form carefully, and feel free to ask questions you might have.

Researcher(s):

Debra Kemp-Koo (Ph.D. Candidate, Registered Psychologist) and Dr. Tim Claypool (Assistant Professor, Registered Doctoral Psychologist)

Department of Educational Psychology and Special Education

University of Saskatchewan

Contact information: phone: (306) 290-7912, email: dlk094@mail.usask.ca

Purpose and Procedure:

Purpose: The main purpose of this study is to explore the experiences and perceptions related to participation in the Arrowsmith program. Another purpose is to identify what changes have occurred for the students participating in the Arrowsmith program that can be discerned from their school records such as: marks, standardized test results, progress reports, teacher comments, and use of resource room and other academic supports in the schools.

Procedures: This research project will run from May to December 2011 with participation of four students who started the LDAS Arrowsmith program in 2008-2009 and their parents. Each

participant will be interviewed separately by Debra Kemp-Koo on two occasions. Each interview will be approximately one hour in length and will take place in a location that provides quiet and privacy, that will be chosen by the participants. The interviews will be audio taped and transcribed. After each of your interviews, and prior to the data being included in the final report, you will be given an opportunity to review the transcript of your interviews, and to add, alter, or delete information from the transcripts as you see fit.

Also, school records in the cumulative folder in the Kindergarten to grade 12 school that you attended in the past if they are available and they will be examined for use of resource room and other academic supports, marks, and teacher comments, before participation in the LDAS Arrowsmith program and after each year of participation in the LDAS Arrowsmith program.

The research findings will be reported in the dissertation of Debra Kemp-Koo and will be submitted for possible publication as journal article(s) and posters or presentations at conferences or training sessions. Direct quotations may be used in any or all of the reporting formats and will be reviewed for approval by the participants before being reported to others.

Potential Benefits: While there is no guarantee that you will receive personal benefits from participation in the study, you may experience greater awareness through participation in the interviews and examination of the school records. You may receive clarification of your progress. Also, you will contribute to the independent research that is currently lacking on the Arrowsmith program in general. You will contribute to information on the LDAS Arrowsmith program for LDAS to use in explaining their program, deciding on the future of the program, and/or improving the program.

Potential Risks: The interviews or school records may cause or contribute to doubt in your mind about your past, present or future participation in the LDAS Arrowsmith program. A loss of anonymity is potentially present since the LDAS Arrowsmith program involves a small number of students and parents who are all known to each other. There is a risk you may feel that your perceptions are misrepresented. You will be given a transcript of the interviews and possible quotations that may be used so you can add, alter, or delete information, to reduce this risk.

Storage of Data: The information that is gathered throughout this project will be kept in a locked filing cabinet in Dr. Tim Claypool's research office for five years. When the data is not needed anymore, it will be destroyed beyond recovery.

Confidentiality: The data from this research will be published and possibly be presented at conferences; however, your identity will be kept confidential. Although direct quotations may be reported from the interview, you will be given a pseudonym of your choosing, and specifically identifying information such as exact age, school, and parent's occupation will be removed from the report. Information concerning number of years and full or part time participation in the LDAS Arrowsmith program, type and severity of the learning disability may be included in reports to enhance the informational value of the research.

Because the participants for this research project have been selected from a small group of people, all of whom are known to each other, it is possible that you may be identifiable to other people on the basis of what you said.

Right to Withdraw: Your participation is voluntary, and you can answer only those questions that you are comfortable with. There is no guarantee that you will personally benefit from your involvement. The information that is shared will be held in strict confidence and discussed only with the research team. You may withdraw from the research project for any reason, at any time, without penalty of any sort, including participation in the LDAS Arrowsmith program.

Questions: If you have any questions concerning the research project, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided if you have other questions. This research project has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on (insert date). Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Out of town participants may call collect.

Follow-Up or Debriefing: A brief written summary of the results will be available to participants and others interested in the experiences of participants in the LDAS Arrowsmith program specifically and the Arrowsmith program generally. The brief written summary results will be reported as a group.

Consent to Participate:

Written Consent

I have read and understood the description provided; I have had an opportunity to ask questions and my questions have been answered. I consent to participate in the research project, understanding that I may withdraw my consent at any time. A copy of this Consent Form has been given to me for my records.

_____ _____

(Name of Participant) (Date)

_____ _____

(Signature of Participant) (Signature of Researcher)

Appendix I

Interview Questions

Questions for First Interview (Parents)

1. Tell me about the journey you experienced with your child before and during the identification of their learning disability.

2. Tell me how your child's participation in the LDAS Arrowsmith program has affected the cognitive, academic, emotional, and interpersonal functioning of your child.

3. What do you see as being the most important changes in your child since participating in the Arrowsmith program?

4. What aspects of the LDAS Arrowsmith program do you feel helped your child the most?

5. What changes to the LDAS Arrowsmith program do you feel would benefit your child or other children who are participating in the program?

Questions for First Interview (Students)

1. Tell me what it has been like having a learning disability and how you came to understand your learning disability.

2. Tell me how your participation in the LDAS Arrowsmith program has affected your ability to think.

3. Tell me how your participation in the LDAS Arrowsmith program has affected your performance in school and academic areas such as reading, writing, spelling, and math.

4. Tell me how your participation in the LDAS Arrowsmith program has affected how you feel about yourself and your ability to understand and express your emotions.

5. Tell me how your participation in the LDAS Arrowsmith program has affected you ability to get along with other people such as teachers, parents, siblings, and friends.

6. What do you see as being the most important changes you have made since participating in the LDAS Arrowsmith program?

7. What things in the LDAS Arrowsmith program do you feel helped the most?

8. What things in the LDAS Arrowsmith program do you feel could be improved to make it better?

Appendix J

Quotations Release Form

Research Ethics Boards (Behavioural and Biomedical)

QUOTATION RELEASE FORM

I,_____, have reviewed the quotations from my personal interviews and my child's interviews in this study that may be used in reports and presentations, and have been provided with the opportunity to add, alter, and delete information from the quotations or entire quotations (for direct reference) as appropriate. I acknowledge that the quotations accurately reflect what I said in my personal interviews and what my child said in his/her interviews with Debra Kemp-Koo. I hereby authorize the release of these quotations to Debra Kemp-Koo to be used in the manner described in the Consent Form. I understand that these quotations will be attributed to a pseudonym and not my real name or my child's real name. I have received a copy of this Quotation Release Form for my own records.

_____ _____

Name of Participant Date

_____ _____

Signature of Participant Signature of researcher

Appendix K

Transcript Release Form

Research Ethics Boards (Behavioural and Biomedical)

TRANSCRIPT RELEASE FORM

I,_____, have reviewed the complete transcript of my personal interviews in this study and my child's interviews, and have been provided with the opportunity to add, alter, and delete information from the transcript as appropriate. I acknowledge that the transcript accurately reflects what I said in my personal interviews and what my child said in his/her interviews with Debra Kemp-Koo. I hereby authorize the release of this transcript to Debra Kemp-Koo to be used in the manner described in the Consent Form. I have received a copy of this Data/Transcript Release Form for my own records.

_____ _____

Name of Participant Date

_____ _____

Signature of Participant