Abstract

This dissertation includes studies that tested an integrated model of human abilities. Two individual studies were done to understand the phenomenon of giftedness through common and domain-specific aspects of intelligence. The first study was a conceptual test investigating gifted students with learning disabilities (GLD) in terms of their profiles of abilities or disabilities. A model of intelligence was created to explain giftedness with and without learning disabilities. The second study was an empirical test of gifted and GLD students' feelings of direction toward learning and academic activities.

The results suggest that gifted students are gifted in practical and idealistic content domains, and auditory and visual representation domains, whereas GLD students are gifted in the idealistic content and visual representation domains. Giftedness appears in domains that are determined by domain memory and can appear as disabilities in specific domains when the domain memory is weak. Gifted students are more "all-rounded" because their level of domain memory is high and balanced, whereas GLD students are gifted in idealistic and visual domains but disabled in practical, auditory, and language-related domains because practical and auditory domain memory levels are much lower than idealistic and visual domain memory levels (i.e., GLD between-domain differences).

The findings suggest that individual differences in terms of abilities or disabilities may be best understood as both giftedness in domains (i.e., ds) and high general intelligence (g). Discussion and new directions for further study were provided.
# TABLE OF CONTENTS

Abstract.......................................................................................................................... ii

Table of Contents............................................................................................................. iii

List of Tables..................................................................................................................... vi

List of Figures................................................................................................................... vii

Acknowledgments............................................................................................................. viii

Dedication........................................................................................................................ ix

CHAPTER I ....................................................................................................................... 1

   Prologue....................................................................................................................... 1

   Introduction................................................................................................................. 3

   References.................................................................................................................... 14

CHAPTER II .................................................................................................................... 17

   Gifted Learning Disabilities as Domain Giftedness............................................... 17

   An Integrated Model of Human Abilities................................................................. 23

      Domains................................................................................................................ 27

   Conceptual Analysis................................................................................................. 32

   Cognitive Characteristics of GLD Students........................................................... 33

      General Abilities or Characteristics of GLD Students........................................ 35

         Thought Process.............................................................................................. 35

         Attention and Memory.................................................................................... 42

      Domain-Specific Abilities or Characteristics of GLD students.................. 45

         Language......................................................................................................... 46

         Math................................................................................................................ 50
CHAPTER III

Domain Feelings of Direction in Gifted Students and Gifted Students with Learning Disabilities

The Integrated Model of Human Abilities

Giftedness within the Integrated Model of Human Abilities

Method

Participants

Research Tasks

Procedures

Analysis

Results and Discussion

Domain Feelings in Gifted and GLD students

Learning

Reading

Writing

Math

General Feelings in Gifted and GLD students

General Discussion

References
LIST OF TABLES

Table 2-1: Cognitive Characteristics of Gifted Students with Learning Disabilities

Table 3-1: Participants’ Grade, Sex and Age

Table 3-2: Domain Feeling of Direction

Table 3-3: Coding Criteria for Domain Feelings with Emotional Indicators

Table 3-4: Domain Feelings of Direction of Gifted and GLD Students
LIST OF FIGURES

Figure 1-1: The Integrated Model of Human Abilities........................................7
Figure 1-2: Domain-Specific Abilities and Characteristics.................................10
Figure 2-1: The Integrated Model of Human Abilities........................................24
Figure 2-2: Domains..........................................................................................42
Figure 2-3: GLD in Practical Domains...............................................................56
Figure 2-4: GLD in Idealistic Domains..............................................................57
Figure 2-5: GLD in Social Domains.................................................................58
Figure 3-1: The Integrated Model of Human Abilities........................................78
ACKNOWLEDGMENTS

I am tremendously indebted to a number of individuals without whose help and support this study would not have been successfully completed. Although I cannot mention all of their names here, certain individuals deserve special mention. First of all, I am most grateful to my research supervisor, Dr. Marion Porath, who enthusiastically devoted her time and energy to valuable comments and advice on this study. I am grateful for her sincere encouragement and guidance. I am very grateful to my committee members, Dr. Elizabeth Jordan and Dr. Janet Jamieson, whose questions, comments and advice greatly inspired me and helped me clarify my thesis and achieve my task. I especially thank them for their everlasting support and encouragement with my academic work. I am grateful to Dr. Joseph Lucyshyn, my departmental examiner, who provided critical feedback and recommendations that made my work achieve spirit. I am also grateful to Lynda McDicken for her sincere concern about my research life. Last but not least, I have to give my sincere thanks to my great supporters, my daughter YoungRong and my son YoungGeun, who have always encouraged me, and my loving wife SungJin for her great understanding and persistent support and love.
DEDICATION

To my family
CHAPTER I
Prologue

High ability is witnessed across fields and in all societies. In school, some students show high ability in major academic areas such as reading, writing, or math, and others in areas such as art, geometry, music, computer graphics, and so on. High abilities are also witnessed in the career world of a society. Some individuals show high ability in economics, politics, religion, science, and/or writing and others in art, music, and/or architecture. All these individual fields collectively constitute a society; they have social values in their own way. This researcher was particularly curious about the following two gifted students with different profiles.

“Emma couldn’t sleep. Too many thoughts buzzed in her head. Tomorrow was the city-wide competition for local history projects. Emma was one of the delegates from her school. Last year she won an honourable mention for her project on Vancouver’s Strathcona neighbourhood. The judges said it was a real accomplishment because Emma was in Grade Four and all the other kids were in Grades Five, Six, and Seven. This year she set her sights on winning. She chose an unusual topic, researched it carefully, and designed a display that she thought would impress the judges. Last year she noted how the winner had organized her display, dressed in costume, and included different sources of information. Now, of course, she was running over everything she had done in her mind. “Please, please let it be the best,” she said to herself. That would be awesome! Then she could get back to concentrating on violin for the youth symphony recital and getting her speech ready for her class project on the legislature. Oh – and reading those books piled beside her bed and writing her novel!

So much interested Emma and, finally, now that she was in a gifted program, she felt like other people understood that. She was already thinking ahead – maybe she could try for the program that helped you start university early. Wouldn’t that be cool!

Brett leaped out of bed as soon as his alarm went off. Only his hockey friends understood that getting up at 5:00 in the morning wasn’t a big deal. It was just what you had to do to get time on the ice and, for Brett, time on the ice was everything. He’d been doing this three times a week for five years, since he was 7. That was during Grade Two when he first began to notice that he was different from the other kids. He was always in trouble for his messy work and he had to
get help with his reading from Mrs. Johnson. Everyone said that only the dumb kids went to Mrs. Johnson.

Things at school weren't a whole lot better for a long time, thought Brett, as he threw on a jacket and grabbed his skates and hockey equipment. At least he had hockey. He knew he was good at that. That knowledge helped when he struggled with reading at school. But now, in Grade Seven, other things were happening. He was allowed to write on a computer now – that helped a lot. There was geometry in Math. Instead of getting all tangled up in columns of numbers and trying to read word problems, geometry made sense to him and the class was beginning to notice that he was acing the tests. He also had this cool art teacher who gave them neat projects and said what a gift he had. Brett still worried a lot, though. Next year was high school. Kids said the work was really hard. How could a kid who could barely read handle that?” (Porath, 2008, p. 1).

Although Emma and Brett are both gifted students, they are different in the areas in which they show high interest and ability. Emma is a gifted student, and Brett is a gifted student with learning disabilities (GLD). Emma seems to show high ability in design (or art), music and speech as well as in reading and writing, whereas Brett seems to struggle with reading or writing but shows high interest and ability in art and geometry. This researcher has been highly motivated to know why and how gifted students and GLD students are different from each other.

Introduction

To date, researchers have tried to understand “giftedness” either in terms of general (g) (Jensen, 2002; Spearman, 1927) or domain-specific (Gardner, 1983; Thurstone, 1947) aspects of intelligence. However, giftedness has not been understood or defined in an agreed manner by either perspective in terms of testable cognitive abilities or observable cognitive characteristics, due to a controversy over the nature of intelligence itself. Researchers who argue for g say that there is a single intelligence
involved with all knowledge or performance because a general factor is submerged in all domains (or disciplines). Intelligence allegedly can be measured by IQ tests (Gottfredson, 2002; Jensen, 1988; Terman 1925); a general factor is evident in factor-analyses of subtest performance. On the other hand, those who defend multiple intelligences argue against IQ in that IQ tests measure only certain domains such as language and math (Gardner, 1983; Sternberg, 1988). They argue that intelligence is multiple and independent and knowledge develops domain-specifically in various social contexts, and that intelligence can be measured by problem solving or products that are socially valued. As a result, an almost infinite number of definitions of giftedness have been constructed (Rogers, 1986).

The controversial concepts of intelligence have also been barriers to full understanding of giftedness when it co-occurs with learning disabilities (GLD). Gifted students with learning disabilities show a great discrepancy between their achievement and potential ability; they display comparative underachievement in areas such as reading, spelling, and math (Silverman, 1989a; 1989b). The paradoxical phenomenon is not completely understood, but most researchers recognize GLD. Understanding the nature of GLD is critical because, despite the increasing number of GLD students, they have not, in general, been identified for programs for gifted students nor for programs for students with learning disabilities because their giftedness masks their disabilities or their disabilities mask their giftedness (Brody & Mills, 1997).

It is not clear whether all the abilities or characteristics of GLD students originate from a single, general intelligence (g) or from multiple, independent intelligences. Why cannot all gifted students learn well at school? Does it mean that giftedness is irrelevant
to learning at school? Such an argument is contradictory to the traditional concept of
giftedness based on IQ that predicts students' high academic achievement. Furthermore, it
is not convincing that all the characteristics of gifted students are related to general
intelligence because the characteristics are not generalized to all gifted individuals (Clark,
2002; Tuttle, 1983). On the other hand, if GLD is a domain-specific phenomenon, it is
more likely understood (Winner, 2000). But could the multiple intelligences suggested by
Gardner (1983) account for all the characteristics of GLD students?

Meanwhile, there is a strong belief that human abilities consist of both general
and domain-specific abilities (Carroll, 1993; Case, 1992; Demetriou, 2002; Jensen, 2002).
Depending on the researcher, either general or domain-specific abilities are merely more
stressed (Demetriou). This belief suggests that human abilities should be understood
through both general and domain-specific aspects of intelligence. However, despite this
belief, the abilities of gifted students or gifted students with learning disabilities may not
be well understood in terms of both general and domain-specific aspects because the
general and domain-specific abilities are not agreed upon among major individual models
or theories of intelligence (Song & Porath, 2005). None of the models specify
interrelationships between abilities in the cognitive mechanism, that is,
interfunctionalities, or how abilities are functionally related to each other. In this
situation, understanding gifted students or gifted students with learning disabilities in
terms of general and domain-specific aspects of intelligence based on a specific model or
theories may be biased.

An integrated model of human abilities (Song & Porath, 2005) was
conceptualized based on interrelationships between abilities proposed by major models of
intelligence. Due to their lack of power to explain cognitive characteristics of gifted students and disagreement on general and domain-specific cognitive abilities, these models were ‘rebuilt’ in a unique way. The newly established model hypothesizes a cognitive mechanism that accounts for how domain-specific knowledge is formed, as well as which abilities are general and domain-specific, how they are related functionally, and how they account for general and domain-specific cognitive characteristics of gifted students. The cognitive mechanism has important implications for our understanding of the chronically controversial concepts, “intelligence” and “knowledge.” Clearer definitions of what intelligence is (g or multiple), what knowledge is, and how knowledge develops (“genetic or environmental,” “rationalistic or empiricist”) may result from this model. The model also identifies general and domain-specific observable characteristics of gifted students from the testable abilities of the major models or theories (Carroll, 1993; Case, 1992; Case et al., 2001; Gardner, 1983; Sternberg, 1988).

For example, unusual curiosity is one of the characteristics general to all gifted students; curiosity appears from one of the general abilities to find relationships and form knowledge. The language-relevant characteristics (e.g., high level of language development), which appear only to specific groups of gifted students, appear from linguistic abilities.

The model may help us to better understand gifted students and gifted students with learning disabilities in terms of general and domain-specific abilities or characteristics. Studies on students identified as “gifted” suggest a variety of cognitive characteristics that seem to be general to this heterogeneous group, but the characteristics cannot be generalized to all students identified as gifted because students have their own
unique patterns of development (Clark, 2002; Tuttle, 1983). This suggests that there must be cognitive characteristics general to all gifted individuals and domain-specific cognitive characteristics general only to specific groups of gifted individuals; there is considerable agreement that the mind has conceptual capabilities that are general, as well as those that are specific (Carroll, 1993; Case, 1992; Demetriou, 2002). The general capabilities may appear as general characteristics that occur in all groups of students identified as gifted, and specific capabilities may be shown as domain-specific characteristics that would reveal themselves as unique characteristics in specific groups such as GLD students.

According to the integrated model, which is shown in Figure 1-1, humans are cognitive beings who form knowledge through thinking. In thinking, they find relationships between domain stimuli in memory (i.e., domain memory) and connect the stimuli through found relationships; the connected stimuli are domain knowledge. That is, knowledge consists of two components, relationships and stimuli. The ability to find relationships and form knowledge is defined as general intelligence \(g\). While finding relationships, humans plan and control their thinking processes (executive ability, i.e., metacognition, or metacomponents) (Demetriou, 2002; Sternberg, 1988) on one hand, and process information (processing ability) (Sternberg, 1988) on the other hand. Executive and processing abilities are instrumental to \(g\); an individual may not find relationships without them. The three abilities fundamentally involved with knowledge formation – \(g\), executive ability (i.e., metacognition or metacomponents), and processing ability (e.g., reasoning) - are defined as general abilities. Processing capacity is the mental space where processing and reasoning occur (Case, 1992).
When an individual is stimulated by internal or external demands ("activation level"), he or she may activate the instrumental cognitive functions - executive and processing functions ("performance level") - to find relationships. The individual who activates the instrumental functions is labeled as the activator (Song, 2004); ability at the general activation level is labeled $g$; and the other general abilities as those at the general performance level (Figure 1.1). The term "the activator" is used for ease of presentation; it is not meant to imply an entity separate from the individual (Song, 2004).

General intelligence ($g$) appears to be domain-specific when it is engaged with
domain stimuli [i.e., multiple intelligences as defined by Gardner (1983)]. The term used in the cognitive mechanism of the model, "domain-specific abilities (or intelligences)" refers to the general abilities that "work" with domain stimuli; it is not considered support for Gardner's concept of multiple intelligences. For example, when g is engaged with linguistic stimuli (g in linguistic stimuli), it appears as linguistic intelligence; and if g is engaged with mathematical stimuli (g in mathematical stimuli), it appears as mathematical intelligence (Gardner's term). Accordingly, the kind of stimuli coming through the sensory organs, which are connected and formed as domain knowledge through the general abilities, determines domains; an individual 'must' have stimuli to process and connect. These could be language, number, space, and sound, color and light (visual stimuli), taste and smell (taste and olfactory stimuli), and touch (tactile stimuli). For example, linguistic stimuli are connected to each other and formed as linguistic domains (e.g., reading, writing); numerical stimuli formed as numerical domains (e.g., calculation); and visual stimuli formed as visual domains (e.g., art).

Most of the domain stimuli in Figure 1-1 were identified from the major models or theories of intelligence (Case, 1992; Gardner, 1983; Sternberg, 1988) when the theoretical model was established, based on the interrelationships between abilities suggested by the models or theories. The practical and social domain stimuli were drawn from practical (Sternberg) and social (Case, 1992; Gardner; Sternberg) abilities or intelligences that are related to practical and social thoughts [i.e., practical entities (e.g., daily objects) and ideas (e.g., successful adaptation to a new culture) and social entities (e.g., mind) or ideas (e.g., knowledge of mental states)]. The idealistic domain stimuli were defined by idealistic abilities or characteristics of gifted students (e.g., ability to use
rules fairly, sense of justice, fairness, or morality) (Song & Porath, 2005). Most of the
domain stimuli in the performance level were also drawn from domain abilities or
intelligences suggested by the major models or theories. The other stimuli (i.e., smell,
taste, and feeling) were added as domain stimuli that come into the mental space through
the human sensory organs (i.e., mouth, nose, skin) (Song & Porath, 2005).

In the cognitive mechanism of the model (Figure 1-1), there are three domain-
specific abilities on the domain activation level that stimulate the activator to reason with
domain-specific stimuli: practical, idealistic, and social, which may be conceived of as
“feelings of direction” (Shavinina & Seeratan, 2004). Feelings of direction are about
domains and domain abilities (Shavinina & Seeratan, 2004). In the integrated model
suggesting that the kind of stimuli determines domains, “domain” refers to domain
stimuli connected through relationships (i.e., domain performance or knowledge such as
reading, math, or art), and domain abilities or intelligences refer to general abilities or g
in domains. Two feelings of direction are hypothesized: feelings about relationships (or g)
and feelings about domain stimuli (or ds). The former is termed ‘general feelings of
direction,’ and the latter ‘domain feelings of direction.’ In knowledge formation, the two
feelings of direction are hypothesized to be “mental engines” by which exceptional
figures in history “went for” their domains and developed domain knowledge (Figure 1-
2).

Domain feelings of direction stimulate an individual to direct attention to domain
stimuli of interest, and the general feelings of direction stimulate him/her to direct
attention to relationships between the attended stimuli and form knowledge. For example,
strong feelings about practical, idealistic, and/or social domain stimuli stimulate gifted
individuals to direct attention to such domain stimuli, and then strong feelings of relationships stimulate them to think about relationships between the stimuli through the executive and processing functions, and form rich domain knowledge by connecting (or integrating) the stimuli with found relationships.

Feelings of direction were highlighted by Albert Einstein’s remarks:

During all those years there was the feeling of direction, of going straight toward something concrete. It is, of course, very hard to express that feeling in words; but it was decidedly the case, and clearly to be distinguished from later considerations about the rational form of the solution. (Shavinina & Seeratan, 2004, p.73)

Einstein’s words are considered as general feelings of direction in physics. (He
said this while talking about relativity.) Rational thinking about a solution is considered thinking about relationships between stimuli (i.e., knowledge level); it does not seem to be related to thinking about specific domain stimuli themselves (i.e., stimuli level).

Domain feelings of direction are those about domain stimuli. Thus, an example of domain feelings of direction may be the feeling of ‘shape’ (Shavinina & Seeratan, 2004) (i.e., feeling about visual stimuli), which may intuitively occur when gifted individuals are engaged with visual objects. When gifted individuals look at objects in the world, they may intuitively come up with a feeling of shape, which may drive them to art after they think about relationships.

The general and domain-specific abilities and feelings of direction suggested by the model are considered to be useful in understanding gifted students with learning disabilities; both cognitive strengths and weaknesses can be articulated in terms of general and domain-specific aspects of intelligence. Although Emma and Brett, described in the Prologue, are both gifted students, they are different in the areas in which they show high interest and ability. Emma seems to be an all-round gifted child because she shows high ability in design (or art), music and speech as well as in reading and writing. Meanwhile, Brett seems to be gifted only in visual-related domains; he shows high interest and ability in art, geometry, and sports. Despite the difference, they may show high general abilities.

Therefore, the purpose of this study is to view giftedness with learning disabilities (GLD) through the general and domain-specific aspects of intelligence suggested by the integrated model of human abilities (Song & Porath, 2005); this is a test of the model. The model has only been tested conceptually through application to gifted
children and has not been tested at all in terms of feelings of direction. An empirical test with gifted and GLD students is a first step in validating the model.

This research program was carried out through two related studies. The first study proceeded as a conceptual test of the model using characteristics of gifted students with learning disabilities identified by individual researchers. The second study was an empirical test of the model using interview data from gifted students and gifted students with LD.

The studies are unique in their view of abilities through multiple theoretical perspectives – general and domain-specific aspects of intelligence. They contribute to the field of giftedness and dual exceptionality theoretically and practically. The identification of general and domain-specific cognitive characteristics of gifted students with and without learning disabilities increases understanding of giftedness and the paradoxical phenomenon of GLD (e.g., Why ‘gifted’ is gifted? Why GLD is GLD?). The studies provide a critical view of how gifted students with and without LD are different in terms of general and domain-specific abilities and characteristics. It is suggested that, if giftedness and GLD are explained appropriately by both general and domain-specific aspects of intelligence, the domain(s) in which gifted students with and without LD are gifted or disabled may also be identified. If giftedness appears domain-specifically, even gifted students without LD may show variability in their profiles of ability as suggested by Matthews (1997).

Practically, the two studies contribute to identification and education of gifted students with and without learning disabilities. GLD students, who are highly able but experience underachievement in school learning, can be supported with various
approaches in terms of learning skills or strategies that will be implied by the various aspects of general and domain-specific abilities and characteristics identified by this study.
References


CHAPTER II

1Giftedness with Learning Disabilities (GLD) as Domain Giftedness

There is little doubt that some students who exhibit characteristics of giftedness also show learning disabilities. While they display exceptional abstract or creative thinking (Baum, Owen, & Dixon, 1991; Brody & Mills, 1997), they also exhibit characteristics of learning disabilities (Baum & Owen, 1988): weak memory and perception (Baum & Owen; Hulme, 1992; Siegel, 2003; Wong, 2004), distractibility (Baum & Owen; Brody & Mills; Silverman, 1989a; 1989b), attention deficit and hyperactivity (Baum, 1988; Baum, Owen, & Dixon), and off-task behavior (Baum, 1990; Beckley, 1998).

Some gifted students have difficulties with auditory sequential functioning. They show delayed auditory processing (Bireley, Languis, & Williamson, 1992) and difficulty with phonics (Silverman, 1989a; 1989b), which is very critical to reading, language arts, and many other academic areas (Bender, 2001). They also may have problems with sequential processing, demonstrated in difficulty learning material that requires sequential abilities and is taught in a sequential manner, especially in areas of reading, spelling, rote memorization and computation (or numeracy) (Munro, 2002; Silverman, 1989a; 1989b; 1993). Gifted students who display these characteristics constitute a group of gifted students with learning disabilities (GLD); they exhibit a discrepancy between ability and achievement (Baum & Owen, 1988; Emerick, 1992; Rimm, 1997; Whitmore, 1980).

1 A version of this chapter has been resubmitted for publication. Song, K. H. Gifted with Learning Disabilities (GLD) as Domain Giftedness.
Other GLD students may display high spatial (or wholistic) abilities that are in contrast to their low sequential abilities (Munro, 2002; Silverman, 1989a; 1989b). According to Silverman, these GLD students are superior in geometry, science, computer programming and graphics as well as art, music, poetry, and electronics. They are extraordinarily capable with puzzles and mazes; are excellent at mathematical reasoning; have a keen visual memory and unusual imagination; are highly creative; have penetrating insights; and easily grasp metaphors, analogies, and satire. These GLD students are more likely to use global wholistic rather than analytic sequential learning strategies and learn in an all-or-nothing fashion rather than in a stepwise incremental way (Munro). They also do best on tasks on intelligence tests that involve solving spatial puzzles, tracing mazes, duplicating block designs, counting three-dimensional arrays of blocks, visual transformations, mental rotations, and envisioning how a folded and cut piece of paper would appear opened up.

Based on a review of literature on GLD, it may be hypothesized that GLD students may be gifted in one or more domains other than the language and number domains that are significantly emphasized in school learning. Giftedness may appear as a domain-specific rather than a general characteristic. First, characteristics general to GLD and LD students suggest this. As noted by Liddle and Porath (2002), whatever the global level of cognitive performance, giftedness and deficits may co-exist in the same child when intelligence is viewed as multidimensional. Second, even though GLD students show difficulties with auditory and/or sequential abilities, they may show high abilities in the areas of visual and wholistic abilities. Given the fact that school learning predominantly requires auditory-sequential verbal (verbal explanations) and numerical
(addition, subtraction, multiplication, division) abilities, GLD students’ potential weaknesses in sequential abilities may show a strong relation to difficulties in early learning in schools where the mastery of sequential skills is emphasized (Silverman, 1989a; 1989b). They are usually not afforded opportunities to demonstrate their intellectual strengths. Third, despite difficulties with learning at school, the fact that GLD students exhibit superior learning outcomes in areas ‘outside of class’ like art or music (Baum, Owen, & Dixon, 1991; Munro, 2002; Snelling, 2007) suggests that they may be better in learning in areas other than language and number. Fourth, numeracy (i.e., computation such as addition, subtraction, and multiplication) needs auditory-sequential abilities (Bender, 2001; Cawley et al., 1979; Jordan et al., 1996), and math requires visual-spatial abilities such as geometric skills (Ackerman et al., 1986). Then, the fact that GLD students may be poor at numeracy, but very good at mathematical reasoning (Silverman, 1989a; 1989b), may suggest that they are poor at auditory-sequential abilities, but very good at visual-spatial abilities. Last, the fact that some researchers note that GLD students have weak memory, while others argue that they have a keen visual memory, may suggest that some GLD students may have weak memory in auditory-sequential-relevant areas but have good memory in visual-spatial-relevant areas. Considering all the characteristics of GLD students and the demands of school, it may be natural that these students often show negative attitudes toward school (Bruns, 1992; Dias, 1998; Ford, 1996; Rimm, 1995), distractibility, and off-task behaviors.

Therefore, it is necessary first to explain not only what abilities or characteristics (i.e., observable behaviors) GLD students share with gifted students
without disabilities, but also in which domains GLD students are disabled. If there are cognitive characteristics that are general and domain-specific among gifted students (Song & Porath, 2005), it is reasonable to think that GLD students may also have general and domain-specific cognitive characteristics. Gifted students with and without cognitive disabilities may share the same level of general cognitive abilities, which appear as general cognitive characteristics of gifted students, but disabled levels of domain-specific cognitive abilities may appear as domain-specific cognitive characteristics in gifted students with learning disabilities.

In spite of the current consensus that giftedness must be viewed domain-specifically (Gardner, 1983; 1999; Renzulli, 1978; Sternberg, 1988), the cognitive phenomenon of GLD has not been satisfactorily explained by a multidimensional perspective on giftedness. The perspective of multiple intelligences does not support general aspects of intelligence; rather, it is argued that intelligences are independent of each other (Gardner; Thurstone, 1947). Nor does it categorize domains in terms of cognitive processes, rather, suggests domains depending on performances that appear in various social and cultural contexts. Sternberg, who studies cognitive processes (i.e., metacomponents and reasoning) and suggests multiple abilities or intelligences, does not provide any criteria for domains in terms of cognitive processes. He introduced various abilities or intelligences such as analytical, creative, and practical (1988), and wisdom (2000; 2003). However, the proliferation of "intelligences" followed Gardner (1983), not specifying how those abilities or intelligences are independent of, and related with other abilities or intelligences in the cognitive mechanism. Gardner (1999), who revived the concept of multiple intelligences, does not explain fully how the nine multiple
intelligences that he hypothesized are interrelated. As a result, it is not known whether they are independent or not. Some researchers argue that Gardner’s intelligences cannot be independent (Morgan, 1996; Klein, 1997). Although Gardner argued that his hypothesized intelligences are independent on the basis of neurological data, if areas for certain intelligences are relatively autonomous, how are separate and autonomous intelligences integrated? Dance is both musical and physical; conversation is both linguistic and interpersonal; and solving a physics problem requires both spatial and logical-mathematical abilities (Klein). Klein argued that the multiple intelligences could be coordinated by a central executive. Furthermore, Gardner did not provide a whole picture of cognitive abilities in which abilities or intelligences are related to each other or domains (Gardner, 2003). As a result, it is not known whether the multiple intelligences, which are defined from various social and cultural contexts, really exist separately and independently in the brain or are integrated by a single higher order ability in a cooperative manner.

As noted by Winner (2000), “Our understanding of giftedness is most likely to advance if we define giftedness simply as unusually high ability in any area” (p. 153). However, which domain intelligence(s) among the multiple intelligences could account for giftedness with LD? GLD has not been fully explained by general intelligence either. How can gifted students, defined by general intelligence (or high IQ), be disabled and how can they not learn well?

In regard to the questions raised above, the integrated model of human abilities hypothesized by Song and Porath (2005) is useful because the model explains how general and multiple intelligences are related and how they function domain-specifically
in forming domain knowledge. The model was conceptualized based on interrelationships between abilities proposed by major models of intelligence (Carroll, 1993; Case, 1985; Case et al., 2001; Gardner, 1983; Sternberg, 1988). Due to their lack of power to explain cognitive characteristics of gifted students and disagreement on general and domain-specific cognitive abilities, these models were 'rebuilt' in a unique way. The newly established model hypothesizes a cognitive mechanism that accounts for how domain-specific knowledge is formed, as well as which abilities are general and domain-specific, how they are related functionally, and how they account for general and domain-specific cognitive characteristics of gifted students. The cognitive mechanism has important implications for our understanding of the chronically controversial concepts, "intelligence" and "knowledge." Clearer definitions of what intelligence (g or multiple) and knowledge are may result from this model.

This model also identifies general and domain-specific observable characteristics of gifted students from the testable abilities of the major models or theories (Carroll, 1993; Case, 1985; Case et al., 2001; Gardner, 1983; Sternberg, 1988). According to the model, the general and domain-specific abilities may be the origin of characteristics of gifted students, which can be observed in learning or test situations. For example, unusual curiosity, a characteristic which is widely witnessed in gifted students, may stem from g, the ability to find relationships between stimuli and the language-related characteristics of gifted students (e.g., avid reading) may come from linguistic abilities, defined as domain-specific characteristics general to specific groups of gifted students (e.g., academically gifted).

However, this model has not been tested conceptually through application to a
population other than gifted children. Therefore, this study seeks to identify general and
domain-specific cognitive characteristics of GLD students to test the hypothesis that
GLD is giftedness in domains other than language and number. The model may help us to
better understand gifted students with learning disabilities in terms of general and
domain-specific abilities or characteristics. Although studies on “gifted” students suggest
a variety of cognitive characteristics that seem to be general, the characteristics cannot be
generalized to all students identified as gifted because students have their own unique
patterns of development (Clark, 2002; Tuttle, 1983). Given the considerable agreement
that the mind has conceptual capabilities that are general, as well as those that are specific
(Carroll, 1993; Case, 1992; Demetriou, 2002), there must be cognitive characteristics
general to all gifted individuals and domain-specific cognitive characteristics general
only to specific groups of gifted individuals. The general capabilities may appear as
general characteristics that occur in all groups of gifted students, and specific capabilities
may be shown as domain-specific characteristics that would reveal themselves as unique
characteristics in specific groups such as GLD students.

An Integrated Model of Human Abilities

The integrated model of human abilities (Song & Porath, 2005), which suggests
the nature of g and general and domain-specific abilities and characteristics of gifted
students, is used as a theoretical framework by which cognitive characteristics of GLD
students may be explained. The integrated model suggests that there are both general and
domain-specific cognitive abilities and characteristics. Cognitive abilities refer to abilities
that are identified in models of intelligence or psychometric abilities (e.g., General
Intelligence Theory, Multiple Intelligence Theory). Cognitive characteristics refer to
observable behaviors (e.g., curious, creative, avid reading) in test or class situations. The model also suggests that knowledge develops domain-specifically through general cognitive abilities (Figure 2-1).

![Diagram of the Integrated Model of Human Abilities](image)

**Figure 2-1.** The Integrated Model of Human Abilities (Song & Porath, 2005, p. 242)

According to the model, humans are cognitive beings who form knowledge through thinking. In thinking, they find relationships between domain stimuli in memory (i.e., domain memory) and connect them through the found relationships; the connected stimuli are domain knowledge. That is, knowledge consists of two components, relationships and stimuli. The ability to find relationships and form knowledge is defined as general intelligence ($g$). While finding relationships, an individual plans and controls his/her thinking processes (executive ability, i.e., metacognition, or metacomponents) (Demetriou, 2002; Sternberg, 1988) on one hand, and processes information (processing
ability) (Sternberg, 1988) on the other. Executive and processing abilities are instrumental to \( g \); an individual finds relationships through those functions. The three abilities that are involved in knowledge formation, \( g \), executive, and processing, are defined as general abilities.

When an individual is stimulated by internal or external demands ("activation level"), he or she may activate the instrumental cognitive functions - executive and processing functions ("performance level") - to find relationships. The individual who activates the instrumental functions is labeled as the **activator** (Song, 2004). The term "the activator" is used for ease of presentation; it is not meant to imply an entity separate from the individual (Song, 2004). Ability at the general activation level is labeled \( g \); and the other general abilities as those at the general performance level (Figure 2-1).

The general abilities **appear** as domain-specific abilities when they are engaged with domain stimuli; \( g \) (general intelligence) **appears** to be domain-specific when it is engaged with domain stimuli [i.e., multiple intelligences as defined by Gardner (1983)]. The term used in the cognitive mechanism of the model, "domain-specific abilities or intelligences," refers to the general abilities or \( g \) in domains; domain-specific abilities, as defined in this study, are not considered support for Gardner’s concept of multiple intelligences. For example, when \( g \) is engaged with linguistic stimuli (\( g \) in linguistic domain), it **appears** as linguistic intelligence, and if \( g \) is engaged with mathematical stimuli (\( g \) in mathematical domain), it **appears** as mathematical intelligence (Gardner’s term). Accordingly, the kind of stimuli coming through the sensory organs, which are connected and formed in thinking through general abilities to become domain knowledge, determines domains; an individual ‘must’ have stimuli to process and connect. Stimuli
could be language, number, space, sound, color and light (visual stimuli), taste and smell (taste and olfactory stimuli), or tactile. So, linguistic stimuli are connected to each other and formed as linguistic domains (e.g., reading, writing); numerical stimuli are connected and formed as numerical domains (e.g., calculation); and visual stimuli are connected and formed as visual domains (e.g., visual art).

Processing capacity is the mental space available for processing and reasoning (Case, 1992). Level of memory may be indicative of different sizes of mental space. Short-term memory is the workplace for processing (mental space in this study) (Case, 1985; Halford, 1982; Halford, Maybery, O’Hare, & Grant, 1994). Memory level is related to the size of mental space (Case); the larger the mental space, the stronger memory. The existence of domain memory and processing suggests that there are two domain mental spaces (i.e., auditory and visual). Memory is domain-specific and independent: auditory memory vs. visual memory (Gardner, 1983; Winner, 1996). There is the phonological loop that is specialized for the retention of verbal information (i.e., phonological store) and a rehearsal process that maintains representations in the store (i.e., working memory) (Gathercole, 1998). The visual-spatial sketchpad is specialized for the processing and storage of visual material (Baddeley & Logie, 1999). In the cognitive mechanism of the model, domain memory is one of the two components that constitute knowledge (i.e., domain stimuli and relationships); domain memory (ds, compared with g) contains the material that is processed and connected through relationships.

At the top of the cognitive mechanism of the model (Figure 2-1), there are three domain-specific abilities on the domain activation level that stimulate an individual to find relationships between domain-specific stimuli: practical, idealistic, and social, which
may be conceived of as “feelings of direction” (Shavinina & Seeratan, 2004). Feelings of
direction are intuitions that gifted individuals have about domains and domain abilities
(Shavinina & Seeratan, 2004); they occur in gifted individuals as directional feelings that
make them “go for” their domains of interests. In the integrated model, “domain” refers
to domain stimuli connected through relationships (i.e., domain performance or
knowledge, e.g., reading, math, art), and domain abilities or intelligences refer to general
abilities or g in domains. For example, the stimuli of verbal and written language are
connected in a relationship that is part of reading performance. Therefore, two feelings of
direction are specified: feelings about relationships (g) and feelings about domain stimuli
(ds). The former is termed ‘general feelings of direction,’ and the latter ‘domain feelings
of direction.’

In the cognitive mechanism, the two feelings of direction are hypothesized to be
“mental engines” by which exceptional figures in history “went for” their domains and
developed domain knowledge. Domain feelings of direction stimulate gifted individuals
to direct attention to domain stimuli or existing knowledge of interest, and the general
feelings of direction stimulate them to direct attention to relationships between the
attended stimuli.

Domains

Despite discussions about the nature of domains (Ceci, 1989; Gardner, 1983),
little consensus has been achieved on the definition of a domain. Some definitions are
based on products or performance in social contexts. For example, Matthews (1993)
defines domain based on academic fields (e.g., math, science). Gardner defines it as
products (e.g., novel, music) or performances (e.g., reading, dancing) in a society.
The integrated model specifies domains in terms of content and representation because domains involve both. Content refers to entities (stimuli level) or ideas (knowledge level), whereas representation refers to the form in which content is represented (i.e., symbolization) (Alexander, 1967; Gardner, 1983). For example, when we say or write “car,” the entity of a car is content and the verbal or verbal written word is its representation. When we represent a mountain by a triangle, the mountain is content and the triangle is its representation. Likewise, ideas refer to knowledge (e.g., adaptation, fairness, justice, algebra) that individuals form from entities in the world; they are also represented by symbols. For example, number represents real entities in the world; and the idea of algebra (knowledge level) comes from numbers (Gardner, 1983). The ideas of successful adaptation to new environments, fairness, or justice, which are characteristics of gifted students, may also come from entities in the social or natural world.

The integrated model suggests three content domains: practical, social, and idealistic. The domains were identified from abilities or intelligences suggested by major models or theories of intelligence (Carroll, 1993; Case, 1992; Case et al., 2001; Gardner, 1983: Sternberg, 1988) - practical (Sternberg), social (Case; Gardner; Sternberg), and idealistic (Song, 2004; Song & Porath, 2005) abilities or intelligences that are related to practical, social, or idealistic thought content. Practical intelligence is related to daily material entities or adaptation to new cultures (i.e., practical ideas); social intelligence to human minds (i.e., mental entities) or knowledge of human mental states (i.e., social ideas); and idealistic abilities to rule systems (i.e., abstract entities) or sense of justice or fairness (i.e., idealistic ideas).
This model suggests linguistic, mathematical, spatial, auditory, visual, taste, olfactory, and tactile domains as representation domains. Linguistic, mathematical, spatial, auditory, and visual representation domains were suggested by major models or theories of intelligence (Carroll, 1993; Case, 1985; Case et al., 2001; Gardner, 1983; Sternberg, 1988). Taste, olfactory, and tactile stimuli were added by Song (2004).

In this model, representation domains are determined by the kind of stimuli coming into the mental space through the sensory organs [i.e., auditory (ear), visual (eye), taste (mouth), olfactory (nose), and tactile (skin) domain stimuli]. The individual sensory stimuli are basic and independent; they are connected for domain performance or knowledge. An individual forms domain knowledge (or does performance) with the stimuli through processing in an independent or integrated manner. In processing contexts, the respective domain stimuli are processed and connected and formed as independent domain performance or knowledge. For example, in some visual arts, stimuli may only be visually processed and connected. Where representation is integrated, multiple independent domain stimuli are processed and connected and formed as integrated domain performance or knowledge. In language or math, for instance, auditory and visual domain stimuli are connected because language and number are phonological or verbal (i.e., auditory) and written (i.e., visual) representation stimuli. They are also the forms of symbolization in which visual entities (e.g., real tree) are represented by verbal (e.g., “tree (word),” “one (number),” or verbal-written (e.g., letter “tree,” number “1”). Therefore, viewed from the social product-based definitions, language- and math-related domains seem independent, but they are integrated in processing contexts.
As defined in this study, domain reflects the cognitive mechanism in which multiple cognitive components work cooperatively and yield products or performances in social contexts; cognitive processing precedes appearance of domain products or performances in social contexts. The definition may be more useful in understanding abilities or disabilities of gifted students than a social product-based definition because they can be understood more scientifically in the fundamental neurological and processing contexts, in which domains or intelligences (Gardner’s term) defined in social contexts can be analyzed into smaller independent domains or intelligences.

Gifted students may show practical-, idealistic-, and/or social-relevant abilities or characteristics when they engage with the content of those domains, and auditory-, visual-, taste-, olfactory-, and/or tactile-relevant abilities or characteristics when they engage with those domain representations in an independent or integrated manner. Emma, the gifted student described in the Prologue, shows abilities and interest in language (e.g., reading, writing, speech), auditory (e.g., playing violin), and visual domains (e.g., designing). Her profile suggests that she is practical and idealistic; she shows the practical sense of successful adaptation to the social culture in which success in contests is practically valued (e.g., how to impress the judge or how the previous winner had organized her display and dressed in costume); and she is also interested in writing a novel which is idealistic thought involving imaginary worlds.

Meanwhile, when considered according to the definition of domain in this study, academic “subject areas” -- coherently organized bodies of knowledge (Marini & Case, 1989) -- may be interpreted as integrated domains in terms of representation and content. In representation, most academic subjects use language (i.e., auditory-visual integrated
domain. Reading is not possible without auditory-verbal ability (Gardner, 1983).

Studies on dyslexia support that reading requires an integration of auditory and visual domain abilities: Dyslexia can be caused by phonological deficit (Torgesen, 1999; Wagner & Garon, 1999) or visual processing difficulties (Behrmann, 1999; Marie-Line et al., 2007). Specifically, math and physics use language and/or number as well as geometric symbols. Considering that space cannot be isolated from time (Cooper, 2000), history may be made up of language and time. Music may be an integrated domain of language or sound, and visual imagination. Art may consist of color and figure (or shape). Cooking may consist of shape, taste, smell, and feeling. Many subject areas may differ only in the ratio of the independent domain contributions; auditory domain representation is stressed more in some subjects; visual domain representation in others; and taste, olfactory, or tactile domain representations in still others.

In content, language arts can be practical, social, and/or idealistic depending on whether they carry practical, social, and/or idealistic content. Likewise, math can be practical and/or idealistic depending on content. When it deals with numbers to add, subtract, multiply, or divide practical entities, it can be a practical domain; when it deals with time or distance in space (e.g., geography), it can be an idealistic domain. When it deals with both types of content, it is integrated domain knowledge. This is also true for art. People can draw idealistic content (e.g., imaginary, fanciful, or abstract pictures or stories) and practical content (e.g., food, clothes, or social success in a practical sense). The representation and content domains may reflect the social world that consists of human beings and practical and idealistic entities and ideas represented by auditory and visual domain stimuli in an independent or integrated manner.
Conceptual Analysis

Conceptual analysis was used to discover hypothesized interrelationships between abilities and characteristics (Song, 2004). The analysis is useful to find interrelationships between abilities, disabilities, or characteristics of GLD students, which may show in which domain(s) GLD students are gifted or appear disabled and why they are gifted but disabled in language and math. The analysis proceeded through three cognitive steps. The first step was “identification” in which abilities and/or characteristics were identified based on definitions in the literature on giftedness and GLD; the second step was “comparison and evaluation” in which abilities and/or characteristics were compared and evaluated in order to find relationships between them; and the final step was “integration” where abilities and characteristics were connected to each other based on the relationships found through the previous steps. The analysis was informed by theories of development (Case, 1985), general intelligence (Carroll, 1993; Case et al., 2001), domain-specific cognitive abilities (Gardner, 1983; Sternberg, 1988), and “extracognitive” (Shavinina & Seeratan, 2004) aspects of high ability.

**Step 1 (identification):** Cognitive abilities or characteristics of GLD students were identified from those in the literature on GLD and classified into seven categories based on the attributes of the cognitive abilities or characteristics. For example, the characteristic of ‘high abstract reasoning’ is classified as a strength in the category of thought-process; and the characteristic of ‘poor auditory memory’ is classified as a weakness in the category of attention and memory.

**Step 2 (comparison and evaluation):** The abilities or characteristics were compared and evaluated in light of theory. For example, research on GLD indicates
information processing problems despite high general intelligence. General intelligence theories, which suggest that a single $g$ is engaged with any domain performance or knowledge, may not explain the characteristics of GLD students. On the other hand, the integrated model may explain the characteristics better than the theories that informed it. According to the suggestion that general abilities (e.g., $g$, executive, and processing) "work" with domain memory, resulting in domain performance or knowledge, even gifted students can struggle with processing when they have problems with domain memory (e.g., weak memory).

Step 3 (integration): The characteristics of GLD students, which were compared and evaluated in the previous steps, were connected through relationships found from the analysis informed by theory. For example, the fact that GLD students show the characteristics of ‘high abstract reasoning but poor sequential processing’ may result from the discrepancy between their keen visual memory and poor auditory memory.

Cognitive Characteristics of GLD Students

Silverman’s (1989a; 1989b) list of characteristics of GLD students was used to define primary cognitive characteristics. Her collection represents the majority of characteristics identified by various individual researchers (Baum, Owen, & Dixon, 1991; Bireley, Languis, & Williamson, 1992; Brody & Mills, 1997; Klein, 1980; Rivera, Murdock, & Sexton, 1995; Suter & Wolf, 1987). The cognitive characteristics were coded according to their attributes. The coding resulted in seven categories as shown in Table 2-1. The thought process- and attention- and memory-related characteristics may be general, while the language-, math-, music- and space-related characteristics may be domain-specific in that the former categories of characteristics may appear in the latter
categories of characteristics. The categorized characteristics were analyzed in light of theory.

*Table 2-1: Cognitive Characteristics of Gifted Students with Learning Disabilities*

<table>
<thead>
<tr>
<th>Categories</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thought Process</td>
<td>. Creative thinking ability</td>
<td>. Struggles with sequential material</td>
</tr>
<tr>
<td></td>
<td>. High abstract-reasoning ability</td>
<td>. May fail at subjects emphasizing sequencing</td>
</tr>
<tr>
<td></td>
<td>. Unusual imagination</td>
<td>. Performs poorly on timed tests</td>
</tr>
<tr>
<td></td>
<td>. Understanding of complex relations and systems</td>
<td>. Emotions can overpower reasoning</td>
</tr>
<tr>
<td></td>
<td>. Good problem-finding skill</td>
<td></td>
</tr>
<tr>
<td></td>
<td>. Astute questioning ability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>. Penetrating insights</td>
<td></td>
</tr>
<tr>
<td></td>
<td>. Highly developed intuition</td>
<td></td>
</tr>
<tr>
<td>Attention and Memory</td>
<td>. Keen visual memory</td>
<td>. Poor auditory memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Poor short-term memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Difficulty with rote memorization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Often inattentive in class</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. May fail at subjects emphasizing memory</td>
</tr>
<tr>
<td>Language</td>
<td>. Sophisticated sense of humor</td>
<td>. Poor listening skills</td>
</tr>
<tr>
<td></td>
<td>. Grasp of metaphors, analogies, Satires</td>
<td>. Written vocabulary less sophisticated than oral</td>
</tr>
<tr>
<td></td>
<td>. Sophisticated oral vocabulary</td>
<td>. Struggles with decoding words</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Refuses to do written work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Handwriting is illegible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Has great difficulty with spelling and phonics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Weak in language mechanics, such as grammar, punctuation, capitalization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. May fail at foreign languages and subjects emphasizing audition</td>
</tr>
<tr>
<td>Math</td>
<td>. Excellence at mathematical reasoning</td>
<td>. Poor computation</td>
</tr>
<tr>
<td>Music</td>
<td>. Possible musical talent</td>
<td></td>
</tr>
<tr>
<td>Space</td>
<td>. Early ability in puzzles and mazes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>. Exceptional ability in geometry and science</td>
<td></td>
</tr>
<tr>
<td></td>
<td>. Possible artistic talent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>. Possible mechanical aptitude</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>. Finds clever ways to avoid weak areas*</td>
<td>. May be unable to learn unless interested</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Hopelessly disorganized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>. Finds clever ways to avoid weak areas*</td>
</tr>
</tbody>
</table>

*This characteristic may be considered a strength or weakness depending on the situation.*
General Abilities or Characteristics of GLD Students

The characteristics in the thought-process, and attention and memory categories may be explained by theories of development (Case, 1985), general intelligence (Carroll, 1993; Case et al., 2001), and domain-specific cognitive abilities (Gardner, 1983; Sternberg, 1988). The theories state that thought processes, and attention and memory exist in any domain in a general or domain-specific manner. Case’s developmental theory suggests processing capacity and the form and centrality of conceptual structures as general aspects; three-stratum theory (Carroll) and united model of the mind (Case et al.) suggest hypercognition, and processing efficacy and capacity, respectively, along with g as general; triarchic theory (Sternberg) suggests metacomponents as general; and Multiple Intelligence theory (Gardner) suggests domain-specific intelligence, processing, and memory.

Thought process. GLD students’ characteristics in the thought process category may be explained by theories suggesting g, reasoning (Carroll, 1993), or processing efficacy (Case et al., 2001) as general abilities. The characteristic related to reasoning or processing may be explained by reasoning (Carroll, 1993) or processing efficacy (Case et al., 2001). However, considering that g theories argue that g is involved with any cognitive performance or knowledge, GLD students’ poor sequential ability may not be well accounted for by these theories. According to the theories, GLD students, who are gifted (i.e., high g), must show high reasoning or processing and accordingly high performance in any domain. However, GLD students who have a problem with sequential processing may not show high performance in domains that require sequential processing.
GLD students’ characteristics of ‘high abstract reasoning but poor sequential processing’ may be explained better by multiple intelligence theories than $g$ theories because the former argue for domain-specific intelligences and processing. Based on multiple intelligence theories, GLD students may have high intelligence related to abstract processing but low intelligence related to sequential processing. However, these theories do not specify which intelligences are related to abstract processing and sequential processing, respectively.

The other characteristics such as ‘creative thinking, unusual imagination, understanding of complex relations and systems, good problem-solving, penetrating insights, and highly developed intuition’ may not be explained by $g$ or multiple intelligence theories. Despite $g$ theorists’ suggestion of $g$, the identity of $g$ is not known (Demetriou, 2002). As a result, it may not be known which characteristics can be explained by $g$. Likewise, it may not be explained by multiple intelligence theories because it is not clear which intelligences can explain those characteristics.

Considering the limitations of the theories, the integrated model may help explain the characteristics in the thought process category better than the theories that informed it because the model specifies the ability of $g$ and other general abilities based on interrelationships between abilities suggested by the theories in terms of function. The integrated model suggests that $g$ is the ability to find relationships between stimuli and form knowledge. Thus, the characteristic of ‘understanding of complex relations and systems’ may be directly explained by $g$. According to the model, when the ability to find relationships ($g$) is disabled, a student cannot be gifted due to an inability to discover the relationships that are foundational to knowledge. However, this is not the
case with GLD students; they are gifted. The fact that GLD students understand complex relations and systems means that they are not disabled in dealing with relationships.

*G* ability may also help to explain the characteristics of creative thinking, unusual imagination, good problem-solving, penetrating insights, and highly developed intuition. Those characteristics may not be considered as limited to specific domains. Given that they are characteristics of giftedness (Baum, Owen, & Dixon, 1991; Brody & Mills, 1997; Song & Porath, 2005), they may be related to *g* in the discovery of relationships (e.g., created, imagined, intuited relationships). Gifted students may infer or create new relationships and form creative knowledge (Song, 2004) because of their high *g*. Considering the model suggests that *g* appears in domains, which are determined by domain stimuli, the fact that GLD students may show high visual memory but poor auditory memory suggests that the *g*-related characteristics above may appear in visual or visual-related domains in which keen visual memory and processing are required. That is, GLD students may show creative thinking, unusual imagination, good problem-solving, penetrating insights, and highly developed intuition in highly visual or visual-related domains. This hypothesis is partially supported by studies (Gardner, 1983; Renzulli, 1978). Creativity is an essential factor of giftedness along with task commitment and above average ability in various areas (Renzulli). Creativity and problem-solving exist in any domain. Intuition and insights may be more prevalent in those with “visual minds” or may be derived from spatial models (Gardner).

The characteristics of ‘high abstract reasoning, struggle with sequential material, may fail at subjects emphasizing sequencing; and perform poorly on timed tests’ may
also be explained better by the integrated model than the theories that informed it. According to the model, the characteristic of 'high abstract reasoning' may appear in domains in which abstract stimuli are processed in order to find relationships between them and form abstract domains (or knowledge), that is, idealistic domains in which abstract content is connected. The characteristics related to poor sequential processing may appear in domains such as language or math that require auditory-sequential memory and processing. Reading, spelling, rote memorization and computation (or numeracy) require auditory and/or sequential ability (Bender, 2001; Cawley et al., 1979; Gardner; Jordan et al., 1996; Munro, 2002; Silverman, 1989a; 1989b; 1993).

According to the model, if processing ability is disabled in an individual, he or she cannot be gifted because relationships are fundamental to knowledge formation; relationships cannot be found without processing. The fact that GLD students show high ability in abstract reasoning suggests that they are not disabled in processing despite their poor sequential processing.

Characteristics of GLD students may not be fully understood by using only the perspective of representation domains; GLD students who are poor at linguistic thinking may show a gifted level of idealistic domain knowledge, which may be formed in other ways (e.g., visual thinking). However, most of the theories that informed the integrated model do not specify domains in terms of content and representation; nor do they specify a cognitive mechanism for processing content and representation stimuli. They focus on representation domain abilities (e.g., verbal, linguistic, mathematical, spatial); these abilities may not explain fully why GLD students show ‘high abstract reasoning and keen visual memory but poor sequential processing and poor auditory memory.’
The characteristics of GLD students may be better explained by the integrated model which suggests that content is represented by, and processed with, representational stimuli (e.g., verbal, written) in the cognitive mechanism. In the mechanism, abstract reasoning may refer to a cognitive activity in which abstract content is visually processed in order to find relationships. Likewise, auditory representation (e.g., auditory-verbal) may be used to process content, associated with practical domain stimuli. Though characteristics related to practical domains were not found in the literature, if the stimuli exist independently, there should be a counterpart. Considering the two contrasting representations [i.e., two preferences of learners - verbal or non-verbal (or visual) (Munro, 2002; Wechsler, 1992)], if visual stimuli are preferred to represent abstract content, auditory stimuli may be preferred to represent practical content. The fact that GLD students show keen visual memory but poor auditory memory suggests that the disparity between abstract and sequential processing may result from the difference between visual and auditory memory. In other words, their keen visual memory enables GLD students to process abstract content while their poor auditory memory restricts their processing of auditory-sequential representation stimuli (e.g., language). In short, memory affects processing. The relationship between memory and processing is supported by the following research results. Deficits in auditory memory and processing but strengths in visual memory and processing are characteristic of students with (G)LD (Baum & Owen, 1988; Bireley, Languis, & Williamson, 1992; Silverman, 1989a; 1989b). Individuals with LD suffer deficits in Short-Term Memory (STM), a substrate of the phonological system; the deficit may also contribute to problems in verbal Working Memory (WM) in contrast to their intact
visual STM and WM (O’Shaughnessy & Swanson; Swanson et al., as cited in Wong, 2004).

The relation between content and representation is supported by some studies. Practical intelligence, which is the ability to adapt to new environments, is closely related to speech function (Sternberg, 1988; Vygotsky, 1978). Auditory representation is used to deal with practical aspects in real life situations [e.g., reading labels on bottles of household goods or newspapers (Willis, Schaie, & Lueers, as cited in Sternberg, 1988); successful adaptation to new cultures and communication with people (Sternberg & Grigorenko, 2004)]. Reading labels and communication with people may require auditory-verbal or auditory-numerical performance. Successful adaptation is impossible without good communication and the ability to read useful information. Students gifted in practical domains may prefer to deal with aspects of life and ideas in the material world. Thus, practically gifted individuals may show their giftedness in natural sciences such as chemistry and acoustics, or social sciences such as economics. They may have high potential for auditory or auditory-related domain performance (e.g., listening, reading, writing, or production of melodies). Considering that GLD students have poor auditory memory and processing, they may be disabled in practical domains.

The connection between idealistic thoughts [e.g., abstract-relevant (e.g., justice, fairness, or morality)] and visual thinking is also supported by other studies. What characterizes mathematicians whose gift is nonlinguistic (e.g., visual-spatial) representation is a love of dealing with abstraction. Abstract reasoning characterized by mathematical reasoning is done through wholistic or spatial processing rather than linguistic sequential processing (Gardner, 1983). “Visual-spatially gifted learners”
are characterized by idealistic thinking; they display personally complex rule systems; dominance over peers; concern for morality, justice, fairness, and global issues; and superiority in class discussions, even though they are not interested in classes in school (Munro, 2002; Rogers & Silverman, 1998; Silverman, 1989a; 1989b). Gifted students in the leadership domain exhibit the same characteristics as spatially gifted students such as dominance over people (Cattell et al., 1984).

Leadership and spatial abilities have a strong correlation (Skinner, 1981). Gifted students in idealistic domains may be interested in abstract entities (e.g., rule system, space, or energy) and visual representations, and think about abstract ideas (e.g., ideals for behavior and society such as fairness, or justice). Thus, idealistically gifted individuals may exhibit their giftedness in natural sciences such as physics, cosmology, and optics, or social sciences such as law, politics or ethics. They may also have high potential in visual and visual-related domain performance (e.g., art, architecture, or sculpture).

Even though characteristics related to social domains were not found, social thought may be represented by both auditory and visual domain stimuli because human mental states can be recognized either by auditory stimuli such as vocal tones or by visual stimuli such as facial expressions. Facial expressions (i.e., visual-facial) or tones of voice (i.e., auditory-vocal) are frequently employed as tools to recognize mental states (Ekman, 1994; Russell, 1995). The major gifted domains currently discussed are shown in Figure 2-2.
Attention and memory. Gardner’s (1983) multiple intelligence theory and Case’s (1992) developmental theory may explain some GLD students’ characteristics in the attention and memory category. The characteristics of ‘keen visual memory’ but ‘poor auditory memory’ may be explained by Gardner’s theory suggesting that memory occurs domain-specifically. Case’s developmental theory suggests that memory level is related to processing capacity (Case, 1985); according to the theory, GLD students may have better visual than auditory processing capacity. However, when it comes to characteristics such as ‘often inattentive in class,’ neither g nor Multiple Intelligence theory may explain them properly because they do not specify how attention affects or is related to other cognitive components.

The integrated model may help to explain the attention-related characteristics of GLD students better than the theories that informed it through hypothesized functional
interrelationships between cognitive components. According to the model, control of attention is essential to executive and processing functions, which are fundamental to performance or knowledge formation. This was implicit in the original model (Song, 2004); the present model explicitly specifies control of attention as an executive function. The executive and processing functions follow sequential steps, in which attention division and inhibition are required independently of each other. An individual has to divide his or her attention among many sequential steps such as metacomponential processing (planning, regulating, and coordinating) and information processing (encoding, inferring, evaluating, and application) on the one hand, and inhibition of attention to distracters on the other hand. If the individual loses control of attention, executive and processing functions may be in disarray. This is supported by the finding that attention works in concert with executive functioning (Barkley, 1996b) as well as working memory (Cherkes-Julkowski et al., 1997) and, thus, problems with attention can subsequently result in widespread difficulties (Zera & Lucian, 2001). Interrupted executive or processing functions may appear as disinhibition, causing difficulties in concentration on specific tasks or learning, which may appear as distractibility. Other studies also regard attention control as an important executive function (Hinson, Jameson, & Whitney, 2003; Kane & Engle, 2000; Kane et al., 2004; Lavie, Hirst, de Fockert, & Viding, 2004; Schmeichel, 2007).

According to the model, gifted students with high ability to find relationships but with disabilities in the executive or processing function may not find relationships and form knowledge as effectively and quickly as gifted students without disabilities. Even though they are highly curious about relationships and potentially able to find
relationships, GLD students may not plan, regulate, control, or reason well. These are critical abilities in finding relationships on the performance level. Some research evidence also supports this argument. GLD students show rapid learning of high interest material (Baum, 1984; Schiff, Kaufman, & Kaufman, 1981; Whitmore, 1980) and intensity and commitment to self-selected work in nonacademic settings (Baum, Renzulli, & Hebert, 1995; Reis, 1998; Weiner, 1992). This suggests that they do not show disabilities in executive or processing functions in specific domains in which they are interested and show giftedness. Other research results suggest that gifted students generally use metacognition more than average students in particular areas (Carr, Alexander, & Schwanenflugel, 1996).

The reason why GLD students show disinhibition (or attention deficit or distractability) in specific domains may be explained by the interrelationship between attention and memory in the cognitive mechanism of the model. In the mechanism, visual memory refers to visual stimuli to which attention is directed; similarly, auditory memory refers to auditory stimuli to which attention is directed. In the cognitive mechanism, lively and durable attention and memory, which can be translated into strong short-term memory, may be prerequisite to the processing functions that find relationships in working memory; thus, weak short-term memory delays or interrupts the related processing functions. The fact that GLD students show keen visual memory but poor auditory memory suggests that their relatively weak auditory memory may limit auditory inhibition and processing, whereas their keen visual memory may enhance visual inhibition and processing. Then, GLD students process visual stimuli effectively and form high visual or visual-related domain knowledge but process
auditory stimuli poorly and accordingly form poor auditory or auditory-related domain knowledge. In short, memory affects attention, which is essentially related to executive and processing functioning through which knowledge is formed. The fact that memory affects attention is supported by the finding that attention works with working memory (Cherkes-Julkowski et al., 1997).

The characteristic of ‘often inattentive in class’ may result from GLD students’ poor auditory memory. Poor auditory memory causes inattentiveness in cognitive activities that require high auditory memory and processing. Characteristics such as ‘poor short-term memory, difficulty with rote memorization, and may fail at subjects emphasizing memory’ may result from GLD students’ ‘poor auditory memory.’ Considering that school learning mostly involves listening, reading, and writing, all of which require high auditory-verbal function, the characteristics may be frequently witnessed among GLD students who have poor auditory memory. Evidence that memory plays an important role in cognition is found in some studies. Remembering of some sort is necessary for virtually any human cognitive activity; whatever stimulus is encountered, individuals are likely to deal with that stimulus using some comparison with situations met earlier in their experience (Meadows, 1993). The kind of gift one has tells a lot about the kinds of information one can best hold in memory (Winner, 1996).

**Domain-Specific Abilities or Characteristics of GLD Students**

Characteristics of GLD students in the categories of language, math, and space are domain-specific. The characteristics may be explained by most of the theories that informed the integrated model because the theories postulate the same or similar
abilities despite differences in the number of abilities presented among the theories. More specifically, for language-related abilities, verbal (Carroll, 1993; Sternberg, 1988), social-verbal (Case et al., 2001), narrative (Case, 1985), or linguistic (Gardner, 1983) ability or intelligence are suggested; for math-related, quantitative (Case et al., 2001), or logico-mathematical (Case, 1985; Gardner, 1983) ability or intelligence are suggested; and for spatial-related, spatial ability or intelligence is suggested (Carroll, 1993; Case, 1985; Case et al., 2001; Gardner, 1983).

**Language.** GLD students show both strengths and weaknesses in language-related characteristics: They show ‘sophisticated sense of humor, grasp of metaphors, analogies, satires, and sophisticated oral vocabulary’ but also weaknesses in listening-, reading-, and writing-related characteristics. These characteristics may be explained by verbal-linguistic ability (Carroll, 1993; Case et al., 2001; Gardner, 1983; Sternberg, 1988). More specifically, strengths of GLD students may be explained by these students’ high verbal-linguistic ability; their poor writing-related (e.g., refuse to do written work, illegible handwriting, and weak language mechanics) and reading-related (e.g., poor decoding) characteristics may be explained by their poor verbal-linguistic ability. That is, strong and weak verbal-linguistic abilities may co-occur in GLD students. However, it may not be easily understood how GLD students who show poor ability in some verbal-linguistic activities (i.e., listening, phonics, reading and writing) can show high ability in other verbal-linguistic activities (i.e., sense of humor, sophisticated oral vocabulary). What theoretical ability or abilities can explain both characteristics of GLD students?

The integrated model may help to explain these seemingly contradictory
characteristics better than the theories that informed it with the contributing ratio between domains. According to the model, domains are formed in an independent or integrated manner from two fundamental domain stimuli: auditory and visual domains in terms of representation. Most of the domains are those in which auditory and visual domains are integrated with different ratios. According to the model, language is an integrated domain in which auditory stimuli are connected with visual stimuli. Thus, linguistic activities basically require both auditory and visual memory and processing, even though the contributing ratio of both may vary depending on the activities; some require auditory memory and processing more than visual memory and processing, and others require the opposite pattern. That is, performances or knowledge even in the same domains can be different from one another in terms of the contributing ratio of auditory and visual domain functions and abilities. Therefore, the seemingly contradictory characteristics of GLD students in the language category may result from the difference between the students' visual and auditory memory and processing.

Considering that the model suggests that general abilities "work" with domain memory and that performance or knowledge occur in domains, the characteristic of 'grasp of metaphors, analogies, and satire' may be explained by GLD students' high visual memory and processing. Metaphoric ability, which is highly correlated with analogical ability, is the particular hallmark of logical-mathematical intelligence characterized by non-linguistic (e.g., visual-spatial) reasoning (Gardner, 1983); it is found in painters, dancers, architects, engineers, and scientists as well as poets, all of whom may require superior visual-spatial thinking. Even though there is no specification of what kinds of metaphors they are, considering GLD students' high
visual memory and processing, it is most likely that they are visual metaphors, analogies, or satire, which is verbalized later. That is, although those abilities require both auditory and visual memory and processing, they may appear in GLD students who have higher visual than auditory memory and processing. For example, when an individual says, “My mind is a lake,” the visualizing of ‘the mind’ as ‘a lake’ precedes verbalizing it to other people; visual representation may be prerequisite to verbal representation. That is, thinking of the metaphor requires keen visual memory of ‘lake’; when the mind is connected to the lake (“My mind is a lake”), the stimuli from the mind are compared with those from the lake in working memory. Therefore, visual metaphors, analogies, and satire that require keen visual representation may be frequently witnessed in GLD students, who have a higher level of visual memory and processing than auditory memory and processing.

Also, poor listening-, phonics-, reading-, and writing-related characteristics of GLD students may be explained by the students’ poor auditory functions. According to the model, written language used in reading and writing is verbal or phonological (auditory) written (visual); auditory ability is primary and critical in those activities. So, poor auditory-sequential functions may result in difficulties with reading and writing as well as listening. Reading and spelling require auditory-sequential ability (Bender, 2001; Cawley et al., 1979; Gardner; Jordan et al., 1996). Reading is not possible without auditory-verbal ability (Gardner); linguistic intelligence, which is related to listening, reading and writing, is highly dependent on auditory ability.

Considering the high visual functions of GLD students, the characteristic of ‘sophisticated sense of humor’ may also be more related to visual memory and
processing than auditory memory and processing (i.e., visual humor). Humor is a performance of high g, but its formation may be different depending on domain preference in terms of representation. For GLD students who have keen visual memory but poor auditory memory, their humor may be formed more visually than verbally in the mind, and verbally represented later. That is, GLD students’ sophisticated sense of humor may be visually represented first and later verbally represented to other people; thus, high visual function may be required for a sophisticated sense of humor. Humor develops with visual-spatial ability in children (e.g., pattern recognition) (Clarke, 2008). People with right hemisphere damage have difficulties appreciating humor (Bihrlle, Brownell, Powelson, & Gardner, 1986; Dagge & Hartje, 1985; Shammi & Stuss, 1999). Humor engages the right hemisphere of the brain, the strongest side for visual-spatial learners; and visual-spatial learners thrive on the use of color and humor (Golon, 2004).

The characteristic of ‘sophisticated sense of humor’ may also be explained in terms of content. Although humor is verbally represented, the content of humor may be different depending on gifted domains (e.g., practical, idealistic, or both). Sophisticated content may be visually represented in mental space before it is verbally represented; even individuals who have high ability in verbal representation may not show sophisticated humor without creating visually represented sophisticated thought. The model explains sophisticated sense of humor as high idealistic domain performance dealing with non-practical ideas such as abstract or funny stories. Golon (2004) found that learners with visual-spatial strengths improve their memorization of information if they are allowed to create silly, ridiculous, funny, or humorous stories with it.
Math. GLD students may show excellence at mathematical reasoning but poor computation. These characteristics may be explained by quantitative (Case et al., 2001), or logico-mathematical ability (Case, 1985; Gardner, 1983): Quantitative ability may explain computation in that computation deals with quantity; and as noted by Gardner, logico-mathematical ability may explain mathematical reasoning. According to the relations, GLD students may have poor quantitative ability but high logico-mathematical ability. It may raise questions. Is logico-mathematical ability related to only mathematical reasoning? Is not quantitative ability related to mathematical reasoning? If the two abilities are both related to mathematical reasoning, why does the disparity between the two abilities occur?

Considering this complexity and limitation, the integrated model may help to explain these seemingly contradictory abilities. According to the model, math is an integrated domain in which auditory and visual domains are integrated. Depending on the contributing ratio, some mathematical performances may require more auditory than visual domain functions, and others may require the opposite pattern. The fact that GLD students may show excellent mathematical reasoning but poor computation may result from the disparity between their visual and auditory memory and processing. Their high visual memory and processing may enable them to do excellent mathematical reasoning, but their poor auditory memory and processing may limit their computation in math. Math requires visual-spatial abilities such as geometric skills (Ackerman et al., 1986), and numeracy (i.e., computation such as addition, subtraction, and multiplication) requires auditory-sequential abilities (Bender, 2001; Cawley et al., 1979; Jordan et al., 1996). Mathematical reasoning is more than computation and can be carried out
intuitively or visually in a wholistic manner, without relying on linguistic sequential steps (Gardner, 1983). A heavy spatial component underlies mathematical reasoning (Winner, 1996).

**Music.** GLD students show the characteristic of ‘possible musical talent.’ The characteristic may be explained by musical ability suggested by Gardner (1983). Unlike the other theories, Gardner suggests musical ability as a separate ability. According to his theory, GLD students’ possible musical talent may be explained by their high potential musical ability. However, considering that musical ability is related to mathematical and linguistic abilities as well as spatial ability (Gardner), what is the relationship among the three abilities involved in music? And what theoretical ability or abilities of the other theories can explain the characteristic of GLD students?

The integrated model may help explain the characteristic of GLD students because it suggests that, like language and math, music is an integrated domain in which auditory and visual domains are integrated in a different ratio. The possible musical talent of GLD students may result from their keen visual memory and processing. However, despite their keen visual memory and processing, their poor auditory memory and processing may affect their musical performance. Musicians have been noted to have prodigious auditory and visual memory and reasoning (Winner, 1996); in music, in which auditory sense is crucial, the entry point to musical experiences may be a preference of visual sense (e.g., rhythmic series of colored forms, seeing music performed) (Gardner, 1983).

**Space.** GLD students show no weakness in spatial-related performances; rather, they show many strengths such as ‘early ability in puzzles and mazes, exceptional
ability in geometry and science, possible artistic talent and mechanical aptitude.' These strengths may be explained by their high spatial ability (Carroll, 1993; Case, 1985; Case et al., 2001; Gardner, 1983) in that each type of performance requires high visual-spatial functions. In particular, GLD students show 'excellent' ability in geometry and science but 'possible' artistic talent and mechanical aptitude. That is, different levels of abilities in spatial-related performances may exist in GLD students. However, the theories may not explain why GLD students who show "excellent" ability in some spatial activities can show "possible" ability in other spatial abilities. What theoretical ability or abilities can explain the difference?

The integrated model may help to explain the characteristics because the model considers space as different from language and math domains. Spatial performance or knowledge is related to the visual domain (e.g., visual-spatial), whereas language and math are domains in which auditory and visual domains are integrated. The characteristics of 'early ability in puzzles and mazes and exceptional geometry' may result from GLD students' keen visual memory and processing because those performances are carried out visually. Progress in geometry is difficult without developed spatial ability (Gardner, 1983).

Meanwhile, the characteristic of 'exceptional ability in science' may be observed when GLD students are engaged with science content or performances that require high visual-spatial abilities (e.g., experiment, observation, discovery, and mental imagination). But GLD students who have poor auditory memory and processing may not show excellent performance in science content or performance that require high auditory functions. "After individuals have attained a certain minimal verbal facility, it
is skill in spatial ability which determines how far one will progress in the sciences” (Smith, as cited in Gardner, 1983, p. 192). Einstein, who showed high ability in science, said, “The words of the language, as they are written and spoken, do not seem to play any role in my mechanism of thought” (Gardner, p. 190).

The characteristics of ‘possible artistic talent and mechanical aptitude’ may be explained by GLD students’ keen visual memory and processing, which may be required in artistic and mechanical performances. The centrality of spatial thinking in the visual arts is self-evident, and painting involves an exquisite sensitivity to the visual and spatial world; artistically gifted students have exceptional visual memory (Winner, 1996). The fact that there is a close relationship between mechanical ability and visual-spatial ability has been noted repeatedly by numerous researchers (Anderson et al., 2001). However, unlike geometry and science, some artistic and mechanical works require substantial sequential manual skills and time consuming practice. Cave painting is the earliest known form of sequential art (Graffix multimedia, 1992-2006). Comics are a form of sequential arts (Eisner, 1985). GLD students’ poor sequential processing may affect artistic and mechanical performances. GLD students, who are highly curious about relationships due to their high $g$ but have poor sequential ability, may not stick to the manual work needed for a high level of artistic or mechanical performance. Instead, they may just ‘go for’ mental work involving relationships in their visual mental space (e.g., geometric or scientific thinking). GLD students' handwriting is often poor and labored (Silverman, 1989a). LD students demonstrate difficulties in mechanical problems in writing (Newcomer & Barenbaum, 1991).
In conclusion, the characteristics of GLD students may be explained by the integrated model better than the theories that informed it. Even though the theories, which suggest general and/or domain-specific abilities, may explain the characteristics of GLD students generally, they may be limited in explaining why GLD students show strengths and weaknesses within the same domains. Lack of agreement as to the nature of \( g \) among the theories limits the explanation of GLD students' characteristics related to thought processes, and attention and memory, which may exist in any domain. And failure to attend to possible relationships between domain-specific abilities limits explanation of the characteristics related to specific domains. On the other hand, the integrated model specifies \( g \) based on interrelationships between abilities suggested by the theories that informed the model; how \( g \) is related to domains or domain abilities; and how various domains are formed through processing of independent domain stimuli in terms of content and representation. Characteristics related to thought processes, and attention and memory may be explained better by \( g \) and general abilities. Domain-specific characteristics of GLD students in the domain categories may be explained better by integrated domains with different contributing ratios of auditory and visual domains.

GLD students may be gifted in idealistic domains but may be disabled in practical domains. However, their high \( g \) makes them unlike “ordinary” LD students; GLD students may partly mask their learning disabilities. In the cognitive mechanism, GLD students’ high general abilities “work” with idealistic and visual domain memory, which may appear as high idealistic and visual domain attention or inhibition, and processing. On the other hand, their high general abilities “work” poorly with practical
and auditory domain memory, which may appear as practical and auditory domain attention and processing deficits or disinhibition. Even gifted students with high \( g \) may not form a gifted level of specific domain knowledge if their relevant domain memory is weak; poor domain memory restricts the working of general abilities in the domains. That is, GLD may occur due to large differences between domain memories (i.e., GLD between-domain differences).

Discussion and Implications

This study, which suggests that, despite high \( g \), giftedness and disability in domains can co-occur depending on level of domain memory (\( ds \) compared to \( g \)), provides a new perspective on giftedness and giftedness with disabilities (e.g., GLD). Gifted students may show a high level of practical, social, and idealistic domain intelligences, and knowledge (or performance); in representation, they may show high ability in auditory and visual domains in an independent or integrated manner; they may be academically gifted. Gifted students show high domain memory (high \( ds \)) as well as high \( g \). Otherwise, gifted students may be defined as gifted with domain disabilities (i.e., GLD). GLD students may show large discrepancies among practical, social, and idealistic domains in content, and they also show large discrepancies between auditory and visual representation domains. Their attention is more inclined to stimuli of one or more domains than the other(s), appearing as disinhibition (or attention deficit) in the other domain(s). As a result, they may show large differences in attention, processing, intelligence, and knowledge (or performance) in the domains. They may also show difficulties in connecting different domain stimuli and forming or dealing with integrated domain knowledge or performances (e.g., language- and math-related).
because the magnitude of the difference interrupts integration. The domain differences that may cause GLD are termed 'GLD between-domain differences.' The unbalanced states of domain memory and attention can be hypothesized as follows.

If a gifted individual has weak practical domain memory, he/she is mostly likely to show poor practical domain reasoning, knowledge (or performance) and feelings of direction because he/she directs much less attention to practical domain stimuli (Figure 2-3). This student may be disabled in the practical domain but gifted in idealistic and/or social domains. In terms of representation, spatially gifted but reading disabled students may belong to this group of GLD students (e.g., verbal GLD).

![Diagram of domain memory and attention]

The square in dotted lines means much weaker domain memory and attention than the others.

Figure 2-3. GLD in Practical Domains

Einstein, who is considered as GLD (Fetzer, 2000), may be a good example of an individual gifted in idealistic domains. Einstein, one of the geniuses in the history of science, had serious problems with language, whereas he showed high interest in space,
light, and world peace (Brian, 2005). He worked in physics that deals with abstract entities and visual stimuli (e.g., space, energy, light). The reason that more gifted individuals in this group have been known as great achievers in history may lie in their giftedness in idealistic and visual domains that contributed to a high level of abstract knowledge or creation of visual artifacts.

A gifted individual who has low idealistic domain memory is likely to show poor idealistic domain reasoning, performance (or knowledge), and feelings because he or she directs much less attention to idealistic domain stimuli than practical and/or social domain stimuli. (Figure 2-4). A GLD student may be disabled in idealistic domains but gifted in practical and/or social domains.

![Figure 2-4. GLD in Idealistic Domains](image)

When a gifted individual has low social domain memory, he/she is likely to show poor social domain reasoning, performance (or knowledge), and feelings because
he or she directs much less attention to social domain stimuli (e.g., people’s faces or vocal tones) (Figure 2-5). The gifted student may be disabled in social domains but gifted in practical and/or idealistic domains. In terms of representation, academically gifted but socially disabled students (Winner, 1996) may belong to this group of GLD students.

Figure 2-5. GLD in Social Domains

Given that intelligence (g) functions in domains, it is necessary to question the present concept of disability. The present term “learning disabilities” may stem from a unidimensional perspective of g as linguistic or mathematical intelligence predominantly used and emphasized in school learning. Instead of GLD, GD (Giftedness in Domains) is suggested to support a broad conceptualization of intelligence or different ways of being intelligent. Considering that a single general intelligence that appears as multiple
intelligences in various academic, social, or natural contexts is hypothesized, GD is a reasonable suggestion. To date, other domains of giftedness have been overlooked. The traditional concept of giftedness, which is highly dependent upon IQ tests with linguistic and mathematical foci, may be biased. This paper suggests that students gifted in idealistic, or social domains, who have been getting relatively little attention compared to the group of students gifted in practical domains, who show high ability in language- and math-related performances that require high auditory functions, must be included in research in terms of cognitive abilities and personal characteristics.

This study has important implications for definition, identification, and education of gifted students. Based on the integrated model, GLD may be defined as disabilities in practical or idealistic domains in terms of content, disabilities in auditory (e.g., listening, verbal expression) or visual (e.g., visualizing, spatial expression) independent domains, and disabilities in integrated domains in which one independent domain ability is much more required than the other domain abilities (e.g., phonological reading and writing), due to large differences between auditory and visual domain abilities. Gifted students should be identified by ability to deal with relationships in domains. Thus, it is highly recommended that giftedness not be identified only by learned knowledge; this study implies that giftedness has more to do with finding new relationships (i.e., create or discover relationships) than learned relationships in domain knowledge.

Considering the diverse aspects of academic contexts, gifted students in different domains should be supported in content and representation. Gifted students should be provided with materials that reflect their preferred domain content (e.g., material, abstract entities or ideas), and be supported in opportunities to express their knowledge in their
preferred representation(s) (e.g., language, number, space, time, figure, color, or sound). As noted by Armstrong (1988), it is recommended that teachers employ multiple learning tools (i.e., vivid images and pictures, color, music, movement). Expanding the 'repertoire' of students’ capabilities is also recommended. For the GLD student in the Prologue, Brett, who suffers from disabilities in reading, writing, and sequential math but is good at art, geometry, and sports, teachers or schools should provide him opportunities to deal with learning content with the help of visual representations (e.g., diagrams, geometric symbols, figures, real objects, bodily gestures) rather than merely with linguistic representations such as verbal explanations, reading books, or writing. In terms of content, he should preferably be provided with idealistic domain content [e.g., abstract entities: the universe or rules, or abstract knowledge: cosmology, physics, or politics].

A great deal of scientific knowledge has been formed by GLD individuals with visual strengths (e.g., Einstein). It may be that they can contribute to science due to their high interest in visual domain activities such as visual thinking, imagination, observation, or experiments. Considering that knowledge is formed by finding relationships between stimuli, these individuals need to be supported with direct experience of the real world.

Despite its contribution and implications, this study has two shortcomings. One is that the characteristics dealt with in this study may not represent all types of learning disabilities. The GLD students in this study are those who show high ability in spatial or spatial-related domains but poor ability in verbal or verbal-related domains (i.e., verbal GLD type). The second is that the characteristics of GLD students’ practical thought are limited to speculation about the relation between practical thought and auditory representation; GLD students with poor auditory memory are considered practically
disabled. Whether GLD students are socially gifted or disabled cannot be known from this study due to the lack of related characteristics.
References


Schmeichel, B. J. (2007). Attention control, memory updating, and emotion regulation


Swanson, K. Harris, & S. Graham (Eds.), *Handbook on learning disabilities* (pp. 158-198). New York: Guilford.


University of British Columbia.


CHAPTER III

Domain Feelings of Direction in Gifted Students and Gifted Students with Learning Disabilities

In learning at school, there are primarily two groups of gifted students. One group is gifted students without learning disabilities. The other group is gifted students with learning disabilities (GLD), or students who are twice exceptional. The former group is known for their high academic achievement at school, whereas the latter generally does not show such achievement. They, rather, have difficulty with certain academic activities but exhibit superior learning outcomes in areas 'outside of class' (Baum, Owen, & Dixon, 1991; Munro, 2002; Snelling, 2007). Given that giftedness is defined by a high level of intelligence, it is paradoxical that GLD students, whose intelligence falls within the level of giftedness, do not learn well at school, compared to their gifted peers. Why and how does the paradoxical phenomenon happen?

Given that both gifted groups are defined with reference to "intelligence," it is not surprising that some believe that intelligence is not unitary but multiple, reflecting domain-specific intelligences (Gardner, 1983; Renzulli, 1978; Sternberg, 1988). Few deny the existence of domain-specific abilities (Demetriou, 2002). However, one group of researchers admits the existence of domain-specific abilities but argues that intelligence is unitary and general (i.e., g) (e.g., Carroll, 1993; Jensen, 2002; Spearman, 1923). Even though there is a lack of specification of relationships between g and specific

1 A version of this chapter will be submitted for publication. Song, K. H., Domain Feelings of Direction in Gifted and GLD Students.
abilities and disagreement about the function or ability of \( g \), general intelligence researchers argue that \( g \) is present in all domain-specific knowledge or performance. Therefore, debates about the nature of intelligence and giftedness traditionally have revolved around the characterization of intelligence as general or specific.

The integrated model of human abilities (Song & Porath, 2005) presents a cognitive mechanism that has the potential to explain both \( g \) and multiple intelligences theories. The model hypothesizes how general and domain-specific aspects of human abilities may occur based on the interrelationships between abilities suggested by major models or theories of intelligence in terms of function (i.e., interfunctionality). Based on the interfunctionalities of abilities, the model explains the role of \( g \) in ability, what domain-specific abilities are, and how \( g \) is related to domain-specific abilities in the cognitive mechanism. According to the model, \( g \), the ability to find relationships between domain stimuli and form domain knowledge, *appears* as domain-specific intelligences [i.e., multiple intelligences as defined by Gardner (1983)] when it engages with domain stimuli, which determine domains and are only domain-specific. Therefore, domain-specific abilities or intelligences reflect general intelligence or \( g \) that appears in domains when \( g \) engages with domain stimuli coming through the sensory organs from the social and natural environments.

The model explains how phenomena such as giftedness with and without learning disabilities (LD) are different. GLD occurs due to a low level of specific domain memory, compared to that of memory in other domains (i.e., between-domain differences); lack of specific domain memory may limit the functions of abilities including \( g \). Accordingly, even gifted students can be disabled in specific domains where
domain memory is weak. This is the case with students who are GLD (e.g., verbal or non-verbal GLD); for example, GLD students who have poor auditory memory may be disabled in domains that require high auditory memory and processing (e.g., language-related domains).

The model also suggests *domain feelings of direction* as ‘domain mental engines’ that boost the development of domain knowledge or performance. *Feelings of direction* (Shavinina & Seeratan, 2004) are intuitions that occur in gifted individuals as directional feelings that make the individuals “go for” their domains of interests. The feelings of direction are related to domains or domain abilities (Shavinina & Seeratan). In the integrated model, “domain” refers to performance or knowledge in a school subject or discipline (e.g., reading, math, art), and “domain abilities or intelligences” refer to general abilities or g in domains. For example, the stimuli of verbal and written language are connected in a relationship that is part of reading performance. Therefore, feelings of direction are specified into two: feelings about relationships (g) and feelings about domain stimuli (ds). The former is termed ‘general feelings of direction’ (e.g., feeling of ‘right or wrong’) and the latter ‘domain feelings of direction’ (e.g., feeling of sound or shape). When gifted students are engaged with domains of interest, they may feel strongly (or intuitively think) about domain stimuli and relationships in the domains.

Feelings of direction were highlighted by Albert Einstein’s remarks:

During all those years there was the feeling of direction, of going straight toward something concrete. It is, of course, very hard to express that feeling in words; but it was decidedly the case, and clearly to be distinguished from later considerations about the rational form of the solution. (Shavinina & Seeratan, 2004, p.73)
Einstein’s words are considered as general feelings of direction in physics. (He said this while talking about relativity.) Rational thinking about a solution is considered to be thinking about relationships between stimuli; it does not seem to be related to thinking about specific domain stimuli. Domain feelings of direction are those about domain stimuli. Thus, an example of domain feelings of direction may be the feeling of ‘shape’ (Shavinina & Seeratan, 2004) (i.e., feeling about visual stimuli), which may intuitively occur when gifted individuals are engaged with visual entities.

In the cognitive mechanism of the model, domain feelings of direction stimulate an individual to direct attention to the real world or existing knowledge, find relationships and form more domain knowledge. Finding new relationships may result in discovered knowledge; creating new relationships may result in creative knowledge; and learning relationships in existing knowledge may result in learned knowledge. Therefore, domain feelings of direction stimulate the development of domain knowledge or performance and are critical to understanding gifted and GLD students who are gifted in different domains. This study tested the integrated model of human abilities (Song & Porath, 2005) with gifted and GLD students in terms of domain feelings of direction. If these students are gifted in different domains, they may show differences in domain feelings of direction.

Compared with the research focused on understanding giftedness or GLD through abilities, few studies have viewed the different gifted phenomena in terms of feelings of direction. An exception is Shavinina and Seeratan’s (2004) series of studies which focused on extracognitive phenomena in gifted adults and adolescents and identified feelings of direction (e.g., I aspire to something) that guided their mental activity on the way to their outstanding scientific discoveries, along with other
extracognitive phenomena (e.g., preference, beliefs) that also guided their thinking. Extracognitive aspects refer to specific intellectual intentions and beliefs that influence exceptional achievements; specific feelings that scientific geniuses and other highly creative individuals say contribute to their advanced development; specific preferences and intellectual values; luck, chance, intuition, and other similar phenomena in extraordinary development and performance; and social, cultural, and historical influences on talent development. The participants in the studies were adults and adolescents gifted in math or science. They were “a famous Russian scientist, three intellectually gifted adolescents, and Nobel laureates” (Shavinina & Seeratan, 2004, pp. 74-75). The number of Nobel laureates was not specified; autobiographical and biographical literature was used to identify the extracognitive phenomena of Nobel laureates.

Shavinina and Seeratan’s (2004) studies contributed to the field of giftedness in that they provide a new direction for thinking about giftedness, namely through feelings of direction, which are considered as one aspect of extracognition. However, their work focused on only gifted individuals, not those considered GLD. It also did not specify general and domain feelings of direction. Considering that a domain may be determined by the type of stimuli, feelings about domain stimuli are important in understanding students gifted in specific domains. According to the integrated model, gifted students, who may have strong feelings of direction about relationships due to their high g but weak feelings of direction about specific domain stimuli, may not form a high level of domain knowledge or performance. The students may direct less attention to domain stimuli, resulting in poor domain memory and knowledge or performance. As a result,
they may not have strong domain feelings of direction about domain knowledge.

Therefore, this study, as a test of the integrated model of human abilities, sought to understand how domain specificity appears in the form of domain “feelings” of direction in academic areas among gifted students and GLD students. That is, this study investigates how these students ‘feel’ about (i.e., are drawn to) domain-specific stimuli and knowledge (or performance).

The Integrated Model of Human Abilities

Humans are cognitive beings who form knowledge through thinking. In thinking, they find relationships between stimuli in memory (i.e., domain memory) and connect them through the found relationships; the connected stimuli are domain knowledge (Figure 3-1). That is, knowledge consists of two components, relationships and stimuli. The ability to find relationships and form knowledge is defined as general intelligence (g). While finding relationships, an individual plans and controls his/her thinking processes (executive ability, i.e., metacognition, or metacomponents) (Demetriou, 2002; Sternberg, 1988) on one hand, and processes information (processing ability) (Sternberg) on the other hand. Executive and processing abilities are instrumental to g; an individual finds relationships through those functions. The three abilities, g, executive, and processing, fundamentally involved with knowledge formation, are defined as general abilities.

When an individual is stimulated by internal or external demands (“activation level”), he or she may activate the instrumental cognitive functions -- executive and processing functions (“performance level”) -- to find relationships. The individual who activates the instrumental functions is labeled as the activator (Song, 2004). The term “the activator” is used for ease of presentation; it is not meant to imply an entity separate
from the individual (Song). Ability at the general activation level is labeled $g$; and the other general abilities as those at the general performance level (Figure 3-1).

As mentioned in Chapter Two, in the model, there are general abilities such as $g$, executive, and processing abilities which "work" with domain stimuli in mental space and appear as domain-specific abilities. That is, the general abilities appear domain-specifically when they meet with domain stimuli. The term used in the model, "domain-specific abilities or intelligences," means general abilities or $g$ in domains. Processing capacity is the mental space for memory and processing (Case, 1992).

The kind of stimuli in mental space determines domains; domain stimuli are processed and connected and formed as domain knowledge. So, for example, linguistic
stimuli are connected to each other and formed as linguistic domains (e.g., reading, writing). The integrated model suggests domains in terms of content (i.e., practical, social, and idealistic) and representation (linguistic, mathematical, spatial, auditory, visual, taste, olfactory, and tactile). The individual stimuli are connected in an independent or integrated manner and formed as independent or integrated domain knowledge. For example, visual stimuli may be visually processed and connected and formed as visual arts, and auditory and visual stimuli are integrated into language. Linguistic intelligence seems to be independent, but it is an integrated intelligence between auditory and visual intelligences; language-related domains (e.g., academic subjects) are integrated domains.

There are three domain-specific abilities that stimulate an individual to direct attention to domain stimuli and form domain knowledge (activation level): practical, idealistic, and social, which may be conceived of as “feelings of direction” (Shavinina & Seeratan, 2004) (Figure 3-1). Gifted students may show practical-, idealistic-, and/or social-relevant abilities or characteristics when they deal with domain content, and auditory-, visual-, taste-, olfactory-, and/or tactile-relevant abilities or characteristics when they meet those domain representations in an independent or integrated manner.

Giftedness within the Integrated Model of Human Abilities

According to the domain-specific explanation for intelligence in the model, giftedness, which is defined by a high level of g, appears in domains (i.e., domain giftedness). Gifted students are defined as those who have relatively balanced abilities between domains, though they rarely show a perfect balance between verbal and spatial abilities (Winner, 1996). They are gifted in practical, social, and idealistic domains in
terms of content, and show high ability in auditory and visual domains in terms of representation. In representation, they can be considered “all-rounded” because they can show high ability in auditory- or/and visual-related domains (e.g., art, music, math, language-related).

Meanwhile, gifted students with learning disabilities (GLD) are defined as those who have large differences between domain abilities. In terms of representation, the differences hinder integration of auditory and visual domains, causing disabilities in language-related domains (e.g., reading, writing, language-related aspects of math). In students identified as GLD, much more attention is directed to one or more domain stimuli (i.e., attention inclination) than the other(s), resulting in a domain processing deficit. As a result, GLD students form a much higher level of specific domain knowledge or performance than that in other domains. Accordingly, they may be gifted in specific domain(s), but disabled in the other domain(s).

GLD is largely divided into two groups in terms of representation: GLD in auditory domains (i.e., verbal GLD) and GLD in visual domains (i.e., non-verbal GLD). Spatially gifted but reading disabled students may belong to the group of students who are GLD in auditory domains; and verbally gifted but reading disabled students (Hettinger & Knapp, 2001) belong to the group of students who are GLD in visual domains (Montgomery, 2003).

The traditional concept of giftedness, which is highly dependent upon IQ tests with linguistic and mathematical foci, may be biased (Gardner, 1983; Sternberg, 1988) because giftedness can appear in domains in an independent manner (e.g., musical performance, reproduction of melodies or visual such as geometry, art, computer
graphics) as well as in an integrated manner (e.g., language- or math-related). The notion that one can be gifted in domains other than language or math is especially salient for gifted students with learning disabilities. Gifted students with learning disabilities (GLD) exhibit difficulties in auditory-sequential functioning (Bireley, Languis, & Williamson, 1992) that is required in reading, language arts, and many other academic subjects (Bender, 2001). These students show poor performance in reading, spelling, rote memorization and/or computation (or numeracy) (Munro, 2002; Silverman, 1989a; 1989b; 1993).

Despite these difficulties, GLD students may display high spatial (or wholistic) abilities (Munro, 2002; Silverman, 1989a; 1989b). They may be superior in geometry, science, computer programming and graphics as well as art, music, poetry, and electronics. They may be extraordinarily capable with puzzles and mazes; excellent at mathematical reasoning; have a keen visual memory and unusual imagination; highly creative; have penetrating insights; and easily grasp metaphors, analogies, and satire (Silverman). GLD students are more likely to use global wholistic rather than analytic sequential learning strategies and learn in an all-or-nothing fashion rather than in a stepwise incremental way (Munro). GLD students may be gifted in visual domains and domains in which more visual than auditory functions are required but disabled in auditory domains and domains in which more auditory functions are required than visual functions. Therefore, gifted students may show practical and idealistic, and auditory and visual domain feelings of direction in a more balanced manner, whereas GLD students may show more idealistic and visual domain feelings of direction in any knowledge or performances.
Method

This study is part of a larger study on children’s and adolescents’ understanding of learning and their own academic abilities (Porath & Lupart, 2007). The project focuses on students’ perspectives on learning and their understanding of their particular patterns of development in reading, writing, and math. Children whose development is advanced (i.e., gifted children) and children who have both advanced capabilities and learning disabilities (i.e., gifted learning disabled children - GLD) were the focus of the study. Gifted students with learning disabilities exhibited difficulties with oral language, written language, and/or reading. Eighty-one gifted students were the participants in the study, 11 of whom were GLD. One GLD student was excluded from this study because he was in Grade 1. Participants were six to sixteen years old.

Participants

Twenty students identified as gifted or GLD participated in this study. Ten gifted students with LD were matched for age and gender with 10 students identified as gifted (Table 3-1). They were selected from Grades 3 to 12, considering that children from middle childhood on may be more likely to express domain feelings of direction accurately than younger students because they have more experience of academic activities related to domain-specific abilities. The students attended schools in two large western Canadian cities. There were nine males and one female in each group. The average age of the GLD students was 152.1 months (12.68 years) and that of the gifted students was 145.9 months (12.16 years).
Table 3-1: Participants' Grade, Sex and Age

<table>
<thead>
<tr>
<th>Grade</th>
<th>Sex</th>
<th>Age in months</th>
<th>Grade</th>
<th>Sex</th>
<th>Age in months</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>M</td>
<td>095</td>
<td>3</td>
<td>M</td>
<td>103</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>108</td>
<td>3</td>
<td>M</td>
<td>109</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>122</td>
<td>5</td>
<td>M</td>
<td>125</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>141</td>
<td>6</td>
<td>M</td>
<td>138</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>149</td>
<td>7</td>
<td>M</td>
<td>150</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>150</td>
<td>7</td>
<td>F</td>
<td>146</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>168</td>
<td>9</td>
<td>M</td>
<td>171</td>
</tr>
<tr>
<td>10</td>
<td>M</td>
<td>180</td>
<td>10</td>
<td>M</td>
<td>166</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>204</td>
<td>12</td>
<td>M</td>
<td>173</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>204</td>
<td>12</td>
<td>M</td>
<td>178</td>
</tr>
</tbody>
</table>

The gifted students met the local school boards' criteria of advanced intellectual ability and achievement and attended one of three programs. Each school board defined giftedness as advanced intellectual ability and achievement. The definitions include, as commonalities, demonstrated or potential cognitive abilities and performance (or achievement) that are exceptionally advanced. However, each used somewhat different indicators of ability and achievement, as described below. Some children attended elementary multi-age classes for gifted children. Criteria for inclusion in these classes are typically reading and math skills three or more grades above grade level; at least two standard deviations above the mean on cognitive ability tests; demonstrated ability to focus on tasks; enjoyment of complexity and marked motivation to learn quickly and to learn advanced material. Others attended elementary challenge programs for gifted and highly able students in grade 3 to grade 7 and were identified by their teachers (teachers
with strong knowledge of gifted children) as gifted. Criteria for inclusion in these programs are interest in independent research and demonstrated advanced levels of conceptual development through questions, products, ideas and analytic and creative thinking. The adolescents attended an accelerated program to prepare them for early university entrance. Entrance criteria for the program are academic strengths at the 99th percentile as well as organization and time management skills, personal resilience and stamina and commitment to early university entrance.

Adolescent students identified as GLD (14 to 17 years) attended a private school for students with learning disabilities. The criteria for identification as GLD is an IQ of 130 or above on an individual, standardized intelligence test and learning disabilities in oral language, written language, and/or reading. Younger GLD students (7.9 to 12.5 years) were teacher-identified using a district checklist of characteristics of gifted/learning disabled students and attended a challenge program for GLD students. They also exhibited learning disabilities in oral language, written language, and/or reading.

Teacher nomination was part of the identification process for all the students. In all but the challenge programs, formal testing using standardized intelligence and achievement tests also were done: In the challenge programs, teacher nomination by the classroom teacher and the challenge teacher is the primary method of identification.

The gifted and GLD students were recruited by sending a notice to parents of all eligible students in the programs. Only students whose parents consented and who themselves assented to participate in the project were included.
Research Tasks

Conceptions of Learning. Each participant completed Bickerton’s (1994) Conceptions of Learning interview (Appendix A). The interview was semi-structured, a useful method through which rich responses from children can be obtained (Porath & Lupart, 2007). This format also allows for clarification and confirmation of the child’s reasons for his or her responses and the meaning(s) conveyed. Participants were asked to respond to questions about the meaning, experience, and source of learning (“What does learning mean? What is happening when you are learning? Where does learning come from?”). The interview was done in the first research session with each participant.

Conceptions of Literacy. This interview was developed by Porath (2004) following the format of Bickerton’s (1994) interview on learning. It also was administered in a semi-structured format and was done in the second research session with each participant. Participants were asked to respond with feelings about reading, writing, and math (“Describe what reading/writing/math means to you. What is happening when you are reading/writing/doing math?”) and their preferences for being taught these subjects (See Appendix B).

Procedures

Participants were interviewed individually in a quiet room at their school. Their responses to the questions were audiotaped and then transcribed for analysis. The interviews were conducted by the lead researcher in the larger study or by a graduate research assistant. Each interview took 20 to 30 minutes. Coding of the data was done by the researcher. An independent coder with background in education coded the same data set using the coding categories. The agreement between the two raters was 97%.
Analysis

The interview data were content analyzed for domain feelings of direction in terms of representation and content suggested by the theoretical model. In content (Table 3-2), practical domain feelings of direction refer to those feelings about material entities or ideas that are useful in real life situations; and idealistic domain feelings of direction refer to those about abstract entities or ideas (e.g., justice, fairness). In terms of representation (Table 3-2), auditory domain feelings of direction refer to those about auditory stimuli in reading, writing, and math; and visual domain feelings of direction refer to those about visual stimuli in those activities. The domain feelings of direction may be ‘domain interests,’ which are ‘domain mental engines’ (Song & Porath, 2005).

Domain feelings of direction shown by students gifted in specific domain(s) may be understood better in terms of domain representation and content; because domains consist of representation and content. Even GLD students who suffer in language-related (e.g., reading, writing) or numerical (e.g., addition) activities that need auditory-sequential abilities (Bender, 2001) may show strong feelings of direction toward such activities if the activities deal with their own domain content. As Gardner (1983) pointed out, content is as important as representation skills. According to the theoretical model, if there is no content, there is no representation.

Considering that the present term, gifted students, refers to those who are gifted in academic domains at school and GLD students refers to those who are learning-disabled in academic settings, the social domain is not dealt with in this study. In representation, the present research is focused on auditory and visual domains, which are allegedly two major modes of intellectual functioning (Springer & Deutsch, 1985) related to giftedness;
taste, olfactory, and tactile stimuli are excluded in this study.

Table 3-2. Domain Feelings of Direction

<table>
<thead>
<tr>
<th>Content domains</th>
<th>Representation domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical</td>
<td>Idealistic</td>
</tr>
<tr>
<td>Feelings about material entities or ideas</td>
<td>Feelings about abstract entities or ideas</td>
</tr>
</tbody>
</table>

Results and Discussion

Analysis focused on determining how the two groups of gifted students talk about domain feelings of direction in academic activities such as learning in general and reading, writing, and math, in particular, and how their domain feelings in those activities may differ. For these purposes, domain feelings were identified according to domain representation and content, and the frequency of domain feelings of direction students showed was counted.

Analysis was done with the responses to all the following questions about reading, writing, and math: Describe what reading (or writing, math) means to you; what is happening when you are reading (writing, doing math)?; how would you like someone to teach you reading (or writing, math)?; if you could teach reading (or writing, math) to your class, what would you do?. However, for conceptions of learning, only the first two questions were included (i.e., Describe what learning means to you. What is happening when you are learning?) for consistency in terms of question items.

The responses were analyzed according to the coding criteria for domain feelings in terms of content [i.e., practical (P-c) and idealistic (I-c) domain entities or ideas] and representation [i.e., auditory (A-r) and visual domain stimuli (V-r)]. In content, for
example, “You can use it to get a job,” was coded as ‘P-c’ (practical idea). “I just write for fun” was coded as ‘I-c’ (idealistic idea). In representation, “I do a lot of listening” was coded as ‘A-r’ (auditory stimuli). “I love to think visually in my mind” was coded as ‘V-r’ (visual stimuli).

The responses that implied feelings about domains were considered as domain feelings of direction; showing preferences for domain representation and content may be the expression of domain feelings of direction, even when the responses were not expressed in the form of ‘feel’ explicitly (e.g., a student who expresses a preference for reading out loud without mention of feelings). In fact, the two groups of gifted students rarely expressed the direct term, ‘feel,’ when they showed preferences for domains. Domain feelings were expressed with or without emotional indicators. Domain feelings with emotional indicators were identified by the coding criteria in Table 3-3.

Domain feelings counted as those with positive emotional indicators were, for example, “Reading is fun.” “It means a lot to me. I love reading a lot.” Those with negative emotional indicators were “Math is nothing or boring to me.” “It doesn’t matter to me.” “It is practically nothing. I just don’t like it.” “I hate math.” “How bad math is.” “I can’t read very fast. I can’t write neatly at all.”

Domain feelings of direction in gifted and GLD students are described in relation to domain representation and content shown in each academic activity. More specifically, the domain feelings of gifted and GLD students in learning, reading, writing, and math were tallied across the two groups and academic activities.

Analysis revealed general feelings as well as domain feelings. The general feelings refer to those about relationships (e.g., feeling of being right, wrong, or correct).
The findings of general feelings are consistent with the model in that any knowledge or performance has general (i.e., relationships) and domain-specific (i.e., domain stimuli) aspects. Domain stimuli are connected through relationships in knowledge or performance. Even though this study focuses on domain feelings of direction, general feelings about relationships in knowledge or performance are described at the end of this section.

Table 3-3: Coding Criteria for Domain Feelings with Emotional Indicators

<table>
<thead>
<tr>
<th>Emotional indicators</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>. Much (to me)</td>
<td>. Not much (to me)</td>
<td></td>
</tr>
<tr>
<td>. Great (to me)</td>
<td>. Little (to me)</td>
<td></td>
</tr>
<tr>
<td>. (A lot of) fun</td>
<td>. Nothing (to me)</td>
<td></td>
</tr>
<tr>
<td>. Exciting</td>
<td>. Boring</td>
<td></td>
</tr>
<tr>
<td>. Like it</td>
<td>. Don't like it</td>
<td></td>
</tr>
<tr>
<td>. Love it</td>
<td>. Hate it</td>
<td></td>
</tr>
<tr>
<td>. fast(er)</td>
<td>. can't</td>
<td></td>
</tr>
</tbody>
</table>

Domain Feelings in Gifted and GLD Students

The two groups of gifted students showed domain feelings of direction in content and representation. However, the groups showed the feelings of direction in different ways. There were between-group differences in numbers of domain feelings about learning, reading, writing, and math and within-group differences in number of domain feelings between academic activities. Gifted students expressed both practical (n=11) and idealistic (n=10), and auditory (n=6) and visual (n=6) domain feelings, whereas GLD students showed only idealistic (n=15) and visual (n=10) domain feelings. Only GLD students showed negative emotions in auditory domains (n=9), which is in contrast to positive emotions in idealistic domains (n=6). Gifted students showed domain feelings in
a more balanced manner across the academic activities. They showed both practical and idealistic domain feelings of direction in terms of content (11:10), and auditory and visual domain feelings of direction in terms of representation (6:6), whereas GLD students showed a discrepancy between the two domain feelings of direction in content (0:15) and representation (0:10). GLD students never discussed practical (n=0) or auditory domain feelings (n=0).

The results demonstrate that reading, writing, and math may be related to both practical and idealistic domain feelings in content, and auditory and visual domain feelings in representation. Accordingly, gifted students who show them in a balanced manner may show high ability in those academic activities, whereas GLD students who show a large discrepancy between the two domain feelings of direction may be more likely to suffer in the activities.

In addition to the differences between the two groups of gifted students, within-group differences were found. Gifted students showed differences in domain feelings of direction across the academic activities; some showed more domain feelings in reading, whereas others showed more in writing or math. The results are consistent with findings of academic variability in gifted students (Matthews, 1997). Another difference is that gifted students showed more practical and auditory domain feelings than idealistic and visual domain feelings, but some showed the opposite. Individual differences were also found in the GLD group. Like gifted students, they showed individual differences in domain feelings among academic activities. In addition, some GLD students showed domain feelings with strong emotional indicators, but others showed them without stating an explicit preference.
Table 3-4: Domain Feelings of Direction of Gifted and GLD Students

<table>
<thead>
<tr>
<th>Student</th>
<th>Domain</th>
<th>Learning</th>
<th>Reading</th>
<th>Writing</th>
<th>Math</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Gifted</td>
<td>GLD</td>
<td>Gifted</td>
<td>GLD</td>
<td>Gifted</td>
</tr>
<tr>
<td>1</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Con.</td>
<td>P</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rep.</td>
<td>A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>9</td>
<td>2</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>
Unlike the gifted group, the GLD group showed domain feelings with contradictory emotions (i.e., positive or negative) in two ways. One is that some GLD students showed contradictory emotions within the same academic activity. They were found in reading (e.g., I get interested in reading but long words are really boring and complicated) or math (e.g., I hate math but I like little tricks). The other is that the GLD students showed contradictory emotions across academic activities. All of the GLD students with negative emotions in math expressed positive emotions in reading but expressed negative emotions in writing, except for one who said that he has fun because he and his friends write stories and that he does not like math very much because he has trouble with writing. Some GLD students expressed very strong positive emotions in reading (e.g., means a lot to me, love, pulled into the story, get stuck into the book) but very strong negative emotions in writing and math (e.g., don’t like writing; just don’t like it; just get bored with the actual writing; boring; what bores me, hate math; practically nothing; just get bored; how bad math is). Other GLD students expressed negative emotions in reading and writing (e.g., can’t read fast; skip words, can’t write neatly at all) but positive emotions in math (e.g., learn faster than anyone).

Learning. The two groups of gifted students showed contrary responses in learning. In contrast to gifted students (n=9), GLD students rarely showed domain feelings (n=2). Only GLD students showed negative emotions in learning (e.g., doesn’t matter to me, a bunch of crud, get bored), which is in contrast to the situation in gifted students who showed none. In terms of domains, gifted students showed both domain
feelings in content and representation, whereas GLD students showed only idealistic and visual domain feelings.

The results suggest that learning involves both auditory and visual domain feelings in terms of representation. However, considering that school learning mainly occurs through verbal explanation and reading phonological written language, school learning requires more auditory domain feelings of direction than visual domain feelings of direction. Gifted students, who showed both domain feelings in a more balanced manner, may be gifted in school learning. On the other hand, GLD students, who are not positive about learning and showed no auditory domain feelings, may be disabled in school learning.

Other contrasts were found in the two groups of gifted students, particularly in two areas: learning motivation and terms they used in their responses about learning. Gifted students showed many practical reasons for learning (e.g., to prepare for the future, to get a job, to have a family), whereas GLD students never did. Most gifted students used memory-related terms such as “store, absorb, gather, or take in” (e.g., store new information, absorb information). In contrast, most GLD students used the understanding-related term, “know” (e.g., know more, know new stuff). In addition, while half of the gifted students used the term “information,” no GLD students did.

The difference in the terms may be related to different motivation in learning. Gifted students whose practical domain feelings of direction are higher than idealistic domain feelings of direction may regard content of learning as information to be used in their future rather than as concepts to be understood in themselves due to their high practical motivation. Thus, they may just memorize information for the future; they have
no problem with rote memory if it is practically necessary. Furthermore, their auditory
domain feelings may help rote memory, which needs auditory-sequential abilities (Munro,
2002; Silverman, 1989a; 1989b; 1993). Rote memorization of information may be hard
for GLD students who appear to be idealistically motivated and suffer from a lack of
auditory domain feelings. All GLD students demonstrated conceptual understanding.
Gifted students, who showed both practical and idealistic domain feelings, may be
motivated in both domains, whereas GLD students, who showed only idealistic and
visual domain feelings may be idealistically and visually motivated (Song & Porath,
2005).

Future-orientation and interest in knowledge itself may also be interpreted as
developmental phenomena that generally occur in older gifted students in that they may
increasingly recognize the practical aspects of knowledge as they grow older. However,
the future-oriented tendency was shown by only gifted students, and the interest in
knowledge itself was exhibited by even the Grade 3 GLD student as well as other older
GLD students. The interest in knowledge itself was also witnessed in older gifted
students. Considering that gifted students showed both practical and idealistic domain
feelings, they can also show interest in knowledge, which was mainly shown by GLD
students who show only idealistic domain feelings. Therefore, future-orientation and
interest in knowledge itself may have their own domain 'homegrounds.' The result may
be supported by GLD students who display a high level of intrinsic motivation (i.e.,
learning in itself) in areas of knowledge that are of interest but show difficulty with
extrinsic motivation (i.e., learning as a means for goals) that is in place in most
conventional teaching contexts (Munro).
Specific domain feelings were identified in gifted and GLD students. In representation, auditory domain feelings - *feelings of ‘sound’* (e.g., “do a lot of *listening*”) and visual domain feelings - *feelings of ‘visualizing’* (e.g., “I remember it like if I am *watching* a video”) were identified. In content, practical domain feelings - *feelings of ‘usefulness’* (e.g., “*use* it when you grow up, you can *use* it, prepare to get a job and have a family”) and idealistic domain feelings - *feelings of ‘infinity’* (e.g., “find something interesting – the mysteries of *space* – if one, what’s *outside* of the universe”) were identified.

The feelings of ‘sound’ may be related to auditory stimuli; and the feelings of ‘usefulness’ may be related to practical ideas (e.g., successful cultural adaptation). Feelings of ‘visualizing’ may be related to visual stimuli. Feelings of ‘infinity’ were assigned to idealistic domains considering that this is related to abstract thought. In learning, gifted students may feel like listening and learning useful content for the future on the one hand, and feel like visualizing it in mental space and learning something interesting in itself or something about infinity on the other hand in a balanced manner. Meanwhile, GLD students may only feel like visualizing in their mental space and learning something interesting in itself or something about infinity.

**Reading.** The obvious difference in domain feelings between the two groups was also found in reading. Gifted students showed domain feelings both in terms of content [practical (n=4) and idealistic (n=3)] and representation [auditory (n=1) and visual (n=3)], whereas GLD students showed only idealistic (n=7) and visual (n=3) domain feelings. In the emotional indicators, unlike gifted students, GLD students showed contradictory emotions in reading. GLD students showed negative emotions in the auditory domain.
(n=2), but positive emotions in the idealistic (n=3) and visual (n=1) domains.

The results demonstrate that reading involves both auditory and visual domain feelings. Reading requires visual imagination about content that is represented in phonological written form (i.e., auditory and visual); children’s imaginations often move into a mental space based on what they read (Meek, 2003). Reading is basically intended for content; books are read for content, not representation itself. Nonetheless, phonological written representation is instrumental to thinking about content in reading. Therefore, GLD students, who rarely showed auditory domain feelings, can have negative experiences in reading. However, the fact that GLD students also showed positive emotions in reading may be related to their high visual imagination or content. In short, GLD students, who showed only idealistic and visual domain feelings, may be disabled in reading.

Specific domain feelings were found in reading. In representation, auditory domain feelings were found: feelings of ‘verbalizing’ (e.g., “you are focusing on the book and you are saying the words with your mouth”), visual domain feelings: feelings of ‘shape’ (Shavinina & Seeratan, 2004) (e.g., “just kind of like an image; kind of like a diagram”), and feelings of ‘visualizing’ (e.g., “I start seeing a picture in my mind; kind of like being in a movie.. you watch it; it’s kind of like a dream; I try to draw pictures in my head”). In content, practical domain feelings were found: feelings of ‘reality’ (e.g., I usually read non-fiction books) and feelings of ‘usefulness’ (e.g., you use it in everyday life) and idealistic domain feelings: feelings of ‘fantasy’ (e.g., reading means like fantasy), and feelings of ‘imagination’ (e.g., I kind of imagine; you imagine it; I put myself in a different world; I am pulled into the story).
Feelings of ‘shape’ may be related to visual stimuli, and feelings of ‘imagination and fantasy’ may be related to idealistic domain ideas. While reading, gifted students may feel like reading aloud and reading useful content on one hand, and they may feel like visualizing and reading fantastic, imaginary, or interesting stories on the other hand in a more balanced manner. Meanwhile, GLD students may only feel like visualizing and reading fantastic, imaginary, and interesting stories.

**Writing.** The clear difference between the two groups, especially in representation domains, was present in writing as well. Gifted students showed auditory (n=3) and visual (n=1) domain feelings, whereas GLD students showed no auditory domain feelings but visual domain (n=2) feelings. In content, both groups showed the same number of idealistic domain feelings (n=3). In emotional indicators, GLD students showed high negative emotions in the auditory domain (n=5), which is the largest number of emotional indicators across the three academic activities. Both groups showed the same number of positive emotions in idealistic domain feelings (n=1).

The results suggest that among the three academic activities, writing may need auditory domain feelings the most. Writing is the reverse process of reading in that reading is a process in which phonological written language is used to approach content, but writing is a process in which content is translated into phonological written language. However, writing may require more auditory domain feelings of direction than visual domain feelings of direction. Unlike reading, in which readers can understand a story without necessarily processing all the words in it (Gardner, 1983) in a sequential manner, all the words need to be verbally or phonologically processed in a sequential manner as well as visually processed in a wholistic manner when writing; auditory-sequential
abilities are needed in reading and spelling (Munro, 2002; Silverman, 1989a; 1989b; 1993). Thus, compared to gifted students who are gifted in auditory and visual domains, GLD students, who may be gifted only in visual domains, are more likely to express negative emotions about writing. The fact that all of the GLD students who expressed negative emotions in writing showed positive emotions in reading may reflect the difference between reading and writing. LD in written expression is more common than in reading or math (Mayes & Calhoun, 2007). In short, GLD students generally may suffer the most in writing because of their low auditory domain feelings.

Specific domain feelings were identified in writing. In representation, auditory domain feelings were identified: feelings of 'sequence' (e.g., put your thoughts down in an ordered manner; organize ideas and find out which ones go first) as well as visual domain feelings: feelings of 'the whole' (e.g., I try to think about the whole story), and feelings of 'visualizing' (e.g., make them visualize and it will help them get pictures that they have in their head onto paper in a text medium). In content, idealistic domain feelings are: feelings of 'story' (e.g., like how to write stories; I try to think about the whole story; having fun because me and my friends write stories with each other), feelings of 'poetry' (e.g., make me write poetry and stuff like that), and feelings of 'fun' (e.g., I just write for fun).

Feelings of 'story' and 'poetry' were assigned to idealistic domain feelings considering its imaginary characteristic; the feelings were found only in a GLD student who showed feelings of 'imagination' and idealistic domain feelings. Feelings of 'fun' were assigned to idealistic domains because they are considered as idealistic domain ideas (e.g., fun-related). When writing, gifted students may feel like visualizing
wholistically and writing a story, poetry, or "funny stuff" in a sequential manner. On the other hand, GLD students may feel like visualizing a story, poetry, or "funny stuff" wholistically but may not be able to write them down fully on paper.

**Math.** The tendency that GLD students rarely showed auditory domain feelings was also clearly found in math. Gifted students showed auditory (n=1), visual (n=1), practical (n=3), and idealistic (n=1) domain feelings, whereas GLD students showed no auditory and practical domain feelings but visual (n=4) and idealistic (n=4) domain feelings. In the emotional indicators, only GLD students showed negative emotions in auditory domains but positive emotions in idealistic domains. That is, gifted students showed more balanced domain feelings, whereas GLD students showed a large difference between domain feelings in math.

These results suggest that math may also involve auditory and visual domain feelings at the same time. Math requires visual-spatial abilities (Ackerman et al., 1986) and auditory-verbal abilities (Cawley et al., 1979; Jordan et al., 1996); and numerical problem solving such as addition or subtraction needs verbal-sequential abilities (Bender, 2001). Considering that math may require both domain feelings in representation, GLD students can have contradictory emotions in math. GLD students, who rarely showed auditory domain feelings, are likely to alternatively show positive or negative emotions about math, depending on the combination ratio between the two domain feelings contributing to math. In mathematical fields in which auditory-numerical aspects override visual-spatial aspects, GLD students may have difficulty, but in the opposite situation, they may not. The fact that a GLD student showed negative emotions in math because of his trouble with writing may be in line with this. In short, GLD students may have
difficulties in math because of their lack of auditory domain feelings.

Specific domain feelings were found in math. In representation, auditory domain feelings were found: *feelings of 'sequence'* (e.g., a problem requires many steps) as well as visual domain feelings: *feelings of 'visualizing'* (e.g., show all my steps on the board and print or write clearly the numbers; they can visually see the word without me just saying it; teach by writing some notes; teach me math through pictures; something I can see and perceived as opposed to just numbers; use a lot of examples with a lot of visual things), and *feelings of 'shape'* (Shavinina & Seeratan, 2004) (e.g., manipulating numbers in your head with *symbols*). In content, idealistic domain feelings: *feelings of 'space'* (e.g., I think it is very important because without math we won’t be able to do accurate things like launching a *space* craft), *feelings of 'balance'* (e.g., start with 1+1 and then 2+2 and I keep on doubling and doubling until you reach like 64+64, which is 32+32; 1+1 is 2; 2+2 is 4; 4+4 is 8..; 3x3), and *feelings of 'fun'* (e.g., I am having fun; I like little tricks; she knows all the little tricks and to her, math is like a *game*) were found.

Gifted students may feel like doing math in a sequential manner and for practical purposes on one hand, and doing it in a wholistic, interesting, funny, tricky, game-like, or mentally symbolic manner on the other hand, whereas GLD students may feel like doing math just in a wholistic, interesting, funny, tricky, game-like, or mentally symbolic manner.

*General Feelings in Gifted and GLD Students*

Analysis revealed that both groups of gifted students showed the same general feelings across the academic activities. General feelings refer to feelings about relationships general to any domains.
Specific general feelings were found: feelings of 'knowing' (e.g., knowing more about things, eager to know more, know new stuff, know more), feelings of 'understanding' (e.g., I have a sense of satisfaction when I understand something), feelings of 'relation' (e.g., try to relate to things, strengthening my logical skills), feelings of 'newness' (e.g., store new information, know about something new, getting new knowledge, discover new things), feelings of 'creativity' (e.g., I use creative juice, I create new people in a whole new place, try to change something), feelings of 'wanting to know more' (knowing more, eager to know more, find more), feelings of 'smartness' (e.g., getting smart, become more knowledgeable and mature), feelings of 'importance' (e.g., the basics of language is very important, math is still very important to us), feelings of 'being right' (e.g., you basically know whether or not it's right or wrong), and feelings of 'being good' (e.g., that would be a good way, I think that would be the best way), which may be feelings of 'belief' (Shavinina & Seeratan, 2004).

Considering that g is ultimately related to relationships in knowledge, the feelings of 'understanding, relation, newness, creativity, wanting to know more, and smartness' are assigned to the general feelings; they are all related to relationships in knowledge. The feelings of 'important, being right, belief' are also assigned to the general feelings because they are considered as judgments or evaluation about relationships. The feelings may reflect the characteristic of 'judgmental or evaluative' in gifted students.

In their own domains, both groups of gifted students may commonly feel like they want to know or understand new and more relationships in knowledge, be creative and be smarter with new knowledge. They may also feel like evaluating (or judging)
relationships. The general feelings may be critical to identify gifted students because they are defined as gifted by a high level (i.e., gifted level) of intelligence (g), the high ability to find relationships and form a gifted level of domain knowledge.

A particular finding in the general feelings is that the feelings of ‘importance’ and ‘being right’ were found only in adolescent gifted students in this study. Considering that the other general feelings are common to younger and adolescent gifted students, the phenomenon may be related to increased experience; the common functions may be more activated as children become more experienced. This may be supported by Shavinina and Seeratan’s study (2004) in which those feelings were identified among gifted adolescents and adults.

In conclusion, the only difference between gifted and GLD students is the degree of difference between practical and idealistic domain feelings in content, and auditory and visual domain feelings in representation. Gifted students showed both domain feelings in content and representation in a more balanced manner, whereas GLD students showed large differences between them. Therefore, gifted students may be gifted in both domains, while GLD students may be gifted only in idealistic and visual domains. As a result, gifted students show giftedness in reading, writing, or math that requires both domain feelings, whereas GLD students may be disabled in those domain activities.

General Discussion

This study, as a test of an integrated model (Song & Porath, 2005), investigated domain feelings of direction in gifted and GLD students and identified a variety of feelings. The different levels of domain feelings between gifted and GLD students suggest that gifted students may be academically gifted, whereas GLD students may be
disabled in school learning despite their giftedness in visual domains. The results are consistent with those of previous studies that show that GLD students do not learn well at school (Baum, 1984; Munro, 2002) or struggle with reading, writing, or math (Munro; Silverman, 1989a; 1989b; 1993). Considering that school learning is highly related to those activities that require both auditory and visual domain feelings of direction, GLD students with poor auditory domain feelings of direction are more likely to suffer in school learning.

The results of this study are supportive of the original model in several ways. First, the finding that the two groups of gifted students show general and domain feelings of direction in reading, writing and math may support the model’s suggestion that knowledge or performance has general and domain-specific aspects; when forming knowledge, an individual finds relationships (i.e., general) between domain stimuli (i.e., domain-specific). The finding suggests that both groups of gifted students are gifted in specific domains. Second, the finding that the two groups of gifted students show practical, idealistic, auditory, and visual domain feelings of direction may support the model’s suggestion that independent domains exist in terms of content and representation. The finding suggests that knowledge or performance consists of domain content and representation. Third, the finding that in reading, writing, and math, content or representation domain feelings exist in a mixed manner may support the model’s suggestion that language- and math-related domains are integrated domains. The finding suggests that knowledge or performance appears domain-specifically in an independent or integrated manner. Fourth, the finding that the two groups of gifted students show different levels of domain feelings may support the model’s suggestion that domain
abilities or feelings can be affected by domain memory. The finding suggests that GLD students, who rarely show practical and auditory domain feelings of direction, may have problems with memory in those domains. Last, the finding may also support the model’s suggestion that domain feelings of direction stimulate gifted students to “go for” domains of their own interest (i.e., domain mental engines). The finding suggests that gifted students may “go for” any content domain and school learning in terms of representation, whereas GLD students may just “go for” idealistic domains and ‘out of school learning’ (e.g., visual learning or real experience of the world).

The results of this study support Shavinina and Seeratan’s (2004) study, in part, in terms of feelings of direction. Some of the feelings identified in this study are similar to those identified in their study. In terms of domain feelings, the feeling of ‘infinity’ of GLD students in this study (e.g., “find something interesting – the mysteries of space – if one, what’s outside of the universe”) may be related to the feeling of ‘endless’ in their study (i.e., aspiration to the “endless” in scientific cognition) because the feeling of ‘endless’ is related to thoughts about the origins of space (Shavinina & Seeratan). The feeling of ‘shape’ of GLD students in this study is related to the feeling of ‘shape’ in their study, along with the feeling of ‘beauty or harmony’; beauty or harmony is found in figure or shape (e.g., architecture, diamond) (Shavinina & Seeratan). The feeling of ‘the whole’ found in reading may also be related to feeling of ‘harmony.’ The feeling may be extended to story, which might be expressed as “wholly harmoniously structured linguistic architecture.”

Considering that the feeling of harmony in shape or figure is extended to other areas (e.g., harmonious life, numbers, or theory) (Shavinina & Seeratan, 2004), the
feeling of ‘balance’ in math may be also related to the feeling of harmony. The feeling may be extended to harmony of numbers in math (e.g., 1+1 and then 2+2 and I keep on doubling and doubling until you reach like 64+64, which is 32+32; 1+1 is 2; 2+2 is 4; 4+4 is 8...; 3x3). Although this claim is based on only one GLD student, the fact that the GLD student who showed negative emotion in math said he especially likes division seems in line with the interpretation that GLD students have the feeling of harmony; in division, numbers are divided equally (i.e. harmoniously or in a balanced manner) by the same number. This phenomenon is compared to that of mathematicians who like patterns and also like music because of patterns in music (Gardner, 1999).

For general feelings, the feelings of ‘importance,’ ‘being right,’ and ‘belief’ are consistent with the findings of Shavinina and Seeratan (2004). In their study, these are feelings in the category of intellectual beliefs, which are extracognitive phenomena.

The feelings of direction shown by gifted students expand on Shavinina and Seeratan’s (2004) study. Even though their study contributed to the field of giftedness, suggesting feelings of direction as additional indicators by which giftedness can be understood, the feelings of direction in their study are limited to gifted adolescents and adults. This study identified feelings of direction of gifted and GLD students in childhood and adolescence. This study also specified feelings of direction in terms of general feelings common to all groups of gifted students, and domain-specific feelings shown by specific groups of gifted students. The general feelings inform our knowledge of how gifted and GLD students are gifted, and the domain feelings show how the two groups of gifted students are different. Considering that knowledge or performance has general and domain-specific aspects, domain feelings of gifted students must be understood through
general and domain-specific aspects. In addition, this study identified feelings in terms of representation and content that reflect knowledge structure, as proposed by the model (Song & Porath, 2005).

The differences between gifted and GLD students shown in this study can be partially explained by the multiple intelligences perspective (Gardner, 1983), which seems to have strong explanatory power for the different domain feelings of direction of the two groups of gifted students. The result that gifted students showed balanced domain feelings in reading, writing, and math can be explained by linguistic and logico-mathematical giftedness; that is, gifted students may have two independent intelligences of a gifted level (i.e., linguistic and logico-mathematical intelligences), whereas GLD students who suffer in those activities do not have the same level of the intelligences but a gifted level of spatial intelligence.

However, Gardner's (1983) model is still limited in explaining the general and domain-specific aspects shown by gifted and GLD students in some respects. His model may not explain the general feelings common to any group of gifted students; Gardner (1999) does not accept a single general intelligence. Which intelligence or intelligences among his seven intelligences can explain the general feelings that are common to the two groups of gifted students? Also, the model may not explain fully the domain feelings of GLD students. Why did GLD students show contradictory emotions in reading, writing, or math? If they have low levels of linguistic and logico-mathematical intelligence, why did they show very strong positive emotions in each activity? Why did they show contradictory emotions even between reading and writing, in which an independent linguistic intelligence is believed to be responsible for their success? Why did they show
inconsistent emotions across academic activities?

Moreover, Gardner’s (1983) model, which does not specify domains in terms of content and representation, may also not account for the individual differences within and between the groups of gifted students. Why did some gifted students show more practical and auditory domain feelings, but others showed more idealistic and visual domain feelings? Why did some GLD students show only idealistic and visual domain feelings with positive or negative emotions, but others did not in the same academic activities? The model may not explain why gifted students show balanced practical and idealistic domain feelings, whereas GLD students show only idealistic domain feelings. Which intelligence or intelligences can explain the content domain feelings of direction of gifted students?

The results of this study may also be partially explained by the models that consist of general and domain-specific abilities (Carroll, 1993; Case et al., 2001). The general feelings shown by both groups of gifted students are expected to be explained by $g$ that is involved in any domain knowledge or performance. Wherever $g$ exists, general feelings, which refer to those related to $g$, may also exist. The domain feelings about domain representation may be explained by auditory or verbal, and visual or spatial abilities suggested by the models as domain-specific ones. However, due to the unknown identity of $g$, the general feelings may not be explained by the theories. The models may not explain why the differences between gifted and GLD students in domain feelings occur. They have the same level of $g$ in common that is involved with both auditory-verbal and visual-spatial domains equally. Then, why did GLD students show negative feelings about reading, writing, and math that require both domain abilities? What role
did $g$ have in the activities? In other words, how is $g$ related to domain-specific abilities in terms of function? In addition, the models may not account for practical and idealistic domain feelings because they do not specify domains in terms of representation and content; neither suggests those content domains.

The results of this study are explained better by the integrated model of GLD. First of all, the result that gifted students showed more balanced domain feelings, whereas the GLD students showed only idealistic and visual domain feelings across the academic activities is explained by the model. It suggests that gifted students are gifted in practical and idealistic domains, and in auditory and visual domains, whereas the GLD students are gifted only in idealistic and visual domains.

Second, the result that the GLD students showed a great discrepancy between the two domain feelings is explained by their large disparity between auditory and visual domains. The model suggests that GLD occurs due to large differences between domains (i.e., GLD between-domain differences). The more balanced situations of domain feelings in gifted students can be explained by minor between-domain differences, whereas the disparity between the two domain feelings among GLD students can be explained by large between-domain differences. However, even gifted students show disparities between verbal and spatial scores; some are more auditory-verbal and others are more visual-spatial (Winner, 1996). Gifted students show considerable variability across academic domains (Matthews, 1997).

Between-domain differences may explain the individual differences within the same groups of gifted students. Even gifted students showed differences in domain feelings. Most of them showed more practical and auditory domain feelings than
idealistic and visual domain feelings, but a few showed the opposite pattern. GLD students also showed differences in feelings. Some GLD students showed very strong positive or negative emotions, whereas others show domain feelings without indicating an explicit preference toward the same academic activities. Some GLD students showed positive emotions in reading or math but negative emotions in writing.

Third, the result that gifted students showed a balance between domain feelings in reading, writing, and math is explained by the model’s suggestion that language and math are integrated domains in the processing context. That is, reading, writing, or doing math cannot be possible without integration of two independent domain stimuli, auditory and visual). Although GLD students may not achieve as high scores as gifted students in language- and math-related activities, they can enjoy those activities when they are related to idealistic domain in content and visual domain in representation, in which they show giftedness. As a result, GLD students can show positive emotions for idealistic or visual domain aspects but negative emotions for practical and auditory domain aspects within an academic activity or knowledge.

Last, the result that, unlike gifted students, GLD students showed only idealistic (content) and visual (representation) domain feelings in a consistent manner across the academic activities is explained by the model’s suggestion that auditory domains are related to practical domains, and visual domains are related to idealistic domains.

This study may have important implications for identification and education of GLD students. This study suggests that gifted students may be identified in domains by domain feelings of direction as well as domain abilities. According to the study, the level of general feelings may be a criterion for identification of giftedness; and domain feelings
of direction may be used to determine domains of interest and strength among gifted students. In education, for integrated domains such as reading, writing, and math, complementary functioning between representation and content is helpful for their learning. As shown in reading, if content is very interesting, funny, and requires high visual imagination, GLD students may feel more positively about the activity. Even in writing, where GLD students expressed the largest number of negative feelings among the three academic activities, encouragement to do the activity with idealistic domain content (i.e., abstract, funny, imaginary, fantasy), may help them to become interested in the activity. In addition, visual material may help GLD student to engage with writing more positively. A GLD student who expressed the need for visual mediation in writing may be an example of this (e.g., teach writing through pictures; show them pictures of the writing and make them visualize; help them get pictures in their head onto paper in a text medium). In math, if teachers provide GLD students with interesting tricks and funny aspects of math or visually represented skills, they may show more active engagement or achievement.

For GLD students, idealistic content and visual representation seem critical to their thinking and learning. GLD students who face much difficulty in integrated domain knowledge should be advised to invest their effort into domain knowledge or performance which requires idealistic and visual domain feelings (e.g., cosmology, law, politics, ethics in content, and art, geometry, geography, architecture, computer graphics and games in representation). They also could be advised to invest their time and energy in integrated domain knowledge or performance in which idealistic and visual domain feelings are stressed.
Meanwhile, despite the various approaches to teaching GLD students, their problems in learning still remain since having only interests in visual domains may not guarantee substantial performance in school learning due to low practical and auditory domain feelings that are essential to school learning. However, this study may suggest a way by which GLD students can compensate for their LD to a certain degree in their school learning. Considering that intelligence is related to dealing with relationships, GLD students, who have high g, may be best helped with school learning when they are allowed to think about or deal with relationships. Even linguistically represented facts or ideas in school may be held more strongly in memory when the facts or ideas are connected to problems or phenomena in real life or those kept in their memory rather than when they simply hold the facts or ideas in their memory in the same way as they are presented. (This may be the way GLD students can compensate for their LD, unlike students who are LD but whose intelligence is not as high.) This makes GLD students’ prior or existing knowledge explicit, and their prior knowledge is associated with new facts or ideas in a complex manner. Knowing what they know makes children’s further learning easier (McKeough & Sanderson, as cited in Porath, in press). GLD students like to learn in a more complex and sophisticated way (Coleman, 2005).

There are limitations to the study that also need to be considered. Only ten gifted students and ten GLD students were included. Thus, more data are necessary to ensure generalization. Also, the data did not allow analysis for gender differences in feelings of direction in the major academic activities in school. In each group of gifted students, there was only one female student. Considering this study’s suggestion that considerable academic variability in gifted students may depend on between-domain differences in
term of feelings, future research is recommended to investigate how other types of GLD students (e.g., non-verbal GLD) show domain feelings of direction in academic activities and how gender differences appear in terms of disparity of domain feelings of direction.
References


functioning of gifted, creative, and talented individuals. In L. V. Shavinina & M. Ferrari, M. (Eds.), Beyond knowledge: Extracognitive aspects of developing high ability (pp. 73-102). Mahwah, NJ: Lawrence Erlbaum Associates.


CHAPTER IV

Conclusion

This research was carried out to understand giftedness through general and domain-specific aspects of intelligence. Two studies constituted the research; each was done to test the integrated model (Song & Porath, 2005) that specifies general and domain-specific aspects of intelligence, which has potential to explain how giftedness appears in domains. The focus of this research was on why and how gifted students and gifted students with learning disabilities (GLD) are different from each other. GLD students refer to those who are gifted but exhibit great discrepancy between their practical and idealistic, and auditory and visual domain abilities. The abilities, characteristics, and feelings of gifted and GLD students were analyzed comparatively using the integrated model and the theories that informed it, that is, theories of development (Case, 1985), general intelligence (Carroll, 1993; Case et al., 2001), domain-specific cognitive abilities (Gardner, 1983; Sternberg, 1988), and “extracognitive” (Shavinina & Seeratan, 2004) aspects of high ability.

In the course of the analysis, the theories that informed the integrated model showed limitations in explaining the abilities, characteristics and feelings of gifted and GLD students. Major limitations of the theories were found in lack of provision of a cognitive mechanism which explains how intelligence is related to domains or domain abilities in processing contexts. The theories do not specify relationships in terms of function and the criteria for domains in terms of content and representation. GLD students’ high ability and disability may be fully understood when viewed by both
content and representation. The theories also do not explain how intelligences or domain abilities are functionally related to each other; what are the commonalities or differences between them?

*G* theories were expected to explain the general aspects of gifted and GLD students, but the disagreement between the theories about the ability or function of *g* was a barrier that was necessary to overcome. *G* researchers define intelligence in academic contexts in which language- and math-related domains are highly valued. As a result, the theories explain gifted students’ high levels of domain feelings of direction in reading, writing, and math but not why GLD students, who have high *g*, show low ability and negative emotions in those domains.

The theories that informed the integrated model suggest domain-specific abilities or intelligences, which were expected to explain the domain-specific aspects of gifted and GLD students. *G* and the developmental theories suggest verbal, linguistic, quantitative, spatial, auditory, visual, social, or emotional abilities (Carroll, 1993; Case, 1992; Case et al., 2001). Multiple intelligence theories (Gardner, 1983; Sternberg, 1988) also present several intelligences, which are similar to those suggested by *g* and developmental theorists. However, the theories could not explain satisfactorily the domain-specific aspects of two groups of gifted students. They could not explain why GLD students show contradictory abilities, characteristics, or feelings even in the same domains.

Gardner’s (1983) theory faces criticism that his intelligences are not independent. This research suggests that Gardner’s linguistic and logico-mathematical intelligences are integrated intelligence in that language and number require auditory and visual domain stimuli and processing with which *g* engages. That is, Gardner’s linguistic intelligence
cannot exist as an independent intelligence in the brain; it is formed through integrations of independent sub-domain intelligences (Gardner’s term). This suggestion is in line with previous studies that found that reading needs auditory (Torgesen, 1999; Wagner & Garon, 1999) and visual function (Behrmann, 1999; Farah, 1999; Marie-Line et al., 2007; Willows, 1991) and math requires verbal-sequential and spatial abilities (Ackerman et al., 1986; Bender, 2001; Jordan et al., 1996).

The integrated model, overcoming the limitations of the theories that informed it, not only explains the abilities, characteristics, and feelings of the two groups of gifted students, but also helps provide a solution to the controversy over two major competing perspectives of intelligence (i.e., g or multiple intelligences). The model explains the relationship in function between intelligence and domains. A single g appears in domains; it appears domain-specifically (i.e., multiple intelligences in Gardner’s term) when it deals with domain stimuli. The kind of stimuli in memory (i.e., domain memory) determines domains. Domains can be independent or integrated ones in which auditory and visual stimuli are connected in different ratios; some domains require more auditory stimuli than visual stimuli, and others the reverse. The function of g can be limited by the level of domain memory (i.e., level of ds) because g “works” with domain memory. As a result, high g can appear as disabilities in specific domains depending on the level of domain memory; even gifted students can be disabled in specific domains if they have a low level of domain-specific memory (e.g., GLDs). The g and multiple intelligence theories overlook the level of ds affecting g’s function to form knowledge. The g theories do not note that domain memory, which determines domains, can limit the function of g. Gardner (1983) established the concept of multiple intelligences based on high abilities.
valued in different cultures, and by neurological data which show that domain memory and processing are relatively independent. However, according to the integrated model, intelligence is single, and only domains are multiple, and relatively autonomous in the brain.

The current research produced three important findings related to the phenomena of giftedness and giftedness with learning disabilities (GLD). First, giftedness appears domain-specifically; GLD is giftedness in a specific domain(s) other than language- and math-related domains. In terms of general aspects, the first (conceptual) study suggested that, like gifted students, GLD students have a gifted level of g that is intact and are not disabled in executive and processing functions when reasoning occurs with specific domain stimuli. The second (empirical) study found that both gifted students and GLD students showed the same general feelings (e.g., feelings of relationships) across academic activities (i.e., reading, writing, and math); this finding adds to the work on feelings of direction (Shavinina & Seeratan, 2004) which was limited to science. These general feelings make gifted individuals “go for” domains of interest along with domain feelings of direction.

In terms of domain-specific aspects, the first study suggested that gifted students are gifted in practical and idealistic domains in thought content, and auditory and visual domains in thought representation, whereas GLD students are gifted in only the idealistic domain in content and the visual domain in representation. The domains in the integrated model reconceptualized those suggested by the theories that informed it; the model suggests domains in terms of content and representation. Content domains are practical (i.e., material entities and ideas), idealistic (i.e., abstract entities and ideas),
and social (i.e., mental entities and ideas). Representation domains are auditory, visual, spatial, linguistic, mathematical, taste, olfactory, and tactile. Considering that domains involve domain content and representation, domain abilities may be better understood in term of content and representation. The second study empirically supported the suggestions: gifted students showed both practical and idealistic, and auditory and visual domain feelings in a more balanced manner, whereas GLD students rarely showed practical and auditory domain feelings but idealistic and visual domain feelings.

According to this study, giftedness that coexists with learning disabilities may result from large differences between domain abilities. The differences hinder integration of domains, causing disabilities in integrated domains (e.g., reading, writing, math). For students identified as GLD, much more attention is directed to one or more domain stimuli (i.e., attention inclination) than the other(s), resulting in a domain attention and processing deficit. Accordingly, GLD students form a much higher level of specific domain knowledge or performance than in other domains. Thus, they are gifted in specific domain(s), but disabled in the other domain(s).

The GLD students focused on in this study, who are gifted in visual domains but disabled in auditory domains, may direct relatively less attention to auditory domain stimuli than visual domain stimuli. So, they may have low auditory memory and thus be poor at auditory-sequential reasoning and performance in learning situations in which language and number are predominantly used. They subsequently form poor linguistic and mathematical knowledge or performance (e.g., reading, writing, numeracy). Thus, GLD students with disinhibition in language and/or number may be bored with school learning and frustrated by their poor performance in those domains, even though they
possess a gifted level of $g$, which is the potential ability to form knowledge in those
domains. Because of their mixed abilities, GLD students may have negative experiences
such as feelings of helplessness, a general lack of motivation (Munro, 2002; Whitmore
& Maker, 1985), and misbehavior and frustration (Baum, 1988; Beckley, 1998; Suter &
Wolf, 1987) and be aggressive, disruptive, careless, and frequently off-task (Baum,
1990; Beckley).

These findings that reflect the present agreed-upon but paradoxical concept of
GLD are in line with some previous studies that found that, like gifted students, GLD
students show a high level of processing, memory, reasoning, and creativity (Baum,
1988; Baum, Owen, & Dixon, 1991). The results are also consistent with other previous
studies. In thought content, some individuals show practical giftedness (Sternberg, 1988);
others show idealistic (e.g., leadership) giftedness (Marland, 1972); and still others, social
giftedness (Gardner, 1983; Porath, 2000). In thought representation, some individuals
show giftedness in academic activities (i.e., auditory-visual integrated domain) (Winner,
1996), and others show giftedness in visual-spatial areas (e.g., art, geography, or
computer graphics) (Munro, 2002; Silverman, 1989 a; 1989 b).

Another important suggestion is that giftedness is limited by level of domain
memory (i.e., level of $ds$) that determines domains. A gifted level of $g$ appears as
giftedness in specific domains if the level of such domain memory is high; otherwise, $g$
appears as disabilities. The first conceptual study suggested that GLD occurs due to large
between-domain differences. Unlike gifted students who have minimal differences
between practical and idealistic, and auditory and visual domains, GLD students show
large differences between auditory and visual domain memory. The second empirical
study supported that gifted students showed content and representation domain feelings in a more balanced manner, whereas GLD students showed only idealistic and visual domain feelings. The findings reflect the characteristics of gifted and GLD students found in previous studies; gifted students showed high auditory and visual memory (Clark, 2002), whereas GLD students showed high visual memory but low auditory memory (Munro, 2002; Silverman, 1989a; 1989b).

The last important suggestion is that domains or domain activities require different levels of auditory and visual domain functions. Even in the same domains, more auditory domain than visual domain functions, or the reverse, may be required. The first conceptual study suggested that some linguistic and mathematical activities require more auditory memory and processing, and other linguistic and mathematical activities require more visual memory and processing. GLD students, who have high visual but low auditory memory and processing, showed high ability in metaphor, analogy, humor, and mathematical reasoning, whereas they showed poor reading and writing, and numeracy.

The second empirical study supported that, depending on academic activities, the two groups of gifted students showed different levels of practical and idealistic, and auditory and visual domain feelings. The results are consistent with the finding that gifted students show considerable variability in domain abilities (Winner, 1996) or across academic domains (Matthews, 1997).

This research may provide a new perspective on measuring intelligences and additional stress on the importance of environment for children. Intelligence tests, which allegedly measure level of intelligence, may not measure level(s) of pure intelligence, g, because they may measure level of ds at the same time. Depending on test items or
learning content, students with a high level of \( ds \) but an average level of \( g \) can also achieve high scores in IQ tests or school learning and be labeled as gifted; however, it is not appropriate to say they are gifted in terms of \( g \). Therefore, independent tests are needed that measure \( g \) and \( ds \) respectively in new ways. The model suggests that the level of \( g \) can be measured by the level of relationships in knowledge formed by students \textit{by themselves}, and the level of \( ds \) can be measured by level of domain memory (e.g., short-term memory), or strength of domain feelings of direction. Related with domain memory, as Gardner (1983) suggested, human abilities may evolve over a long period of time through interaction with environment. According to the logic, the unbalanced mental spaces, allegedly causing GLD in this study, may result from interactions with the social and natural environments that demand people to think more spatially than verbally, or vice versa. In this sense, it is recommended that children grow in an environment that provides auditory and visual stimuli altogether and thus encourages auditory and visual thinking in a balanced manner.

The approach taken by this research, which investigated the phenomenon of giftedness through general and domain-specific aspects of intelligence and feeling, is very useful in understanding different forms of giftedness. The results suggested why GLD students are gifted and disabled and how they are different from gifted students without learning disabilities. In addition, the approach to giftedness through feelings is also significant in that it widens the way to understand giftedness. The feelings, hypothesized to be extracognitive phenomena that guide mental activity on the way to outstanding scientific discoveries (Shavinina & Seeratan, 2004), can be indicators of giftedness.
This study also has implications for identification of GLD students. According to the study, giftedness is related to the ability to form domain knowledge, and GLD occurs due to large differences between domain abilities. Therefore, GLD can be identified by large differences between the ability to form practical domain knowledge and the ability to form idealistic domain knowledge, through discovering, inferring, or creating relationships between domain entities or ideas, as well as through learning relationships in domains which are already formed. That is, the differences between domain abilities to discover, infer, or create relationships, as well as to learn them, can be used to identify GLD students.

In terms of representation, GLD students can be identified by large differences between auditory (e.g., verbal comprehension or manipulation) and visual (e.g., high spatial comprehension or manipulation) domain abilities. However, when identifying GLD students by representation abilities, considering content is necessary; representation abilities may be the abilities to deal with tools that represent a gifted level of content.

This identification method may be different from that of identifying by discrepancy between potential ability and achievement. Even GLD students may show high achievement at school by compensating for their poor domain abilities. For example, GLD students can be highly knowledgeable through direct experience or reading books with the help of whole word recognition, even though they have a hard time in learning at school with verbal teaching.

Despite many strengths of this study, there are weaknesses in terms of data to be considered. The first study was conceptual; the second had only a small number of participants. Considering that various kinds of learning disabilities exist, the addition of
more GLD groups (e.g., non-verbal GLD) would contribute to future research. The second study needs to be replicated with more students identified as gifted and GLD. Finally, there is one more thing to be considered. The present research tried to understand giftedness or learning disabilities with more focus on representational abilities. Even though those abilities are critical to communicate, research on domain content, to which giftedness is related and, accordingly, in which gifted students are primarily interested, may be more important. This should be particularly stressed for GLD students who form gifted levels of domain knowledge but struggle with linguistic representation. Studies on domain content may also determine whether GLD students, who are poor in reading and show negative emotions toward it, can show positive emotions in reading due to their gifted domain content. Therefore, further studies are necessary to identify more specifically the content domains suggested by the integrated model.
References


Appendices

Appendix A

Conceptions of Learning
(Bickerton, 1994)

What does learning mean?

What is happening when you are learning?

Where does learning come from?
Appendix B

Conceptions of Literacy

Describe what reading means to you.

What is happening when you’re reading?

How would you like someone to teach you reading?

If you could teach reading to your class, what would you do?

Why would you do it that way?

Describe what writing means to you.

What is happening when you’re writing?

How would you like someone to teach you writing?

If you could teach writing to your class, what would you do?

Why would you do it that way?

Describe what math means to you.

What is happening when you’re doing math?

How would you like someone to teach you math?

If you could teach math to your class, what would you do?

Why would you do it that way?