

2009

The relationship between thinking style differences and career choice for high-achieving high school students

Mihyeon Kim

College of William & Mary - School of Education

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**The Relationship between Thinking Style Differences and Career Choice for
High-Achieving High School Students**

A Dissertation

Presented to

The Faculty of the School of Education

The College of William and Mary in Virginia

In Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

By


Mihyeon Kim

June 2009

**The Relationship between Thinking Style Differences and Career Choice for
High-Achieving High School Students**

By
Mihyeon Kim

Approved July 2009 by



Joyce VanTassel-Baska, Ph.D.
Chairperson of Doctoral Committee



Carol Tieso, Ph.D.



Kyung Hee Kim, Ph.D.

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Acknowledgement

As this part of my life's journey reaches its conclusion, I must gratefully acknowledge the time, support, and guidance of Dr. Joyce VanTassel-Baska, who suggested that I start this educational process and who has continued to guide me through the process for several years. She offered me a role model to emulate, and has exemplified scholarship by way of her prolific publication record and overflowing energy. One day, she talked about her new experiences and learning during the summer, and I cannot forget her twinkling eyes when she spoke about them. Her enthusiasm for learning and her work ethic have inspired me to accept the challenge of new things too, and to stay awake to learning all the time.

Among the faculty, I have to express my gratitude to Dr. Carol Tieso. While I took several courses from her, she also played the role of a mentor. She provided support and advice on how to improve my writing, to enhance my learning in statistics, and to have confidence in my dissertation. She remains a friend, a mentor, and a teacher to me.

Also, Dr. Kyunghie Kim provided feedback about my dissertation, and encouraged me to finish my dissertation as quickly as possible, so that I could move on to the next step in my career. As a Korean, she understood my hardships in studying as a foreigner, and provided me with practical advice that enabled me to survive.

As I reach the final stages of my dissertation, I need to express my gratitude to my husband, Yonghoon Choi, who has been with me the entire length of my new challenge. He understood that copious patience was the best support for me since he had gone through this process before. He provided all the support he could so that I would be able to concentrate on this dissertation without any stress from family. My little son, Frederick, also understood that he had to share only a portion of mommy's time during this journey, although he finally commented that he prefers a working mommy, not a studying mommy.

My colleagues at the Center for Gifted Education provided practical support throughout the process. I particularly wish to acknowledge Sharron Gatling, who has prayed for me. I wish to express my thanks for her friendship, support, encouragement, and understanding.

In addition, I want to thank Soonam Kang for her friendship. She provided me all the support she could, including babysitting my son voluntarily whenever I needed help.

I also thank my parents and my husband's parents for their support and encouragement. They always trusted me and had faith that my new challenge would succeed.

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THE RELATIONSHIP BETWEEN THINKING STYLE DIFFERENCES AND
CAREER CHOICE FOR HIGH ACHIEVING STUDENTS

ABSTRACT

The intent of this study was to study high achieving students' career decision-making associated with thinking styles and to examine factors influencing career choices. A causal-comparative research design and correlational research design were used, with a sample of 209 high school students. Data were gathered from two International Baccalaureate (IB) programs and a Governor's School Program. Students responded to two types of questionnaire—the Thinking Style Inventory, and A Questionnaire Related to Career Choices and Students' Sensitivity toward Environmental Forces.

The findings of this study demonstrated that the effect of program on different thinking styles was significant ($p < .05$), and the effect of gender on different thinking styles was significant ($p < .01$). Also, the findings showed that an external thinking style was a good predictor for choosing the social science area for future careers. However, students with a higher external thinking style chose computer and math areas 73% less than students with lower external thinking style. Also, the findings of the study demonstrated that students' passion for a specific subject and family

environment were also important factors influencing career choices of high achieving high school students.

The study suggested the importance of taking thinking styles into consideration for the career development of high-achieving adolescents. In addition, the environmental influences of parents, family, and schools are also important considerations for students' career development, along with students' inherent interest in a subject. Therefore, parents, teachers, and guidance counselors should recognize their own critical roles in shaping students' career development.

MIHYEON KIM

DEPARTMENT OF EDUCATION

THE COLLEGE OF WILLIAM AND MARY IN VIRGINIA

CHAPTER ONE

Introduction

Since intelligence testing was initiated, many different efforts have been made to measure intelligence (Bartholomew, 2004; Flynn, 1991; Gardner, 1985). In the early stages, researchers and psychologists focused on IQ testing to measure intelligence through the rate of cognitive development (Bartholomew, 2004). However, testing IQ as a measure of intelligence has been criticized for several reasons. First of all, a single test may not be appropriate for measuring the complexity of intelligence (Vernon, 1973). With the concern about testing IQ as a measurement of complex intelligence, Gardner (1985) introduced the Multiple Intelligence Theory as an effort to address differences among students. He assumed that people have different talents rather than having general intelligence, and listed eight diverse intelligences, including visual-spatial, verbal-linguistic, bodily-kinesthetic, logical-mathematical, interpersonal, musical, intrapersonal, and naturalistic intelligences.

The more important criticism of the IQ test is that it is less predictive of students' real world performance when they leave school (Sternberg, Wagner, Williams, & Horvath, 1995). Flynn (1991) also argued that IQ tests are inappropriate predictors of occupational success. He took an example of Chinese and Japanese Americans. The mean IQ score of Chinese Americans born from 1945 to 1949 was 98.5 compared to 100 for whites. However, their achievements in education, occupation, and income were beyond that of whites, and Japanese Americans showed similar results. This suggests that IQ tests cannot adequately predict the expected

achievement of students who have different cultural backgrounds, especially those from Asian countries where the culture favors achievement.

Along with the increasing interest in individual and cultural differences, many style studies, such as cognitive styles, personality styles, or thinking styles, have been conducted to understand different uses of intelligence (Dunn, Dunn, & Price, 1978; Furham, 2008; Mayers & Mayers, 1993; Rayneri, Gerber, & Wiley, 2006; Riding & Rayner, 1998; Thomson & Mascazine, 2000; Witkin, 1976). Understanding styles allows people to nurture their potential abilities appropriately and fit their styles to certain tasks and careers in order to maximize performance with their abilities.

While researchers are interested in styles, various concepts of styles have been introduced to support individual differences among people. Some researchers have explained individual differences by personality (Furham, 2008; Myers & Myers, 1993), and others have tried to examine individual differences through cognitive ability (Rayneri, Gerber, & Wiley, 2006; Riding & Rayner, 1998; Witkin, 1976) or activity-centered approaches (Dunn, Dunn, & Price, 1978; Thomson & Mascazine, 2000). While style research is designed to understand individual differences, much of the research in cognitive areas concerns how well individuals are doing and how they can do better in cognitive areas of performance. However, the thinking style approach focuses on how we are different when we think, rather than how well we think (Sternberg, 1997). Even though students have similar abilities, they may produce different performances through different assessment methods, and respond differently depending on their thinking preferences. The basic assumption of the thinking styles

theory is that people have conflicts because they are different, not because one is better than the other (Sternberg, 1997). Therefore, thinking styles research attempts to understand individual differences in terms of preferences in thinking, and to match those preferences with educational approaches and occupational decisions to maximize an individual's aptitudes. By understanding the thinking styles of students, gifted program developers and policy makers for gifted education as well as general K-12 educators will produce a curriculum that considers students' differences, so that teachers, counselors, and parents may assist students more effectively by providing appropriate educational supports to their talent development.

Along with appropriate talent development, providing successful career development is another important goal of education. Vocational choice is important in determining quality of life and level of happiness (Amir & Gati, 2006; Sternberg, 2007). Various unique factors, such as multi-potentiality, sensitivity to the expectations of others, and perfectionism may influence the career development of gifted students (Perrone, 1991). These unique factors of gifted students may interact with thinking styles, and influence talent development as well as career development paths. Is there then any relationship between thinking styles and choices of careers? How are thinking styles different, depending on desired career choices of the students? Which environmental factors have been identified as supporting or inhibiting appropriate career choices of gifted students?

In a study of 30 graduates of a centralized gifted program at a traditional high school, Emmett and Minor (1993) found that sensitivity to others' expectations and

perfectionism are the significant inhibiting factors for career decisions among students with various personal gifted characteristics. Then how should high schools and colleges help gifted students' career decision making? As Gagne (2005) considers environment as an important factor for students' talent development, Lent, Brown, and Hackett (1994) also agree that parents, teachers, peers, and other environmental elements are critical for students' career development. Therefore, this study examined career decision-making of high-achieving students, associated thinking styles, career-related programs for students, and factors influencing their career development.

This chapter provides a description of the research problem, followed by an introduction to the conceptual framework of this study. Subsequently, a statement of purpose and the significance of the study are discussed. Research questions allied to this study are listed in a separate section. Finally, limitations, delimitations, and a definition of terms associated with this study are cited.

Statement of the Problem

Conventional psychometric intelligence tests have been challenged as predictors of academic success in school or real world performances of students (Sternberg, Wagner, Williams, & Horvath, 1995). To explain students' success in school and real world performances, Sternberg (1994) emphasized individual differences and styles of thinking more than different types of abilities. He believed that intellectual abilities cannot be understood without knowing how individuals react to environmental situations. With this belief, he developed the mental self-governing theory (1997), which is one of the conceptual bases of this study. The mental self-

governing theory hypothesizes that people govern daily activities with different strategies, and he called these different strategies “thinking styles.” Subsequently, he proposed 13 thinking styles that fall into five dimensions of mental self-government: functions (legislative, executive, and judicial thinking styles), forms (hierarchical, oligarchic, monarchic, anarchic thinking styles), levels (global and local thinking styles), scopes (including internal and external thinking styles), and leanings (liberal and conservative thinking styles) (Sternberg, 1997). If students have thinking styles that are different from the favored thinking styles within an educational system, their potential abilities may not be motivated or encouraged. In turn, students may not have the proper opportunities to develop their interests as well as their potential career path. For this reason, there is a need to investigate and understand students’ thinking styles, and provide appropriate educational responses.

Furthermore, acknowledgement of the relationship between different thinking style preferences and desired career choices will provide valuable information to serve students based on their individualized needs. Many parents and teachers think that gifted students can do anything, and even gifted children are often confused about their abilities and preferred domain areas, which are connected to their career path in the future (Webb, Gore, Amend, & DeVries, 2007). As a result, many high achieving students in college often change their majors, and fail to develop their talents for their future potential career paths (Simpson & Kaufmann, 1981). As Lubinski and Benbow (2005) suggested, students’ preferences are related to satisfaction as well as development of their ability. Also, Sternberg (1997) raised the issue of that “people

whose ways of thinking do not match those valued by the institutions are usually penalized” (p. 8), so that main purpose of considering thinking style is to match ways of thinking to the different types and areas of working in the real world in order to maximize individual’s abilities and interests. Therefore, more research in regard to thinking styles and career choice for high school students is needed to provide suitable guidance for each student.

Coupled with individual differences, environmental influence, such as parental and school influences, appears to be a critical factor for students’ making career decisions (Gagne, 2005; Lent, Brown, Hacket, 2000).

Conceptual Framework

The research in this study is based on the mental self-government theory, as proposed by Sternberg (1997). Since Allport (1937) introduced the concept of “styles” based on individual differences, different approaches have been employed to describe the patterns of human behaviors (Dunn, Dunn, & Price, 1978; Furham, 2008; Mayers & Mayers, 1993; Rayneri, Gerber, & Wiley, 2006; Riding & Rayner, 1998; Thomson & Mascazine, 2000; Witkin, 1976). Allport (1937) stated that an individual’s traits are unique because of his or her developmental history, and believed that these traits become persistent styles, in which liking an activity becomes motivation to continue doing it and thus forms habits. Beginning with Allport’s introduction to personality-centered styles, other various style research, including activity-centered styles and cognitive-centered styles, has been conducted to identify patterns of human behaviors. Even though Sternberg’s mental self-government theory

may be considered as one of the theories under the cognitive-centered styles, mental self-government theory stresses the thinking process and matching between preferences in thinking process and different types of jobs rather than cognitive recognition of the information found in other cognitive-centered style theories (Kagan, 1965; Sternberg, 1997; Witkin, 1976). The basic idea of his mental self-government theory is that people need to govern their minds, and these governing activities need to be responsive to environmental changes, just like a government needs to be response into changes in our society (Sternberg, 1997). Sternberg proposed 13 thinking styles within five dimensions of mental self-government: functions (legislative, executive, and judicial thinking styles), forms (hierarchical, oligarchic, monarchic, anarchic thinking styles), levels (global and local thinking styles), scopes (including internal and external thinking styles), and leanings (liberal and conservative thinking styles). Table 1 provides a summary of these defined styles.

Table 1

Summary of Styles of Mental Self-Government Theory

Style	Characterization
<u>FUNCTIONS</u>	
Legislative	Like to create and do new things, and have little assigned formation
Executive	Like to follow disciplines, and prefer to be in the existing structure
Judicial	Like to judge and evaluate people and things
<u>FORMS</u>	
Monarchic	Like to do one thing at a time with devotion regardless of the situation
Hierarchic	Like to do many things at once through setting priorities for work
Oligarchic	Like to do many things at once without setting priorities
Anarchic	Like to take a random approach to problems; dislike systems, guidelines, and practically all constraints
<u>LEVELS</u>	
Global	Like to deal with a big abstract picture rather than focusing on details
Local	Like to deal with details and concrete examples rather than looking at abstract big goals
<u>SCOPE</u>	
Internal	Like to work alone and tend to be introverted
External	Like to work with others, and be sociable
<u>LEANING</u>	
Liberal	Like to do things in new ways and deny tradition
Conservative	Like to do things in traditional way

Purpose of the Study

The purpose of this study is to identify thinking style preferences of high achieving students, and to determine the relationship between thinking styles and career choices between students attending a governor's school specializing in science and technology and students attending an International Baccalaureate (IB) program focused on liberal arts. Thinking styles were identified through the Thinking Style Inventory developed by Sternberg (1997), and modified by Black and McCoach (2008). Many studies have tested the internal validity of the Thinking Style Inventory (Dai & Feldhusen, 1999; Zhang, 2001; Zhang & Sternberg, 1998) in different cultural groups.

This study also examined whether differences in thinking style preferences exist between students attending a governor's school specializing in science and technology and students attending an IB program focused on the liberal arts. The Governor's School Program was developed to meet the needs of high achieving students by providing an accelerated and enriched curriculum (McHugh, 2006). Likewise, the IB program was designed to address the needs of high achieving students through accelerated curriculum methods (Shaunessy, Suldo, Hardesty, & Shaffer, 2006). Even though both programs are designed for high achieving students, a Governors' School Program and an IB program have different academic foci, and different academic foci may demonstrate students' differences in thinking styles as Gridley's study (2007) showed. Gridley studied 71 artists and 127 engineers, and

found that professionals in different areas showed different thinking styles. For example, engineers have higher hierarchic scores than those of artists, and artists preferred to work alone. Therefore, students attending schools with a different academic focus may have different thinking styles.

The schools in this study are located in a county in southeastern Virginia. One Governor's School Program and two high International Baccalaureate (IB) programs will be requested to participate. This study examined if there are statistical differences in thinking styles between students from a Governors' School Program focused on science and math and those from an IB program focused on the liberal arts.

In addition to different disciplinary areas, thinking styles may also be different, depending on gender. Sternberg (1997) believed that:

Style differences between men and women can be socialized in ways that are so much a part of a culture that people are hardly aware they matter, such as differential treatment of boy and girl babies from the time they are born. (p. 103)

Because of different expectations on boys and girls and their different acceptable behavior in society, they may have different thinking styles. Schmader, Whitehead, and Wysocki (2007) added data about different treatment of females and males in work place. They studied 886 letters of recommendation prepared for 235 male and 42 female candidates for chemistry or biochemistry faculty positions at a large American research university, and found that more positive adjectives were used to describe the men than were used to describe the women. Different expectations and

treatment them may cause differences in thinking styles between males and females. Zhang (2002) surveyed 245 college students to identify the role of thinking styles in psychological development of students, and found that male students showed higher levels of commitment and scored higher on the legislative, judicial, liberal, and internal thinking styles than did their female counterparts. Therefore, this study also examined if thinking styles are related to gender.

Furthermore, this study examined if students with different thinking styles are sensitive to environmental forces, and what kinds of career-related programs and factors influence them.

Significance of the Study

This study may provide a greater understanding of the thinking styles of high achieving students. Findings of this study may contribute to more knowledge of the role played by individual thinking style preferences in high-achieving students' different career decisions at high school level. This enhanced understanding may contribute to facilitation of more effective instructional approaches, proper assessments of students, and fitting guidance for high achieving high school students.

The primary significance of this study is to strengthen and expand the existing body of knowledge concerning thinking styles and career decision making of high achieving students. This study will add information to the facilitation of mental self-government theory addressing thinking styles, and may serve to provide information for other researchers, who may then use this thinking style assessment instrument.

This study will also provide valuable information to the research base of the education of high achieving students as well as to career development research.

Findings from this study may be used as a primary means for offering more understanding of the role that thinking styles play in career decision-making. This research may assist in demonstrating a link between thinking style and desired career field, and sensitivity toward environmental forces when students make career decisions. Also, this study will provide information related to how thinking styles are different, depending on gender and programs that students are attending. In addition, this study will explore factors influencing students' career choices. If schools and parents are to respond with counseling and guidance in an appropriate fashion depending on students' individual needs in the process of career choice, it would be highly beneficial for high achieving students to be aware of what they desire for their career in the future. After all, the findings of this research may identify individualized needs for high achieving students' career development, and will provide a basis for better career guidance for high achieving students, maximization of students' potential talents and optimal achievements for their successful career development.

Research Questions

The following research questions focus on seeking answers to five primary inquiries associated with the thinking style differences of high achieving students.

1. To what degree do thinking styles relate to career development of high achieving high school students?

- a. To what degree do thinking styles relate to different factors that influence college choice?
 - b. How are thinking styles related to desired career choice?
 - c. To what degree do thinking styles relate to students' achievement as measured by PSAT scores?
2. Are there differences between high achieving high school males and females with respect to thinking styles?
 3. To what degree are different thinking styles related to high school students' sensitivity toward environmental forces when making a career choice?
 4. How are thinking style preferences of high achieving students attending a Governor's School Program in science and technology different from those of the high achieving students participating in International Baccalaureate (IB) programs with a focus on the liberal arts?
 5. What influence students' choice of career during high school?

Limitations of the Study

Limitations refer to the conditions that a researcher cannot control through the study design (Locke, Spirduso, & Silverman, 2007). The following are the limitations of this study:

This study proposed to use self-reporting questionnaires, and this type of questionnaire can be limited by participants' responses and can be subject to contamination. The responses may not demonstrate how respondents understand the

questionnaire language and respond to the questions in the questionnaire (Fowler, 2002). This research has to depend on such stated responses without verification. In addition to the limitation caused by using self-reporting questionnaires, factors uncontrollable by the researcher, such as the school schedule, willingness to participate, and interest in the research, may result in a smaller response rate.

Further, even though the researcher stressed that the Thinking Style Inventory does not identify ability but identifies the preferences of individuals, participants may try to respond to what they think of as a desirable item in the school context.

Career decision making involves various factors including different cognitive developmental levels and individual environmental background. Even though this study attempts to focus on identifying relationships between different thinking styles and career decision making, participants' career decisions may be the result of interaction with other factors not studied.

Also, participants may interact with various environmental factors to make career decisions. Even though this study is designed to limit environmental factors as students' sensitivity toward environmental forces, other environmental factors may interact with thinking styles to make career decisions.

In addition, participants in the current study were supposed to have different talents and career aspirations, depending on their different academic goals in two different high school programs: the IB program and the Governor's School Program. However, several factors that influenced the results of the current study, such as the

mixture of talents and career-aspirations of students in these two different programs, could not be controlled by the researcher.

In terms of sampling, it is practically impossible to sample students randomly for participation in this type of research. For this reason a convenience sample was employed, and generalizations of the results are restricted to the sample of this study.

Delimitations of the Study

Delimitations “imply limitations on the research design that you have imposed deliberately” (Rudestam & Newton, 2007, p.105), and usually refer to the populations to which the generalization can be made safely (Locke, Spirduso, & Silverman, 2007). The delimitations for this study are that it only includes juniors and seniors in high schools who are attending a Governor’s School Program focusing on science and technology or an IB program focusing on liberal art in districts of southeast Virginia.

Definition of Terms

The following terms have particular significance to this study and should be understood with the accompanying definitions:

- **Thinking style:** A preferred way of thinking. This is not an ability but the way people use their abilities (Sternberg, 1997). Sternberg’s 13 thinking styles are researched in this study and are noted in Table 1.
- **Career choice:** Career choice is defined by Brown and Brooks (1996) as “the thought processes by which an individual integrates self-knowledge and occupational knowledge to arrive at an occupational choice” (p. 426), and this study utilizes this definition about career choice as what the participants reported in the

survey as their desired career choice, based on students' self-knowledge and occupational knowledge.

- **Environmental forces in career development:** Lent and Brown (1996) considered self-efficacy beliefs, outcome expectations, and personal goals as variables regulating career decision behaviors. They believed that these variables interact with other environmental aspects in the path of career development. Environmental factors in this study include resources, parental behaviors, and school influences (Lent, Brown, & Hackett, 2000).
- **Governor's School Program:** Currently, Virginia provides three types of programs; Academic-Year Governor's Schools (AYGS), Summer Residential Governor's Schools (SRsGS), and the Summer Regional Governor's Schools (SRgGS). These programs are serving more than 7,500 gifted students. Among the three types of programs, 18 schools provide acceleration and exploration for gifted students as Academic-Year Governor's Schools. An Academic-Year Governor's school focusing on science and technology participated in this study (Virginia Department of Education, 2008).
- **The International Baccalaureate (IB) program:** The IB program is a rigorous liberal arts curriculum that develops the individual talents of students in a demanding college preparatory curriculum with high international standards. The IB program consists of six subjects, including language, art, second language, study of individuals and societies, experimental sciences, mathematics, and one further option (United Nations International Schools, 2008).

- **High achieving students:** This study considers high achieving students as students who have been selected through an IB program or Governor's School program admission process. For the IB program, students have to be enrolled in Algebra I, Geometry, or Algebra II or higher level math with a grade of B or better, and in French I, Spanish I, or higher with a grade of B or better, and in Advanced English 8 with a grade of B or better. Also their GPA should be 3.0 or higher for first semester of eighth grade year. Personal interview and five recommendation letters are required to be admitted in IB program (yorkcountyschools.org/yhs/IB/2008-2009%20Full%20Application%20Packet.doc). For Academic Year Governor's School programs, students are selected based on PSAT scores, teacher recommendations, and math and science grades through 10th grade (<http://www.nhgs.tec.va.us/governorsschool/admissions.php>).
- **Multipotentiality:** The ability to excel and to develop a wide variety of aptitudes, interests, and skills to a high level of proficiency (Berger, 2006).

Organization of the Study

The information contained within Chapter One establishes the basis for understanding the significance of the information to be presented in Chapters Two through Five. Chapter One provided an introduction and background information for the study. The purpose and significance of the research study on thinking style preferences were presented. Theoretical bases and justification for the study were presented along with the five primary research questions. The relevant distinct terminologies of the study were then defined and clarified. The limitations and

delimitations of this study were expressed, and the chapter concluded with a description of the organization of future chapters.

Chapter Two presents a comprehensive review of the research and literature associated with this study. A review of the literature includes strands of following topics: different approaches to research on thinking styles, the career development literature on high achieving students, and service delivery models for high achieving students.

Chapter Three states the research questions, cites the research design, participants, instrumentation, data collection procedures, data analysis procedures, and time schedules. Then, Chapter Four presents information on research participation, demographic characteristics of participants, and findings in regard to the research questions. Discussions and implications of the findings along with recommendations for future research related to thinking styles is presented in Chapter Five. Appendices include the questionnaire, consent form, and instruments used in the study.

CHAPTER TWO

Literature Review

This chapter provides an overview of theories and constructs that form the conceptual framework of this study. This chapter also provides a comprehensive review of research related to preference of thinking styles of students. In the beginning, different approaches to styles are examined in order to understand thinking styles, differentiated from other approaches, and to provide theoretical foundations of thinking styles. The different approaches to styles, including cognitive styles, personality styles, learning styles, and thinking styles are often used interchangeably in previous research. For this reason, an extensive literature review is provided in this section as well as a discussion of different approaches to styles.

Literature related to the career choice of high school students is also reviewed, followed by service delivery models for high achieving high school students.

Literature reviews on previous research include research meeting the following criteria: (a) inquiry into dimensions of thinking styles; (b) use of the Thinking Style Inventory for measuring the various thinking styles; (c) inquiry about career choice and different thinking styles; and (d) inquiry on service delivery models for career development of high achieving high school students.

Styles Theories and Research

The construct of style has been researched in various fields, including psychology and education, and it has been developed through different approaches. Style research has not been limited to the cognitive aspects, and researchers have explored broad areas of understanding styles (Dunn, Dunn, & Price, 1978; Furham, 2008; Kagan, 1965; Mayers & Mayers, 1993; Rayneri, Gerber, & Wiley, 2006; Riding & Rayner, 1998; Thomson & Mascazine, 2000; Witkin, 1976). Several researchers attempted to organize and integrate style theories, and one of the efforts was made by Grigorenko and Sternberg (1995). They categorized style research as cognition-centered, personality-centered, and activity-centered approaches. As the researchers cautioned, any single aspect of the styles cannot explain individual differences fully. Each of the different approaches has explored distinct areas, and knowledge of these distinct areas will help to understand thinking styles better. Table 2 shows the range of different approaches represented across the literature. Riding & Rayner (1998) provided a comprehensive review of cognitive and activity-centered style research, and differentiated cognitive and activity-centered approaches from personality centered approach. Mental self-government theory may be included in the cognitive-centered approach, but also embraces personality-aspects in attempting to suggest a more comprehensive approach to explain in thinking styles.

Table 2.

Summary of Different Approaches to Styles

Approaches to styles	Definition	Researchers
Cognitive-centered approach	Styles are an individual's consistent approach to organizing and representing information (Riding & Rayner, 1998)	Kagan (1965) Kirton (1976) Witkin (1976)
Personality-centered approach	Styles are determined by an individual's personality (Myers & Myers, 1993)	Myers & Myers (1993)
Activity-centered approach	Styles are related to the various styles of study strategies (Riding & Rayner, 1998)	Dunn, Dunn, & Price (1978)
Mental self-government theory approach	Styles are determined by activities of people's mind analogous to governmental activities (Sternberg, 1997)	Sternberg (1997)

Cognition-Centered Approach

As discussed, a psychometric measure for understanding intelligence was the main issue in early stages of cognitive research. However, after criticism of IQ

measurements of intelligence (Bartholomew, 2004; Flynn, 1991; Gardner, 1985; Vernon, 1973), many researchers showed interest in styles and tried to present various style theories (Dunn, Dunn, & Price, 1978; Furham, 2008; Myers & Myers, 1993; Rayneri, Gerber, & Wiley, 2006; Riding & Rayner, 1998; Thomson & Mascazine, 2000; Witkin, 1976). Since cognitive style is a critical determinant for an individual's behavior and learning, a number of definitions of cognitive styles have been made so far. However, a universally accepted clear definition has not been suggested. In an attempt to clarify cognitive styles, Riding and Rayner (1998) stated that cognitive style is an individual's consistent approach to "organizing and representing information" (p.8), and listed 17 different models related to cognitive styles. Grigerenko and Sternberg (1995) also organized a list of 14 different cognitive styles. Even though these lists include commonly used definitions, they do not contain whole theories about cognitive styles. Over 30 different approaches have been used to define cognitive styles (Riding & Rayner, 1998). This broad range of cognitive styles often extended beyond the preferred pattern of organizing and representing information. Therefore, in this section, three widely used models of cognitive styles will be examined.

Field-dependency vs. Field-independency. This model concerns individual dependency on the structure of an existing visual field. Field independency refers to analytic functioning that is less influenced by the existing visual field, and field dependency refers to dependency on the existing visual field in the process of acquiring and processing information (Sternberg, 1997). A field dependent (FD)

person is also called a global thinking person who typically possesses the characteristics of holistic thinking, uncertainty, and dependence upon others. Therefore, a FD person has an ability to read social cues so that they are considered to be very warm, friendly, and personable. However, field independence (FI) is often analytic thinking (Rayneri, Gerber & Wiley, 2006). A FI person tends to be confident and self-reliant. People with field independence may notice things easily without paying attention to the existing visual situation because they can break the field and restructure easily, whereas people with field dependence struggle to perceive detailed things if they don't pay attention to what they see because this style adheres to structures as given and views things globally in order to make relationships (Witkin, 1976).

With this difference in mind, teachers need to approach students differently to maximize learning. Witkin addressed the importance of considering this cognitive style difference in academic development, in choosing courses to take in schools and in career choice because these connections to students' styles have the potential to change academic performance and achievement in a particular career path. This theory is measured by the Embedded Figures Test that locates a previously seen object in the larger context of an obscure figure (Grigorenko & Sternberg, 1995). Grigorenko and Sternberg argue that "field independence is at least in part a fluid ability" rather than style (p.209).

Adaptors and Innovators. Kirton (1976) introduced a model of adaptors and innovators in the business area. Adaptors more readily anticipate challenges and

threats from within the system, whereas innovators are more ready to anticipate events that might beckon or threaten from outside (Kirton, 2003). The adaptors also prefer to do things better, and the innovators tend to do things differently. Neither one is judged to be good nor bad, but they are different in their approach to problem solving. According to Kirton's theory, adaptors tend to be precise, reliable, efficient, disciplinary, and confirmative. On the other hand, innovators tend to be less focused on customs but generate new ideas, and break existing restraints and perceptions. Since this model was developed in the business and management areas, it is based on the premise that "everyone is an agent of change" (Kirton, p.165). Kirton made the connection that cognitive preference is related to creativity, problem solving and decision-making, and the focus and purpose of this theory is the use of appropriate leadership. Effective leaders should understand the value of every team member and make use of the differences among people as diverse resources. Kirton also stressed that leaders need to understand members' preferences because these preferences are aggregated to the climate of an organization, and managing this climate is an important role of leaders. This theory is measured by the Kirton KAI Inventory Tool, which is a 32-item questionnaire used to measure an individual's problem-solving style. Even though this model has not been developed in the educational realm, it would be beneficial to introduce it because gifted adolescents have the potential to be leaders of our society, and one of the goals of a talent development program is to produce leaders in various areas.

Impulsivity-Reflectivity. This model is proposed by Kagan (1965), and it concerns the conceptual pace of decision making under uncertain situations. This theory reflects the influences of cognitive style on human behaviors. Impulsivity is defined as the tendency of responding quickly to propose a solution to a problem (Kogan, 1958). Impulsive individuals tend to respond quickly so they perform more tasks but have more errors. In contrast, reflectivity is defined as the tendency toward elaborate thinking for finding and presenting a solution to a problem. Therefore, reflective individuals are likely to respond slowly, causing less work to be done but with fewer errors (Riding and Rayner, 1998). If educators identify students' style of impulsivity or reflectivity, teachers may provide more appropriate supports for students' learning. A frequently used instrument for measurement is the Matching Familiar Figure Test, which asks the individual to match the one identical drawing with the standard drawing (Egeland & Weinberg, 1976).

In summary, many researchers have attempted to identify and define cognitive styles, and have attempted to integrate all cognitive styles. Messick and Associates (1976) defined cognitive styles as "consistent individual differences in the ways of organizing and processing information and experience" (p. 5), and identified several dimensions of cognitive styles, including impulsivity-reflectivity and field dependency-field independency. Saracho (1997) introduced Witkin's postulation about cognitive styles through the examination of previous research. First of all, cognitive styles are not about the content of cognitive activity but the process of perceiving, organizing, and processing information to solve problems, learn, and relate

to others. Cognitive styles do not have a clear boundary to explain, but cover rather the boundaries of the human mind and relate to personality characteristics. Many researchers agree on this issue and suggest performing more studies about the relationship between cognitive style and personality (Grigorenko & Sternberg, 1995; Kirton, 2003).

Cognitive styles have a consistent pattern over time, and this pattern can be changed. Sternberg (1997) also made an assumption about cognitive styles, and one of those assumptions was that styles can be changed. However, Kirton (2003) thought that changing this pattern required different levels of rewards. Leaders should decide the level of rewards depending on the gap between the desired pattern and current pattern. If the individuals' pattern and the organization's desired pattern are different, conflicts may arise. The role of leaders is to fit individuals into different tasks depending on their styles and to encourage the change of individual patterns in accordance with the organization's goals.

Finally, cognitive styles are bipolar. This characteristic provides the clean distinction between styles and abilities. Since each pole represents different individual values, there is no issue of having more ability or having less ability. It is a matter of having different cognitive styles. Individual differences in cognitive style play an important role in education as well as being an important element related to the professional choices of students and their vocational path. In the real world, identifying individual differences to fit in the right place is the critical factor in order to achieve organizational goals effectively as well as to optimize the individual ability

of team members. Another effort made to identify individual differences is the approach related to understanding personality differences.

Personality-Centered Approach

Even though personality and intelligence are two distinct domains, many psychological researchers believe that personality styles are mostly related to cognition, and consider personality as a determinant of human behaviors. As cognition-centered research about “style” has made clear, personality and cognition interact with each other. In the personality research area, two different labels, type and traits, are used to indicate personality (Furham, 2008). Types are used to refer to categories such as depression, anxiety, schizophrenia, and traits are used to refer to distinct differences, but are normally distributed on a continuum (Furnham, 2008). A personality-centered approach to styles is close to traits in terms of showing distinct differences of individuals, but style is different from traits since styles influence “cognitive function, interest, values, and personality development” (Ross, 1962, p. 76).

The most widely used personality test is the Myers-Briggs Type Indicator (MBTI), and the MBTI test has often been compared with the cognition construct. The MBTI is based on the theory that differences of human behaviors depend on logical and observable differences in mental functioning, and these differences affect preferences of perceiving and making judgment (Myers & Myers, 1993). Myers and Myers identified “perceiving” as the process of awareness and judgment, of making conclusions about what has been perceived. People perceive by using information

from the five senses, and by intuition from unconscious ideas. Likewise, people judge by using a thinking process which aims at objective findings with logic, and by feeling that has subjective and personal values. Children's preferences on perceiving and judgment (JP) cause their different developments. In this way, people come to have distinct "surface traits". The combination of these perceptions and judgments produce four combinations of personal traits: sensing plus thinking (ST), sensing plus feeling (SF), intuition plus feeling (NF), and intuition and thinking (NT).

In the use of perception and judgment, another difference comes from interests within inner and outer worlds. An introverted person is interested in the inner world of concepts and ideas while an extroverted person is interested in the outer environment of things and people. Myers and Myers (1993) consider introversion and extroversion (IE) as independent preferences, which can be associated with any combination of perception and judgment. MBTI described 16 different personalities.

Even though the MBTI measures differences in individual styles, the authors used the terms "personality types" in this measurement. Usually, types are used to indicate abnormal categories, and traits are used to distribute normal categories (Furham, 2008). However, types and traits are not distinguishable in this measurement (Grigorenko & Sternberg, 1995). So, the personality-centered approach to style does not seem to represent the style comprehensively. In addition to personality-related style research, researchers have explored how students are different in obtaining new knowledge.

Activity-Centered Approach

Educators have realized that intelligence tests are not enough to understand students' individual differences in classrooms and schools, and have begun to show interest in the activity-centered approach in order to understand students better (Grigorenko & Sternberg, 1995). Educators believed that these understandings would lead to improved instruction, and result in enhanced achievements. People labeled the activity-centered approach as a learning-centered approach as well. Many researchers understand that learning styles are related to the various styles of study strategies, but the definitions about learning style became extensive in the following categories (Riding & Rayner, 1998).

1. A focus on the learning process – individual differences related to interaction with environment.
2. Individual differences in pedagogy.
3. The aim of developing new constructs and concepts of learning style
4. The enhancement of learning achievement
5. The construction of an assessment instrument as a foundation for the exposition of theory. (p. 50)

Riding and Rayner (1998) structured five categories into three different model types such as process-based models, preference-based models, and cognitive skill-based models. Since these areas are too broad to cover in this review, this study will examine a model by Dunn, Dunn, and Price (1978), utilizing a preference-based

model. The preference-based model is the model most similar to the style research within a learning-centered approach (Grigerenko & Sternberg, 1995) because preference is the primary interest of style research. Dunn, Dunn, and Price (1978) defined learning style as a “biologically and developmentally imposed set of personal characteristics” (Dunn, Beaudry, & Klavas, 1989, p. 50), and argued that instruction should be responsive to these individual differences in learning.

A theory about learning style by Dunn, Dunn, and Price (1978) explained how students learn by five categories, called stimuli. These stimuli include 21 different elements that influence learning. The environmental stimuli include light, sound, temperature, and room design; emotional stimuli include structured planning, persistence, motivation, and responsibility; sociological stimuli include pairs, peers, adults, self, and group; physical stimuli include perceptual strengths, mobility, intake, and time of day; and psychological stimuli include global/analytic, impulsive/reflective, and right-or left-brain dominance. Among these many elements, people rely more on some of the elements, depending on the process of development and obtained experiences. Among 21 different elements, four to five elements become significantly important for individuals when they adopt new information (Thomson & Mascazine, 2000).

Even though this theory emphasizes the preferences of learning, the preferences are focused on the elements influencing a person’s ability rather than categorizing the preference of the learning process itself aside from abilities. Even Dunn and Dunn (1978) admit that the “Learning Style Inventory has become more

sensitive to ...individual needs” (p. 60). However, the issue is not just for this model but for most of the activity-centered approaches (Grigorenko & Sternberg , 1995), so that the activity-centered approach is differentiated from a thinking style.

Mental Self-government Theory

The thinking style is one of many style studies, and thinking style is not totally different from the definition of cognitive style. Some researchers consider cognitive styles as thinking styles, and others argue that thinking style is an element of cognitive styles (Jones, 2006). However, Sternberg intended to distinguish thinking style from cognitive styles, particularly related to abilities. Even though style research excludes abilities, cognitive styles could not make a clear distinction between style and abilities.

Therefore, Grigorenko and Sternberg (1995) defined thinking style as “a preferred way of expressing or using one or more abilities” (p. 220), and proposed a model of mental self-government for identifying thinking styles and how intelligence is directed to understanding primarily preference, not abilities. However, the mental self-government theory is not separate from other style research. As Allport (1937) argued, and Sternberg agreed (1997), thinking style cannot be separated from structural consistency of personality. In addition, the preference of reacting to environment and the adaptive reaction toward new information cannot be totally different from the thinking style. Therefore, the thinking style is the preference for representation and processing of information in the mind, bound to the consistent structure of personality, the consistent way of interaction with the environment, and adopting new information. Then, preferences shape expressive behaviors and styles.

Sternberg considers activities of people's minds as governmental activities having following five dimensions.

1. functions (legislative, executive, and judicial thinking styles),
2. forms (hierarchical, oligarchic, monarchic, anarchic thinking styles),
3. levels (global and local thinking styles),
4. scopes (including internal and external thinking styles), and
5. leanings (liberal and conservative thinking styles). (Grigerenko & Sternberg , 1995; Sternberg, 1997)

These will be discussed in the following section.

The Functions of Mental Self-government. Just as the government serves the three functions of executive, legislative, and judicial, people also act upon these three functions in their thinking. Legislative people often create things and rules, and like to be imaginative. Creative work will fit their style. Designing new projects, solving problems with new solutions, and creating new business and new organizational systems are the types of work that legislative people will enjoy.

Executive people choose to follow rules rather than creating them, solve problems within preexisting structures, and tend to evaluate themselves based on how the organization evaluates people. Executive people will be good at applying rules and theories, teaching existing knowledge, and enforcing rules; therefore this type of student will be favored within school systems.

Judicial people favor analyzing rules and critique things rather than just following rules. Even though they are not proposing new ideas, judicial people are

good at analysis and evaluation of presented rules, ideas, methods, and structures.

Judicial people like to judge programs, people, writings, and opinions.

The Forms of Mental Self-Government. As the government has forms for ruling, individuals have forms to govern their intelligence and thinking. One of the forms for mental self-government is the monarchic style. Monarchic people are driven to work on one aspect of the work and one task until the work is done. Monarchic people tend to be single-minded, and do not allow other things to distract them while completing what they are working on.

Another form of mental self-government is the hierarchic style. Unlike the monarchic style, hierarchic people can work with multiple goals or tasks. In addition, hierarchic people set the priority for all different goals and do the work systematically. Since they are good at systematic priority setting for multiple goals and solving problems, they fit well in organizations. However, if there is a gap between organizational priority and individual priority, conflict may arise within the organization.

Like hierarchic people, oligarchic people try to work on multiple tasks at the same time. However, oligarchic people consider all the work as having the same importance, so they are easily pressured and have conflicts when they have to choose the work. Since they think that all the tasks are equally important, they will perform equally well if their tasks do have the same importance. However, they will be confused and have conflicts if their tasks have different levels of importance.

The last form of mental self-government is the anarchic style. Anarchic people prefer to work with goals that are difficult for themselves as well as for others. They pursue flexibility rather than being limited by systematic detention. They try random approaches for solving problems, and have a hard time dealing with setting priorities because they do not have specific rules for thinking.

The Levels of Mental Self-Government. As a government has levels of federal and state, there are levels in mental self-government concerning details. Local individuals deal with things in detail. They prefer to take care of all the particulars when they work, and favor working with concrete detailed work. However, they have to be cautious not to ignore the big picture of work.

On the contrary, global individuals look at the big picture and abstract issues of the goals, and are good at conceptualizing ideas. However, they tend to neglect specific detailed things. These two styles work well because they can support each other in order to produce better outcomes.

The Scope of Mental Self-Government. As the government deals with domestic and foreign affairs, mental self-government deals with internal and external interaction. Internal people tend to be introverted and prefer independent work rather than working with others because they are indifferent to establishing relationships with others. On the contrary, external people are outgoing, sociable, and people-oriented. They like to work with others and form relationships with people.

The Leanings of Mental Self-Government. As the government has different leanings such as conservative and liberal, mental self-government also has these

leanings. Conservatives are attached to existing rules and structures, and tend to solve problems within the existing procedures. On the contrary, liberals do not like to reside in the same procedures and existing rules. Liberals tend to seek changes and solve problems beyond existing procedures and rules.

The mental self-government theory assumes that the above 13 thinking styles guide and govern our thinking. An individual does not have only one style among these 13 different thinking styles, but, in actuality, holds more than one style. However, an individual may have differences in flexibility for switching from one style to another when there is a need for switching styles (Sternberg, 1997). Also, Sternberg assumed that styles may change through the developmental span. Since individuals may develop their styles through socialization, individuals' styles can change over time. Another assumption of his is that thinking styles are measurable. He believed that if the construct cannot be measured, then the construct's existence cannot be manifested. Therefore, he developed the Thinking Style Inventory, reflecting his mental self-government theory to measure different thinking styles of individuals producing various performances.

Research Related to Thinking Styles

Thinking styles research has indicated that an individual's preference for controlling and processing information is related to how he or she performs academically (Grigorenko & Sternberg, 1997). The main purpose of considering different thinking styles was to match thinking preferences to the different types and areas of working in the real world so that individuals may maximize their abilities and

happen to produce their optimal achievements with satisfaction when they work.

Sternberg (1997) also stressed individual differences and addressed the point that style research should provide a basis for matching students' style with educational approaches so that students may identify proper career paths based on their preferences, and experience appropriate career development toward their identified career paths. In order to provide appropriate educational approaches and apply suitable assessments, educators need to understand how individuals are different.

Even though a study by Rayneri, Gerber, and Wiley (2006) is not directly related to thinking styles, it examined the relationship between classroom environment and learning style preferences of gifted middle school students and found that most underachieving students are considered to be global learners who have superior abilities in visual-spatial context, deductive reasoning, novelty, and simultaneous process, but who lack persistence. Persistence is defined as "commitment to complete task or assignment" (p.114) in their study. Global learners tend to come up with many new ideas and work on many things simultaneously, but seem to have a hard time continuing to work and finishing assigned work. This study showed that sometimes gifted students who are global learners may lack persistence so that they cannot finish their school work. Consequently, they tend to underachieve in school work. Similarly, if teachers misunderstand students' thinking styles, students may lose proper educational opportunities through the identification process for a talent development program.

Another study to understand individual differences on thinking was made by Torrance, Reynolds, and Ball (1977). They defined thinking styles as the functions of the brain's hemispheres. They developed a questionnaire based on hemispheric theory to examine thinking styles as left-brained. The left-brained style is characterized by information processing in a conceptual and analytic way. The right-brain style is characterized by information processing in a direct and synthesizing manner. However, Torrance's questionnaire was challenged by Zalewski, Sink, and Yachimowicz (1992) because of its construct validity testing. They administered the test to brain-injured adults, and the results indicated that partial brain injury had little or no effect on the responses to various dimensions of the questionnaire. In addition, this study showed that brain-injured adults and normal adults responded to the items in a similar manner. In spite of the criticisms about the hemisphere function theory, Vengopal and Mridula (2007) examined the hemispheric preferences for learning and thinking styles of children and found that there were differences in information processing and retaining information between boys and girls. This study suggested that gender differences may influence ways of thinking.

The purpose of various thinking style research is to promote learning based on individual differences and to achieve better performance in schools as well as in the work setting (Cano-Garcia & Hughes, 2000). Sternberg (1997) believed that schools should provide tailored educational services for students depending on their thinking styles in order to help all students achieve their best performances, and addressed the

issue of providing a tailored curriculum for each of the students based on his or her thinking style.

Sternberg, Wagner, Williams and Horvath (1995) argued that intelligence tests cannot predict job performance accurately, and not represent individual differences in various work settings. Similarly, Grigorenko and Sternberg (1997) believed that abilities may not predict school performances accurately. Sternberg and Grigorenko (1993) asserted that different levels of giftedness should be addressed from childhood in order to achieve optimum development of an individual's potential ability by addressing different styles of thinking. They did not focus only on the students' styles, but also emphasized teachers' styles. This study focused on the students' thinking styles related to performances and career decisions.

To address this issue in terms of relationship between thinking styles and school performances, Grigorenko and Sternberg (1997) studied the relationship between thinking styles, as measured by the Thinking Style Inventory, and performances, as measured by two major homework assignments which involved various tasks testing for analytical, creative, and practical skills. Participants of their study consisted of gifted 199 students ranging from 13 to 16 years. The researchers found that students' performance is associated not only with their levels and types of abilities but also with the three thinking styles: judicial, executive, and legislative. The highest predictive style for school performance based on analytical work was demonstrated by the judicial style. This study showed that different work and assessment should be developed for different styles of thinking and learning.

Therefore, the researchers suggested preferred work styles depending on thinking styles in schools and work environment, and asserted that individuals need to be assessed based on various styles of work assigned to fit each individual.

Zhang (2002) also attempted to identify the relationship between thinking styles and academic performances among 212 college students in the United States. He found that students with a conservative thinking style, who like to follow rules and are disciplined, are rewarded in school, whereas students with a liberal style, who like to challenge the norms, and students with a global style, who like to pay attention to abstract things rather than details, are not academically rewarded. Zhang (2001) also conducted research with Hong Kong secondary school students. One hundred and eighty six students of tenth graders and 213 eleventh graders participated. He found that conservative (requiring conformity), executive (respect for authority), and hierarchical (a sense of order) styles are positively related to achievement. Also, he found that different disciplines require different styles, as social sciences and humanities require either a judicial or hierarchical thinking style, whereas natural sciences tend to require either an executive or conservative thinking style. Also, Zhang and He (2003) studied 193 college students in Hong Kong, and found that students having an external thinking style showed more use of graphic and multi-media work as well as of both basic level and advanced level operations, while students with internal thinking style did not show more usage of specific technical operations than that of other thinking styles. However, both students with higher internal thinking style and students with higher external thinking style showed higher

favorable attitudes toward the use of computing and information technology in education as measured by the Computing and Information Technology scale (Zhang & He, 2003).

In terms of the relationship between scientific giftedness and thinking styles, Park, Park, and Choe (2005) attempted to find the relationship between thinking styles and scientific giftedness, as measured by the Scientific Giftedness Inventory (SGI; Shim & Kim, 2003), with 176 high school students in Korea, and found that liberal, conservative, and judicial styles are positively related to scientific giftedness. From these studies, it can be said that conservative styles are associated with scientific achievement, and cultural differences may influence individual difference preferences. Sternberg (1997) also made an assumption that individuals interact with their environment to develop their styles.

Zhang's (2001) study demonstrated that creativity-generating thinking styles tended to be negatively related to school academic achievement. He urged that schools need to devote more attention to students with creativity-related thinking styles in order to encourage their ability in schools. Even though creativity may improve ways of thinking fundamentally in a more productive manner and allow students to possess competencies in a global society, current educational reform in K-12 public education system doesn't support the growth of creativity in public education (Hadfield, 2000; Robinson, 2006).

The studies discussed related to thinking style have demonstrated that the current school environment cannot encourage students with creativity-related styles.

In the real world, there are various positions and situations that individuals can fit themselves into with better performances and satisfaction. Several studies have shown that individual thinking styles are related to different types of careers (Gridley, 2007; Shindler, 1998; Zhang & Fan, 2007). Gridley (2007) studied 71 artists and 127 engineers, and found that the legislative score for engineers was significantly lower than that of artists, and the executive scale indicated that engineers preferred to execute the plans of others significantly more than artists did. In addition, artists preferred to work alone. Considering these differences, facilitation of various teaching methods for students with different intellectual preferences may also enhance students' learning to prepare them for their career path. Therefore, individual intellectual preference differences need to be addressed in the school setting for appropriate guidance of students and the encouragement of optimum ability of students.

Accordingly, in the real world beyond the school setting, Schmid (2001) called attention to different thinking styles between theorists and designers in engineering and science. He perceived two different thinking styles, as theorists consider tradition, analogy, theoretical beauty, and logical reasoning as sources of knowledge, whereas designers, who are the practitioners, consider gaining experience as a knowledge source to reach a different method for solving problems. He urged that editors should accept different writing styles even though practitioners' writing styles are different from traditional scholarly writing styles in order to promote future contributions from designers to the field.

High school students have to face the real world soon, and they have to be ready for their work in a specific career path. Since many students experience difficulty in finding their career in college (Wyner, Bridgeland, & DiIulio, 2007), educators need to help students to develop suitable career paths depending on individual differences.

Career Choice among High School Students

A career choice is an important decision for an individual, including high-achieving students. The high school years are a particularly critical time to make preparations for the transition to work or college. For this reason, focusing on appropriate career development for high-achieving high school students may help them to identify their preferred knowledge and activities, based on specific developmental needs toward their desired career paths. Otherwise, students may become confused and waste their time, wandering aimlessly instead of pursuing the right career path during adolescence. In support of this claim, Simpson and Kaufmann (1981) studied presidential scholars and found that 55 percent of the 322 respondents changed their academic major in college. This study stressed the importance of career education during adolescence in order to help students to make an appropriate vocational choice in line with their values, and to develop an appropriate career path for their life.

Career Development Theories

Several theories related to career development have attempted to provide a better understanding of how students make career decisions and what elements may influence their choice of a proper career path. The patterns for students' process in choosing career paths are presented from different points of view, including the developmental self-concept, self-efficacy, and the person-environment relationship (Brown & Lent, 2005; Holland, 1973; Lent, Brown, & Hackett, 1994; Super, 1980). This section summarizes Super's (1980) vocational development theory, Holland's (1973) vocational theory, and Lent, Brown, and Hackett's (1994) social cognitive career theory, in order to provide a better understanding of the career development of students.

Super's Vocational Development Theory. Super (1957) proposed that self-concept is a critical component of vocational development because vocational self-concept, which plays an important role in choosing a career that matches an individual's self-image, is formed by interaction between the person and the environment. He identified five stages of vocational development, as follows:

1. In the growth period (ages 0-14), children try out different experiences and develop an insight and knowledge about work.
2. In the exploration period (ages 14-24), individuals explore different possible career choices and become aware of their interests and abilities. Individuals develop their vocational goals based on interests and abilities, and prepare to acquire necessary skills as well as experiences for employment.

3. In the establishment period (ages 25-44), individuals become competent in a career and in advancing it.
4. In the maintenance period (ages 45-65), individuals continue to advance their skills and knowledge in order to be productive while preparing for retirement.
5. In the decline period (ages 65+), individuals adjust their work based on their physical capabilities and try to deal with resources in order to remain independent.

Super believed that the roles of individuals change over different life stages, and that people have particular decision points over the course of the life span that reflect situational and personal determinants. Situational determinants are related to geographic, historic, social, and economic conditions, and personal determinants are related to the inherent foundation of the individual, such as home and the community. When people take on a new role or make significant changes in their existing role, they encounter decision points, such as the decision to enter college (Super, 1980). Super attempted to portray life-long occupational development by way of various roles, decision points, decision processes, and decision determinants within the life stages.

Holland's Vocational Choice Theory. Holland (1996) believed that people make vocational choices based on their personality types and their aspirations for career stability. He proposed six personality types: realistic, investigative, artistic, social, enterprising, and conventional. Holland believed that these personality types interact with work environments, and a person's type must represent the person's work

environment. For instance, a realistic person's work environment would include concrete and practical activities, such as using machines, tools, and materials; an artistic person's work environment would be related to creative effort in music, writing, performance, sculpture, or unstructured intellectual endeavors; an investigative person's work environment would be related to analytical or intellectual activity aimed at troubleshooting or at the creation and use of knowledge; a social person's work environment would involve working with others in a helpful or facilitative way; an enterprising person's work environment would be focused on selling, leading, or manipulating others to attain personal or organizational goals; and a conventional person's work environment would be related to working with things, numbers, or machines to meet predictable organizational demands or specified standards (Holland, 1996). Holland asserted that an individual pursues a career that matches his or her personality type, and that career choices of people based on the personality type could provide vocational satisfaction within the work.

Lent, Brown, and Hackett's Social Cognitive Career Theory. Social Cognitive Career Theory (SCCT) (Lent, Brown, & Hackett, 1994) was developed based on Bandura's (1986) social cognitive theory. This theory addresses the interactive roles of personal, environmental, and behavioral variables in career interest development, career goal development, and actions to produce a particular goal (Chronister & McWhirter, 2003). Lent, Brown, and Hackett (1994) identified four basic elements as influencing factors in one's choice of career: self-efficacy, outcome expectations, goals, and contextual supports and barriers.

Bandura (1986) proposed the view that people's belief about themselves is an important factor in controlling their sense of personal agency within their social system. He defined the perceived self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever the skills one possesses" (p. 391). In cognitive theory, Bandura believed that a student's academic achievement is not determined solely by intellectual factors. Knowledge and skills do not necessarily guarantee a student's academic achievement in every situation. Students with high self-efficacy will interact better with teachers through adopting a positive attitude in school environments; that better interaction will in turn lead to better academic achievement in school work. The SCCT applied this theory to making career choices (Lent & Brown, 1996). The authors believe that self-efficacy is acquired through personal performance accomplishments, vicarious learning, social persuasion, and physiological states and reactions. Outcome expectations are shaped by the consequences of performing particular behaviors that are perceived through direct and vicarious learning experiences; personal goals may be defined as the intention to join in a certain activity. These variables interact with other environmental aspects in career development.

According to the SCCT, environmental factors, such as opportunities, resources, barriers, financial resources, parental behaviors, and school influences, play an important role in career development (Lent, Brown, & Hackett, 2000). Lent,

Brown, Talleyrand, McPartland, Davis, Chopra, Alexander, Suthakaran, and Chai (2002) interviewed 19 college students to examine career choice factors, rejected choices, barriers to choice pursuit, and supports for choice pursuit. They identified interests, direct exposure to work-relevant activities, vicarious exposure to work-relevant activities, work conditions or reinforcers, ability considerations, and leisure experiences as career choice factors. Also, they acknowledged negative social/family influences and excessive educational requirements as rejected choice, and financial concerns as the barriers to make alternative choices rather than ideal choice.

Career Development among High-Achieving Students

Gifted adolescents need proper career education as much as other students do, and counselors and educators are expected to pay attention to the development of appropriate career paths for gifted adolescents, who are likely to make significant future contributions to our society (Gassin, Kelly, & Feldhusen, 1993). Although career development among high-achieving or gifted students is similar in many ways to that of other students, the different characteristics of gifted or high-achieving students are likely to produce different career development issues and career interests (Perrone, 1991). Using Holland's theory, Sparfeldt (2007) compared gifted students with non-gifted students. Sparfeldt studied 7023 third-grade students, and found out that gifted students have higher investigative interests than non-gifted students do.

In addition to differences in vocational interests between gifted and non-gifted students, researchers in gifted education have pointed out that one of the unique factors for the career development of gifted students is multipotentiality (Emmett &

Minor, 1993; Perrone, 1991; Robinson, Shore, & Enersen, 2007; Rysiew, Shore, & Leeb, 1999). Multipotentiality is defined in career choice as “the interest and ability to succeed in so many vocational areas that choosing one career path becomes problematic” (Delisle & Squires, 1989, p. 98). Multipotentiality may work either positively or negatively with gifted students. Some gifted students may benefit from multipotentiality, obtaining a variety of good career choices, while others may suffer from decision-making difficulties (Rysiew, 1999). However, Achter, Lubinski, and Benbow (1996) argued that multipotentiality is a misconception about gifted students, suggesting instead that inappropriate assessments with a ceiling effect raised the issue of multipotentiality. They believe that gifted students show their preferences in interest areas. According to Lubinski and Benbow’s (2006) longitudinal study, students as early as fifth grade showed their abilities and preferences in science, and continue to extend it. Therefore, Lubinski and Benbow asserted that opportunities for early educational intervention, depending on individual needs, will strengthen students’ talent.

Besides multipotentiality, Kerr (1981) identified societal expectations as an inhibiting factor affecting career choice. As researchers in gifted education have mentioned (Emmett & Minor, 1993; Perrone, 1991; Robinson, Shore, & Enersen, 2007; Rysiew, Shore, & Leeb, 1999), most unique career development issues for gifted students are related to the characteristics of the gifted. However, gifted students are also influenced as much by environmental factors such as parents, teachers, and peers as are other students (Gassin, Kelly, & Feldhusen, 1993; Stake & Mares, 2001).

Students at any level of achievement may choose their career based on the expectations of parents, teachers, and society (Rysiew, Shore, & Leeb, 1999; Wigfield, Battle, Keller, & Eccles, 2002). Therefore, overly-high or overly-low expectations from parents and schools may impact gifted students' goal setting. For instance, female students may experience low expectations from family and society, resulting in low goal setting for girls' career choices (Kerr, 1981). As Reis and Callahan (1989) argue, gifted females are not obtaining eminence status proportionate to the increased number of females in the work force.

Furthermore, females are less likely to advance in the disciplines of mathematics, science, engineering, and technology. In U.S. colleges and universities, women constitute only 30 percent of physical science majors and 20.2 percent of engineering majors who earn doctoral degrees (Department of Education, 2008). These data support the contention that women are underrepresented in the science and engineering fields, even though their participation has been steadily increasing. Scott and Mallinckrodt (2005) claimed that discouragement with sex-role stereotypes in career, the lack of positive female role models, and low social support were the reasons for this imbalance in gender in the fields of science and engineering. In terms of environmental influences on female students' career development, Jacobs, Finken, Griffin, and Wright (1998) studied 220 ninth- through twelfth-grade science-talented adolescent girls from rural communities, and found that previous experiences related to science and to parental attitudes are positively related to daughters' intentions to choose a career in science. Their results suggested that more involvement by girls in

classroom science activities, as well as finding ways of bringing parents' support together for girls who have interests in science, would provide more opportunities for girls to feel comfortable in making science their career choice.

Similarly, Montgomery and Benbow (1992) performed case studies with 15 eighth graders, and found that early family influences and educational opportunities are both critical factors influencing the career decisions of gifted female students. A noticeable result in their study was that female gifted students who desired a science- or math-related career tended to have found a sense of career confidence by the age of 13. In sharp contrast, female gifted students who desired a career in fields other than mathematics or science did not have positive attitudes or career confidence by the age of 13, and even at the age of 18, they had broad interest areas rather than having career aspirations in a specific area.

However, Grant's (2000) case study showed that female gifted students who had interests in mathematics and science sometimes changed their career aspirations in mathematics and science during high school due to a negative experience in their schooling, and instead began to suffer from uncertain career aspirations. He also concluded that pressure from parents and societal systems may create a sense of conflict in female students who find themselves caught between personal goals and societal or parental expectations for them. Consequently, Corrigall and Konrad (2007) found that early gender role attitudes may predict later work hours and earnings. Women who place higher levels of significance on work and work-related roles happened to work longer hours and earned more in their career path than did women

with traditional attitudes. Therefore, as Grant identified, gifted female students need guidance interventions for better development of career goals and for confirming appropriate career-related decisions.

In addition to young women who are drawn to science and math as a professional career, artistically talented students seem to show their interests early (Cooley, 2007; Piirto, 2004). Cooley's qualitative study with eight participants majoring in art in a college showed that the participants' artistic ability and self-confidence were developed early, and teachers and mentors played important roles in encouraging their talent and interests. Participants were motivated by the high expectations of teachers or mentors. In particular, students who did not have parental support reported that a mentor's role was critical for their career development in the arts.

As discussed, parents' expectations play an important role in students' career decisions, and appropriate parental support is essential for students' proper career choices in the long run. Therefore, Palmer and Cochran (1988) implemented the Partners Program, which was designed to help parents aid their adolescent children in career planning. Forty tenth- and eleventh-grade students and their parents completed a four-week program, which resulted in students' career maturity being increased through their participation in the career Partners Program. Fourteen years later, a study by Wigfield, Battle, Keller, and Eccles (2002) reaffirmed how vital parental influence can be for students' career development. In addition to the program with parents, Skorikov and Vondracek (2007) studied the effects of career orientation among 234

junior-high and high-school students, and found that structured involvement in a program that identified and encouraged good career choices had a positive impact on problem behaviors. Skorikov and Vondracek (1997) also addressed the importance of making the connection between part-time work experiences and future career choices. They studied the effects of part-time work on 483 high school students, and found no significant relationship between part-time work experiences and career choices. They highlighted that appropriate career education should be paralleled with work experiences, rather than simply allowing an adolescent to have multiple work experiences.

To provide better career-related programs for students, Brown, Drane, Brecheisen, Castelino, Budisin, Miller, et al. (2003) identified five ingredients that are necessary to any critical intervention promoting appropriate career choices:

- (a) workbooks and written exercises;
- (b) individualized interpretations and feedback on tests, goals, future plans, etc.;
- (c) the provision of opportunities to gather information on the task and on specific career options;
- (d) exposure to models of career exploration, decision-making, career implementation, etc.;
- (e) activities designed to help participants understand or build support for their career choices and plans. (p. 413)

Even though their study was not specifically designed for gifted students, the above factors are also critical elements for the gifted. In addition to the above elements, gifted students have other factors to be considered, and Marshall (1981) identified an “individual’s lack of confidence and organized structure, perceived external barriers, difficulty in deciding among equally attractive careers, and personal conflict (both inter- and intra-personal conflicts)” as possible factors to be addressed among gifted students (p. 309). As Marshall stated, the design of structured career related programs and counseling should be based on students’ individual needs and preferences. Kushwaha and Hasan (2005) attempted to explore the effects of introversion or extroversion of students on career choice with 320, 14 to 16 year old, students. They found that extroverted students tend to make better career choices than introverted students, and assumed that extroverted students have the ability to receive more career-related information since extroverted students are more willing to take risks and seek out resources on their own.

Recognizing the need for counseling for gifted students, Kerr and Erb (1991) performed counseling intervention for honors students, as a result of which the students’ confidence in their identity was improved and their career goals became more certain. Twelve out of 39 participants changed their career goals even though they didn’t change their majors, and the majority of the students became aware that their majors in college were intended to be a crystallizing process to reach their career goals. The participants in Kerr and Erb’s study may have noticed that college could be a crystallizing process for career goals, but Greene (2002) had a different opinion: “the

combination of minimal career counseling in high school and limited decision-making skills” led them to have emotional and stressful difficulties in choosing careers, and caused difficulties in experiencing a crystallizing process for their career development. Greene stressed the importance of career education, connecting career and life counseling, and recently, Robinson, Shore, and Enersen (2007) differentiated between career education and career choice. Career education needs to focus on “career- and self-awareness, enabling and facilitating the process of making later career-related decisions” (p. 208). They expressed concern that if a student makes a career choice too early without enough information, he or she may lose the opportunity for another career choice.

Accordingly, Greene (2005) identified developmental timelines as follows: elementary school as the stage of introductory career awareness, middle school as the stage of search for personal identity, and senior high as the stage of independence and initial career decisions. The career developmental process may help counselors to provide appropriate career education through matching students’ interests and careers. Along with the needs for proper career education, Visher, Bhandari, and Medrich (2004) identified several career exploration programs, including career majors, cooperative education, internship, job shadowing, mentoring, school-sponsored enterprise, and tech prep. Neumark and Rothstein (2003) analyzed a set of data from 1997 National Logitudinal Survey of Youth, and found that School-To-Career (STC) program, including cooperative education, internship, job shadowing, mentoring, school-sponsored enterprise, and tech prep, showed positive effects on college

education and employment. More specifically, school enterprise programs showed positive effects on college education. Also, cooperative and internship programs demonstrated increased employment. In addition, Karcher (2005) studied 77 students to identify the effects of mentorship, and found that students who had mentors improved their self-management, social skills, and self-esteem. Even though Karcher studied younger children (fourth and fifth graders), those improved self-management, social skills, and self-esteem may contribute to young adolescents' career development. Facilitating these various programs based on individual styles and preferences may contribute to suitable career development of high achieving students within the high school service delivery models for high achieving students.

Service Delivery Models for High Achieving High School Students

In the era of the No Child Left Behind policy, many educators in gifted education are concerned about optimum talent development of high achieving students because policy makers pay more attention to reducing the achievement gaps among students. To address the needs of high achieving students, many programs across the United States have been started. As an effort to support high achieving high school students, curriculum flexibility has been discussed in gifted education (VanTassel-Baska, 2003), and AP (Advanced Placement) courses, governors' schools, and IB programs are designed as a form of acceleration for high school students. These programs attempt to deal with the needs of gifted adolescents in terms of academic, social, and emotional aspects (McHugh, 2006) by providing an appropriate level of challenge.

Advanced Placement (AP)

AP courses and exams are intended to provide high achieving students the opportunity to avoid prerequisites of large introductory courses in college by earning college credit hours (Colangelo, Assouline, & Gross, 2004). The number of AP test takers continues to increase, now reaching over a million. For example, 2.3 million AP tests were given in 2006 in 37 subjects, and among 2006 high school graduates, about 24 percent took at least one AP exam, up from about 16 percent in 2000 (Mathews, 2007). Taking AP courses allows students to take more interesting and in-depth courses rather than introductory courses in college, and to save time and money by finishing college early. Out of all high school graduates, 76% of the AP alumni had earned master's degrees by age 33 (Colangelo, Assouline, & Gross, 2004). As has been demonstrated, many students have benefited from AP courses as acceleration programs for high achieving high school students.

In addition to providing opportunities for taking college courses, VanTassel-Baska (2001) highlighted the benefits, roles, and issues of AP programs in the talent development process for high achieving high school students. She agreed that AP courses provide accelerated learning, higher order thinking skills, advanced concepts, and powerful incentives to able learners, but she also presented issues to be considered. One of her concerns about AP courses was whether the courses are designed to address different levels of aptitude in the potentially wide range of students. Compared to Governor's School Programs and International Baccalaureate programs, AP courses have a more heterogeneous group in terms of levels of interest

and aptitude. So, as she suggested, facilitating effective grouping and teacher training for successful AP course implementation will enhance the ability to meet the individual needs of high achieving students.

International Baccalaureate (IB) Programs

Another form of a service delivery model for high achieving high school students is the International Baccalaureate (IB) program. The IB program is a rigorous college preparatory program in liberal arts that develops individual talents by demanding high international standards (Tookey, 2000). Through a suitable challenging curriculum for high achieving students, the IB program attempts to help these students develop their potential abilities.

According to Taylor and Porath's (2006) study, students who graduated from an IB program agreed that IB courses taught them to think critically with flexibility, and introduced a variety of topics with great detail. Taylor and Porath performed a qualitative study about program suitability, psychological and emotional impact, and preparation for postsecondary study with seven IB program graduates: they found that most of the students thought that the IB program was suitable to enhance critical thinking and obtain a broad range of knowledge.

Concerning the psychological and emotional impact, participants thought the workload was very high. Since the workload is high, IB students seem to have a strong bond with their peers. Vanderbrook's (2006) study demonstrated that students had strong alliances with intellectual peers through another qualitative study.

Vanderbrook's (2006) participants considered peers an important element in the IB program for support.

While participants of Taylor and Porath's (2006) study felt that they were stressed by the rigorous curriculum, most of the participants were aware that they were better prepared for postsecondary study because postsecondary courses are also challenging and require critical thinking. Most of the participants were satisfied with the IB program experience. Furthermore, 7.5% endorsed the IB Program for helping them to pursue their career goals. Even though Taylor and Porath's study demonstrated positive influences on career development of high achieving students, a lack of guidance in the IB program was raised by the Vanderbrook's (2006) study. Most of the participants thought that their IB program did not have enough support in terms of guidance counselors

Governor's School Programs

Governor's School Programs are enriched and accelerated programs for high achieving students. Governor's School Programs were developed to enhance cognitive skills, to make relationships among all areas of knowledge, and to focus on personal and social development (McHugh, 2006). Even though most of the Governor's School Programs are designed as summer programs, three types of governor's schools exist to serve high achieving students: academic-year governor's schools, summer residential governor's schools, and summer regional governor's schools (Virginia Department of Education, 2008). In Virginia, academic-year governor's schools and summer residential governor's schools are designed for high

school students, and summer regional governor's schools are designed for elementary and middle school students.

Governor's school programs have two directions in terms of curriculum. One direction is utilizing a curriculum representing broad academic areas; the other is focusing on a specific topic in depth such as math, agriculture, or technology (Cross, Hernandez, & Coleman, 1991). Dealing with broad academic areas is based on an enrichment model, introducing various topics to students and broadening their knowledge. On the other hand, focusing on a specific topic represents another type of enrichment, trying to advance students' learning in depth (Cross, Hernandez, & Coleman, 1991). Each governor's school chooses its philosophy, and schools may choose one direction or combine two directions. The purpose of Governor's School Programs is to enhance high achieving students' learning by providing a more appropriate learning environment.

In conjunction with IB programs, Governor's School Programs have provided effective support for gifted adolescents in terms of a similar peer group and academically encouraging climates (McHugh, 2006). Cross, Hernandez, and Coleman (1991) studied a sample of 50 students who participated in a governor school, and found that the most appreciated outcome was having peers around them. Students expressed their satisfaction on sharing common interests and learning experiences. In addition to sharing interests and learning, Governor's School Programs focusing on a specific subject area influence the development of a specific career path for gifted adolescence. Houser (1991) investigated the effectiveness of a governor's school for

the agricultural sciences and found out that one-fifth classified choice of majors and future careers were being in or related to food, agriculture, and natural resources. Furthermore, most participants perceived that they benefited from and were satisfied with their research experience. Sponsler (2007) had similar results that Governor's School Programs focusing on a specific subject influenced the career choice of students. Students from Pennsylvania Governor's School for Health Care (PGSHC) agreed that the governor's school program influenced their decision to pursue a future career in a health profession to a great degree. Seventy-nine percent of the students also believed the program provided confidence and motivation for the development of their professional identities. As it is shown, the Governor's School Program is an influential program for gifted adolescents in career development and making choices concerning their future career.

Dual Enrollment

Dual enrollment allows students to take college courses while they are in high school as one of the curriculum flexibility components for gifted students (VanTassel-Baska, 2003). Similar to AP or IB programs, dual enrollment also serves as a way of introducing in-depth knowledge or introductory college courses to high achieving high school students by allowing students to take college courses (Karp, Calcagno, Hughes, Jeong, & Bailey, 2007). By providing opportunities to explore desired career areas, dual enrollment plays a role in career awareness and career related decision-making because many students gain specific job related skills through dual enrollment courses and obtain post secondary education experiences prior to high school graduation

(Lynch, Harnish, Fletcher, Thornton, & Thompson, 2006). Armstrong and Chancellor (2004) compared the college graduation rate between dual enrollment students and non-dual enrollment students. High-achieving students, defined as high school students with a 3.0 GPA or above, were tracked for four years following their high school graduation. This study found that dual enrollment students graduated from college at a higher rate than non-dual enrollment student for each of the 1994 to 1998 cohorts. Even though this study did not provide career related information, this study showed that dual enrollment is effective for serving high achieving students who can benefit from the experience with college-level courses, which may be connected to future career development.

Summary

In summary, the relevant strands of literature presented in the current study provide a foundation for understanding several kinds of approaches to individual differences, career development, and a range of academic programs for high-achieving students. Discussing the literature on the variety of approaches to individual differences and appropriate career development provides a framework for the examination of different thinking styles and career choices of high-achieving students.

In terms of thinking styles, researchers found that academic achievements varied depending on different thinking styles. Grigorenko and Sternberg (1997) found that the highest predictive style for school performance based on analytical work was demonstrated by the judicial thinking style. Other researchers also found different academic achievements depending on thinking styles. Global learners tend to

underachieve in school work (Rayneri, Gerber, and Wiley, 2006); and students with a conservative thinking style were rewarded in schools while students with a liberal style or with a global style were not academically rewarded (Zhang, 2002).

Thinking styles also varied depending on different disciplines. Social sciences and humanities appeared to require either a judicial or hierarchical thinking style, whereas natural sciences tend to require either executive or conservative thinking styles (Zhang, 2001). In addition, scientific giftedness was positively related to conservative, liberal, and judicial thinking styles (Park, Park, and Choe, 2005). Other than students, Gridley (2007) found that professional artists liked to work alone while engineers tended to like development of their own strategies and plans.

In terms of career development among high-achieving students, the literature demonstrated that high-achieving students have high investigative interests, tended to have multipotentiality (Emmett & Minor, 1993; Perrone, 1991; Sparfeldt, 2007), and are sensitive to environmental factors such as parents and schools, which may inhibit their career development. Through the literature related to the career development of high-achieving students, female students' career development was an issue that needs to be addressed. Females are less likely to advance in the disciplines of mathematics, science, engineering, and technology (Department of Education, 2008). One of the case studies showed that gifted female gifted students who had an interest in mathematics and science have a tendency to change their career aspirations in mathematics and science during high school due to negative experiences in their schooling (Grant, 2000). The career development of female students was influenced

by their school environment. However, school was not the only influencing factor; the role of parents was another critical factor that influences career development (Skorikov & Vondracek, 2007; Wigfield, Battle, Keller, and Eccles, 2002).

To address the needs of high-achieving students for the appropriate career development, different academic programs, such as AP, dual enrollments, IB programs, and Governor's School Programs, have provided services for high-achieving students. In addition to these academic programs, various career-related programs have also been initiated, including cooperative education, internship, job shadowing, mentoring, school-sponsored enterprise, and tech prep.

From the review of literature, students without appropriate career development may experience confusion and wandering during adolescence. These confusions are expressed through college drop out or changing career goals (Kaufmann, 1981). To address this issue, researchers consider thinking styles as a way of enhancing appropriate career development. The research has demonstrated that thinking styles are related to school performance as well as career choices.

CHAPTER THREE

Methodology

This chapter discusses the research design, data collection and analysis of the results from the study. The chapter begins by restating the research questions associated with this study and describing the sample and instrumentation used in this study. Subsequently, the data collection procedures and the discussion of data analysis methods are provided in detail.

Research Questions

The purpose of this study was to identify the thinking style differences between students attending a Governor's School Program in science and technology and students participating in IB programs with a focus on the liberal arts, to identify the relationship between thinking styles and preferred choice of college and career, to identify the relationship between thinking styles and gender, to determine if different thinking styles are related to sensitivity toward environmental forces in terms of career choice, and to explore influencing factors on high achieving students' career choices. The following research questions formed the foundation of the study.

1. To what degree do thinking styles relate to career development of high achieving high school students?
 - a. To what degree do thinking styles relate to different factors that influence college choice?
 - b. How are thinking styles related to desired career choice?

- c. To what degree do thinking styles relate to students' achievement as measured by PSAT scores?
2. Are there differences between high achieving high school males and females with respect to thinking styles?
3. To what degree are different thinking styles related to high school students' sensitivity toward environmental forces when making a career choice?
4. How are thinking style preferences of high achieving students attending a governor's school in science and technology different from those of the high achieving students participating in *International Baccalaureate (IB)* programs with a focus on the liberal arts?
5. What influences students' choice of career during high school?

Description of the Participants

This section describes the participants for this study. The two groups of high achieving students, attending a governor's school focusing on science and technology and International Baccalaureate (IB) programs with a focus on the liberal arts, were asked to participate in this study. A total of 209 responses out of 283 (74%) were received from a Governor's School Program and two IB programs. Out of 209 participants, 95 students (45%) were attending IB programs, and 114 students (55%) were attending a governor's school. In terms of gender, 104 students were male and 105 students were female. Students' age range was 15 to 18, and average age was 16.8 years old. The participating Governor's School Program selects students based on PSAT scores, teacher recommendations, and math and science grades through 10th

grade. To apply to a participating governor's school, students should enroll in an advanced math course (Virginia Department of Education, 2008). Also, the International Baccalaureate (IB) program uses the following five criteria to select students: Unweighted cumulative grade average for sixth and seventh grades, grades in academic subjects for the first semester of eighth grade, recommendations from current teachers, scores on standardized achievement tests, and a completed application with essay (United Nations International Schools, 2008). Students from one Governor's School Program and two IB programs in Virginia were asked to participate in this study.

Instrumentation

This section entails an in-depth discussion of the survey instrument selected for use in this study. Two instruments—the Thinking Style Inventory, and A Questionnaire Related to Career Choices and Students' Sensitivity toward Environmental Forces—were used in this study to examine thinking style preferences and career choices among high-achieving students.

The Thinking Style Inventory

Thinking styles theory considers that people govern daily activities in different ways, and Sternberg called these different thinking styles and, subsequently, developed a Thinking Style Inventory (1997). The Inventory contains Sternberg's theory of 13 thinking styles that fall along five dimensions of mental self-government:

1. functions (legislative, executive, and judicial thinking styles),
2. forms (hierarchical, oligarchic, monarchic, anarchic thinking styles),

3. levels (global and local thinking styles),
4. scopes (including internal and external thinking styles), and
5. leanings (liberal and conservative thinking styles) (Sternberg, 1997, p.26).

The Thinking Style Inventory (TSI) is a self-reporting instrument that assists in determining an individual's preferred thinking style. The TSI consists of 13 different thinking styles with 104 statements, and each thinking style contains eight items. Participants rate themselves on a 7-point scale; one represents that the statement does not describe the participant at all; seven represents that the statement describes the participant extremely well.

The reliability of the Thinking Style Inventory was investigated by Dai and Feldhusen (1999). In their study, data were obtained from 96 students, ages 12-17, who attended a summer residential program for the gifted. The results of the alpha reliability coefficients ranged from .64 to .89, and had an average alpha reliability coefficient of .75.

Validity of the Thinking Style Inventory was established by comparing the inventory with IQ (Sternberg & Grigorenko, 1997). Sternberg (1994) attempted to establish construct validity measured by discriminant validity. Discriminant validity confirms the lack of a relationship among measures which theoretically should not be related (Fraenke & Wallen, 1993). Since thinking styles do not intend to test cognitive ability, discriminant validity was examined by comparing thinking styles with IQ scores used to measure students' ability. According to Sternberg's study, he did not find a statistically significant relationship between IQ and the Thinking Style

Inventory with 85 teachers. Dai and Feldhusen (1999) found a statistically significant relationship between global style and the SAT-Verbal score among gifted students ages 12-17. Dai and Feldhusen (1999) suggested that students who are verbally talented may prefer abstract thinking more than students who are less verbally talented. This result shows that the Thinking Style Inventory may be a predictor of specific types of achievement. Even though they did not find a relationship between math scores on the SAT and the Thinking Style Inventory scores, studies (Grigorenko & Sternberg, 1997; Zhang, 2001; Zhang, 2002) have shown that the thinking style preferences are related to performance in different disciplines.

Black and McCoach (2008) examined the psychometric properties of the Thinking Style Inventory. They performed subscale- and item-level confirmatory factor analysis, post hoc item-level exploratory factor analysis, and subscale score reliability analysis, and then omitted 64 original items. Thirty-two original items were retained, including five subscales of liberal/progressive, external, hierarchic, judicial, and legislative/self-reliant style of thinking, as follows.

Table 3.

Thinking Style Inventory Subscales

Thinking styles	Characteristics
Liberal/Progressive style	Likes to try new methods and find new strategies to solve problems
External style	Likes to work and share ideas with others
Hierarchic style	Likes to order ideas and things to do by perceived importance
Judicial style	Likes to compare and rate ideas or views
Legislative/Self-reliant style	Likes to work based on their ideas and strategies when doing a task

Retained 32 items resulted in internal consistency reliabilities ranging from .729 to .863. This study applied Black and McCoach's suggestions for the Thinking Style Inventory.

A Questionnaire Related to Career Choices and Students' Sensitivity toward Environmental Forces

In addition to the Thinking Style Inventory, a questionnaire was constructed by the researcher to collect demographic information and to examine the sensitivity toward environmental forces of parents and schools in the process of career decision making, influences of career-related educational programs for students' career choices, factors influencing students' career choices and college choices. The questionnaire contained four demographic questions, nine questions about career-related programs,

desired career choices, and factors influencing career choices and college choices, including four open-ended questions. Also, the questionnaire included 13 Likert-type scale questions about career choices' sensitivity toward environmental forces.

The 13 Likert-type scale questions were to measure the level of sensitivity toward two types of environmental forces: parental force, and school force, and to examine influencing factors for high achieving students' career choices.

Environmental forces may influence the level of sensitivity of high achieving students (Cross, Hernandez, & Coleman, 1991; Lent & Brown, 1996; Plamer & Cochran, 1988; Rysiew, Shore, & Leeb, 1999; Wigfield, Battle, Keller, & Eccles, 2002). Table 4 provides the conceptual definitions of those two environmental forces.

Table 4

The Conceptual Definitions of Three Categories of Environmental Forces

Categories	Conceptual Definition
I. Parental influences	Parents play important role for students' career planning by expressing their expectations (Lent & Brown, 1996; Plamer & Cochran, 1988; Wigfield, Battle, Keller, & Eccles, 2002)
II. School influences	Students may choose their career depending on expectations of teachers and guidance counselors. Too high or too low expectations from schools may impact gifted students' ability to set appropriate goals. (Rysiew, Shore, & Leeb, 1999; Wigfield, Battle, Keller, & Eccles, 2002). Also, peers are critical components in the process of developing interests and talents for future careers (Cross, Hernandez, & Coleman, 1991).

The first seven items concerned the extent to which the students are sensitive to parental forces represented by expectation. Then, six items related to the extent to which the students are sensitive to school forces represented by expectation of

teachers, guidance counselors, and peers. Students responded to each question on a 4-point Likert-type scale ranging from strongly agree to strongly disagree. When the Likert scale was created in the 1930s, his original scale had 5-points, but many people may choose a neutral point because a neutral point provides better feelings than negative or positive responses (Fowler, 2002). An open-ended question asks about career-related programs and experiences influencing career choices. Also, questions asking about programs related to career development in schools identified influential career-related programs in schools for high achieving students.

A pilot study was conducted to develop the instrument, which was then named A Questionnaire Related to Career Choices and Students' Sensitivity toward Environmental Forces (QRCCSSEF). Data from this study, including content and construct validity information, were used to revise the instrument for the present study. The instrument contains four demographic questions; seven questions about impact of school program on career choices, including four open-ended questions; and 13 Likert-type scale items about the sensitivity of students' career choices to environmental forces such as the influence of parents and school curricula.

Content Validity

In order to establish the content validity of the questionnaire, it was sent to four experts in gifted education to verify that the content represented the information accurately and was clearly related to the career decision making of high-achieving students and to environmental forces in terms of making career decisions. Experts provided comments related to clarification of wording and organization of

questionnaire to represent content to be tested more clearly. The questionnaire was revised based on their comments, and a pilot test was performed to obtain the construct validity of the questionnaire.

Construct Validity

Sixty-nine high school students who were taking AP courses concurrently participated in this pilot study. While the purpose of content validity is to confirm that the representation of information is adequate as determined by the literature and by the opinions of content experts, the purpose of construct validity is to obtain enough empirical evidence to be confident in interpreting the scores from the test instrument (Fraenkel & Wallen, 1993). This study used a factor analysis approach, and employed an SPSS statistical program to analyze the data.

The researcher developed the items based on the literature related to environmental forces affecting the career decision making of high-achieving students, and revised them based on comments of the content experts consulted. Then, the exploratory factor analysis examined how large a variable's factor loading coefficient must be to use the variable as a constituent in defining the given factor (Grimm & Yarnold, 1995). Table 5 contains the standardized loadings for the items assigned to each of the two dimensions. The rotation of factors is done in order to improve the reliability (Field, 2009), and principal axis factoring with oblique rotation, which allows factors to be correlated, was used in this analysis. Two main factors emerged. Factor one is comprised of sensitivity toward parent-related environmental forces when high-achieving students choose their career areas, and factor two is comprised of

sensitivity toward school-related environmental forces. Even though minimum loadings of 0.4 are suggested for interpretation (Stevens, 2002), only one item, having a loading of 0.196, was excluded from the factor analysis because of the small sample size. Then, items having loadings lower than 0.4, and items having double loadings were revised to increase clarity of items by changing of the wording.

Table 5.

Exploratory Factor Analysis Maximum-Likelihood Loadings (n=69).

Items	Factor	
	1	2
1. My mother's expectations motivated me to decide my desired career	.767	
2. I will consider my father's preferred choice when I choose my career	.760	.157
3. My father's expectations motivated me to decide my desired career	.755	
4. I will consider my mother's preferred choice when I choose my career	.735	
5. My father advised me to choose a current desired career focus	.610	.221
6. My mother advised me to choose a current desired career focus	.591	
7. I will choose my career because of my previous extra curricular activities provided by parents	.446	
8. I follow a guidance counselor's advice when I choose my career goals		.793
9. I follow teachers' advice when I choose my career goals		.775
10. My counselors' expectations helped me to decide my current desired career	.244	.686
11. My teachers' expectations helped me to decide my current desired career		.636
12. My friends' expectations helped me to decide my current desired career		.396
13. I will choose my career because of my previous courses from school related to the desired career		.363
14. I will choose my career because of my previous experiences related to the desired career	-.143	.196

Reliability

The reliabilities of these subscales of the QRCCSSEF were reasonably high, ranging from .78 to .84, as is shown in Table 6. The total scales had an average alpha reliability coefficient of .82, showing reasonably high internal consistency for most research purposes (Gall, Gall, & Borg, 2007).

Table 6.

Cronbach's Alpha Level for A Questionnaire Related to Career Choices and Students' Sensitivity toward Environmental Forces

Environmental Forces	Cronbach's Alpha	Items for Each Scale
Parents	.84	7
School	.78	6
Total	.82	13

Data Collection Procedures

Data were gathered through program coordinators in the participating schools. The cover letter requesting participation in the study, which introduced the researcher, explained the rationale for the study, and assured confidentiality of participation was delivered to program coordinators and principals. Two IB programs and one Governor's School Program volunteered to participate in this study, so the packet containing consent forms, the Thinking Style Inventory, and QRCCSSEF were sent to

two IB program coordinators and classroom teachers in a Governor's School Program who volunteered to participate. Then, IB coordinators and teachers in classrooms administered the instruments to the participants. Administration of surveys took about 30 minutes. Ninety-five students in two IB programs and 114 students in the Governor's School Program (total of more than 209 students) participated in this study.

Data Analysis Procedures

In order to assess the research questions in the most comprehensive manner, this study used a correlational design for Research Questions 1, 3, and 4; and used a causal-comparative research design for Research Questions 2 and 5. Correlational research is used "to express in mathematical terms the degree and direction of relationship between two or more variables" (Gall, Gall, & Borg, 2007, p. 334). This study explored the relationship between thinking styles and desired career choices of high achieving students as well as between thinking styles and sensitivity toward environmental forces. At first, descriptive statistics for each group was calculated; mean scores and standard deviations was computed for demographic information, the Thinking Style Inventory subscale scores, and scores of the sensitivity toward environmental forces in career choice. Also, the desired career choices and factors influencing college choices was coded into numbers for the process of data analysis.

For Research Question 1 about the relationship between thinking styles and career development of high achieving students, three analyses were conducted. First of all, Spearman's rank correlation was conducted to identify the relationship between

thinking styles and different factors influencing students' college choices. Spearman's rank correlation is used to measure the strength of relationship, but used with ordinal variables (Field, 2009). Since students rank the factors influencing their college choice, Spearman's rank correlation was calculated to explore the magnitude of the relationship between thinking styles and factors influencing college choices.

Next, logistic regression was conducted to predict career choices of high-achieving students based on the predictor of thinking styles. Logistic regression is a type of multiple regression analysis. Multiple regression determines the statistical significance of differences among groups of participants if there is significant prediction of participants' scores on the continuous dependent variable (Field, 2009; Grimm & Yarnold, 1995). However, logistic regression is used with a categorical dependent variable, and a continuous or categorical predictor variable (Field, 2009). Since the dependent variable of career choice in this study was a categorical variable, this study used logistic regression to predict students' desired career choices with different thinking styles.

Then, the Pearson product-moment correlation coefficient (r), which is also called the PPMC, was computed to represent the relationship among 13 different thinking styles and students' achievement as measured by PSAT scores. PPMC is the most widely used technique because "most educational measures yield continuous scores and because r has small standard errors" (Gall, Gall, & Borg, 2007, p. 347).

Then, for Research Question 3, scores on 13 different thinking styles and three scores on sensitivities toward three different environmental forces were obtained, and

the PPMC were computed to represent the magnitude and direction of the relationship between variables.

In addition to the correlational research design, this study used a causal-comparative research design for Research Questions 2 and 4. Causal-comparative research is a nonexperimental type of study, and the purpose is to identify the cause and effect relationship between or among different groups (Fraenkel & Wallen, 1993; Gall, Gall, & Borg, 2007). Interpretation of the results from this causal-comparative research design should be understood accordingly, and is usually used for initial exploratory investigation to explore differences that already exist between or among groups because the researcher does not manipulate independent variables (Gall, Gall, & Borg, 2007). The causal-comparative design “involves selecting two or more groups that differ on a particular variable of interest and comparing them on another variable or variables” (Fraenkel & Wallen, 1993, p. 321). This study determined the thinking style differences between students in a Governor’s School Program and students in IB programs and between male and female students. Multivariate analysis of variance (MANOVA) was used to determine whether means from the two groups differed significantly (Gall, Gall, & Borg, 2007). This test is selected because of a multitude of factors associated with the dependent variable of thinking style. MANOVA testing examined differences in all of the 13 different thinking styles between male and female students. Also, MANOVA identified differences in thinking styles between two groups of students, one in a Governor’s School Program and others in IB programs to address Research Question 4.

Open-ended questions were asked for Research Question 5. A question asked about the most important factors influencing students' career choices, preferred educational experiences related to future career development of students, and career related experiences. For that question, the researcher examined the responses from participants, and performed content analysis to obtain information about factors influencing students' career choices, career-related educational experiences for their future career development of students, and career related experiences. Content analysis is an analytic strategy to examine forms of communication to obtain patterns within data (Rossman & Rallies2003). The current study examined responses from open-ended questions through content analysis in order to identify patterns among responses. After a review of the literature, open-ended questions about career development were designed to explore factors influencing high achieving students' career development. Descriptive statistics were also calculated.

Table 7 outlines the research questions with the relevant data sources and analysis techniques used for each research question. Detailed methods for data analysis are also discussed in the following chapter.

Table 7

Data Analysis

Research questions	Instrumentation	Analysis
Question 1: To what degree do thinking styles relate to career development of high achieving high school students?	TSI Questionnaire	
a. To what degree do thinking styles relate to different factors that influence college choice?	TSI QRCCSSEF (ordinal variable for factors)	Spearman's rank correlation
b. How are thinking styles related to desired career choice?	TSI QRCCSSEF (categorical variables for desired career choices)	Logistic Regression Analysis
c. To what degree do thinking styles relate to students' achievement as measured by PSAT scores?	TSI QRCCSSEF (PSAT scores)	PPMC
Question 2: Are there differences between males and females with respect to thinking styles among high achieving high school students?	TSI	MANOVA
Question 3: To what degree are different thinking styles related to high school students' sensitivity toward environmental forces when making a career choice?	TSI QRCCSSEF (sensitivity scale)	PPMC

Research questions	Instrumentation	Analysis
Question 4 : How are thinking style preferences of high achieving students attending a governor's school in science and technology different from those of the high achieving students participating in <i>International Baccalaureate (IB)</i> programs with a focus on the liberal arts?	TSI	MANOVA
Question 5: What influences students' choice of career during high school?	QRCCSSEF (open-ended questions)	Descriptive Statistics, Content Analysis

Ethical Safeguards and Considerations

This research was submitted to the institutional review board (IRB) of the university at which it takes place. All parents of the participants and participants were informed of their right to refuse to participate in the study and to withdraw from the study without penalty. Consent forms (see Appendix E) were delivered to the parents of the students and informed that all information will be kept in confidence. The informed consent form and introductory letter stated the voluntary nature of the study and their right to decline to answer any question or to withdraw from the study at any time without any disadvantage. Participants will receive results of the study upon request.

Conclusion

The previous pages have outlined the participants, procedures, and instruments used to gather data about thinking styles and career development of high-achieving students. The following chapter will address these issues further as it presents

findings related to each of the research questions, drawn from the study instruments described above.

CHAPTER FOUR

Analysis of Results

The purpose of this study was to determine the relationship between thinking styles and career development of students attending a governor's school specializing in science and technology and students attending an International Baccalaureate (IB) program focused on liberal arts. Also, this study examined whether differences in thinking style preferences exist between male and female students, and examined what were the important factors for career development of high achieving students. This chapter reports the results of this study that investigated both career decision making and thinking style preferences among high-achieving students.

Two surveys—the Thinking Style Inventory, and A Questionnaire Related to Career Choices and Students' Sensitivity toward Environmental Forces—were used in this study to examine thinking style preferences and career choices among high-achieving students. Upon the return of the information packets, the completed instruments were entered into SPSS software to analyze the data. Responses to open-ended questions were typed and organized by question for content analysis. Descriptive statistics were analyzed, and the means of subscores were used to conduct Pearson's correlations, logistic regression analysis, and Multivariate Analysis of Variance (MANOVA). The information presented in this chapter details the results of all statistical data analyses associated with this study. The chapter is organized into

three primary sections: (a) research findings, and (b) summary of findings. Tables are provided immediately after each applicable narrative discussion.

Research Findings

Chapter Three detailed how the participants were identified and invited to participate in the study. A total of 209 responses out of 283 (74%) were received from a governor's school and two IB programs. Out of 209 participants, 95 students (45%) were attending IB programs, and 114 students (55%) were attending a governor's school. In terms of gender, 104 students were male and 105 students were female. Teachers and coordinators administered both the questionnaires—the revised TSI and A Questionnaire Related to Career Choices and Students' Sensitivity toward Environmental Forces (QRCCSSEF).

The research findings section of this chapter addresses five research questions about career choices and thinking styles of high-achieving students. To address Research Question 1, logistic regression analysis, Spearman's rank correlation, and Pearson's Product-Moment correlation Coefficient (PPMC) were conducted. Logistic regression analysis was conducted to predict career choices of high-achieving students based on the predictor of thinking styles.

Also, to address Research Questions 2 and 4, Multivariate Analysis of Variance (MANOVA) was conducted. MANOVA was selected because of the multiple levels of factors associated with both the dependent variable of thinking style, as well as all of the independent variables with all their associated levels. This study used PPMC to address Research Question 3, and Question 5 was examined by

descriptive and content analysis. Content analysis is an analytic strategy to examine forms of communication to obtain patterns (Rossman & Rallies2003). The current study applied content analysis to examine responses from open-ended questions. After a review of the literature, open-ended questions about career development were designed to explore factors influencing high achieving students' career development. All responses were typed and organized by questions and interpreted by the researcher. A grounded theory approach was used in which each response was read independently (Creswell, 1994). The frequency of the concepts and types of career experiences influencing students' career choices were determined in order to identify patterns of responses. From the data collected, the key points were marked with a series of key points, which were extracted from the text. The key points were grouped into similar concepts under different categories (Creswell, 1994).

Findings Related to Research Question 1

The first research question associated with this study asked,

- a. To what degree do thinking styles relate to different factors that influence college choice?

Research Question 1.a. was addressed using Spearman's rank correlation statistics. Even though the relationship between thinking styles and students' college choices was not significant, two relationships were statistically significant. A judicial thinking style was significantly related to the students' ($n=206, p < .05$) consideration of college. Students with a judicial thinking style like to compare, contrast, judge, analyze, and evaluate. Those students had a tendency not to consider general college

prestige as an important factor for their college choice ($r = .180, p < .05$). Also, students ($n=206$) with a legislative/self-reliant thinking style, who like to develop and work based on their ideas and strategies, tended to consider their current GPA as an important factor in their college choice, $r = .157, p < .05$ (See Table 8).

Table 8.

Relationship between Students' College Choice and the Thinking Styles of High-achieving Students

	Liberal/Progressive	External	Hierarchic	Judicial	Legislative/ Self-Reliant
General college prestige	-.099	-.047	.000	-.180**	-.066
Specific department prestige	-.060	-.073	-.021	-.101	-.090
Proximity	.043	.066	.021	.067	.024
Financial aid	-.039	.027	.038	.014	-.099
Scholarship	.064	.055	.126	.106	.082
Current GPA	.107	.034	.069	-.062	.157*
Future career goal	-.011	-.077	-.079	.108	.027
Diversity	-.011	-.045	-.097	.065	.021
Other	.081	.057	-.007	.028	-.002

* $p < .05$. ** $p < .01$.

In addition to the relationship between thinking style and students' college choices, details of what the students' concerns are when choosing a college may help educators and parents to understand high achieving students' preferred factors for college choices. Table 9 presents the percentage of students' preferences as being important factors in choosing a college. As shown in Table 10, 45% of the students considered future career goals as the most important factor in their college choice. Other than future career goals, college and departmental prestige and financial aid

were also rated highly by over 10% of the participants as factors major concerns of high-achieving students when they choose a college.

Table 9.

Percentage of Students' Preferences Related to Factors in Choosing a College

	1 st Choice	2 nd Choice	3 rd Choice
General college prestige	12%	15%	21%
Specific department prestige	11%	14%	13%
Proximity	3%	6%	8%
Financial aid	11%	14%	9%
Scholarship	7%	17%	16%
Current GPA	5%	10%	12%
Future career goal	45%	18%	8%
Diversity	2%	2%	7%

b. How are thinking styles related to desired career choice?

This question was addressed by using logistic regression analysis because the dependent variable represents categorical data while the independent variable is continuous. Logistic regression analyses were used to determine which thinking styles would best predict students' desired career choices, and allowed the researcher to assess a model's ability to predict students' desired careers with different thinking styles (Field, 2009; McCoach & Siegle, 2003). Based on the results of logistic regression analysis, thinking styles were good predictors for whether students choose social science or computers and math areas as their desired career or not.

In terms of the social science area, the model correctly predicts 93.4 % of the students as either desiring social sciences as a future career or not. Table 10 reports the results of this analysis. The *Wald* test, which tells whether an effect of predictors exists or not, revealed that only liberal/progressive and external thinking styles were statistically significant predictors for whether students choose social sciences as their desired careers. People with a liberal/progressive thinking style are inclined to pursue change in their life and work environment, and people with an external thinking style are prone to be sociable and enjoy working with others. The results of the current study showed that those students with a liberal thinking style or an external thinking style were predicted to choose the social science area for their future careers.

The odds ratio estimates the change in the odds of membership in the target group. The current study shows that the estimated odds that students with high external thinking style scores would choose a social science as a desired career were 3.10 times greater than students with low external thinking style scores. However, the confidence interval for the odds ratio of students with a liberal/progressive thinking style crosses the value of 1, which means that the odds of these students choosing a social science as a desired career can be either greater or less than students with low liberal/progressive thinking style scores. Because the odds ratio estimation is inconsistent, liberal/progressive thinking style was not considered a good predictor even though the *p* value indicated statistical significance. Therefore, the results demonstrated that high school students who are people-oriented, outgoing, and socially sensitive prefer the social science area for their future careers.

Table 10.

Results of the Logistic Regression Analyses with All Five Predictor Variables in Social Science

Predictor Variable	B	seB	Wald	df	Odds Ratio	95.0% C.I. for Odds Ratio	
						Lower	Upper
Liberal/ Progressive	-1.39	.72	3.71	1	.25*	.06	1.03
External	1.13	.50	5.06	1	3.10*	1.16	8.26
Hierarchic	-.33	.38	.76	1	.72	.34	1.52
Judicial	.48	.44	1.16	1	1.61	.68	3.85
Legislative/ Self-reliant	-.59	.89	.44	1	.55	.10	3.19

* $p < .05$

The overall fit of the new model is assessed by comparing -2 Loglikelihood (-2LL) before and after including predictors in the model. If the value of -2LL after including predictors is lower than the value of -2LL before including predictors, it indicates that the model is predicting the outcome variable more accurately (Field, 2009). In this model, -2LL was reduced from 64.09 to 50.68, indicating that the model is predicting outcome variable more accurately than a model with no predictors.

In a logistic regression analysis, R^2 represent how much the badness of fit improves as a result of the inclusion of the predictor variables. In this study, the Cox and Snell R^2 was .105, and Nagelkerke R^2 was .255 ($p < .05$). Somewhat equivalent to

R^2 in linear regression, and the larger R^2 values indicate that the model is good in prediction.

In terms of the computer and math area, the model with predictors predicts 93.4 % of the students as desiring computer and math. Table 11 reports the results of this analysis. The *Wald* test revealed that only external thinking style was a statistically significant predictor of whether or not students choose computer and math as their desired career. Also, estimated odds that students with high external thinking style scores would choose a computer and math area as a desired career were 73% less than students with low external thinking style scores. The results showed that high achieving high school students who were people-oriented and outgoing did not prefer computer and math areas for their future careers.

Table 11.

Results of the Logistic Regression Analyses with All Five Predictor Variables

	B	seB	Wald	df	Odds Ratio	95.0% C.I. for EXP(B)	
						Lower	Upper
LP	3.71	.79	3.62	1	4.49	.96	20.78
External	5.06	.41	9.82	1	.27**	.12	.62
Hierarchic	.76	.44	.59	1	1.40	.59	3.34
Judicial	1.16	.45	1.19	1	.62	.26	1.47
LS	.44	.84	.25	1	.66	.13	3.39

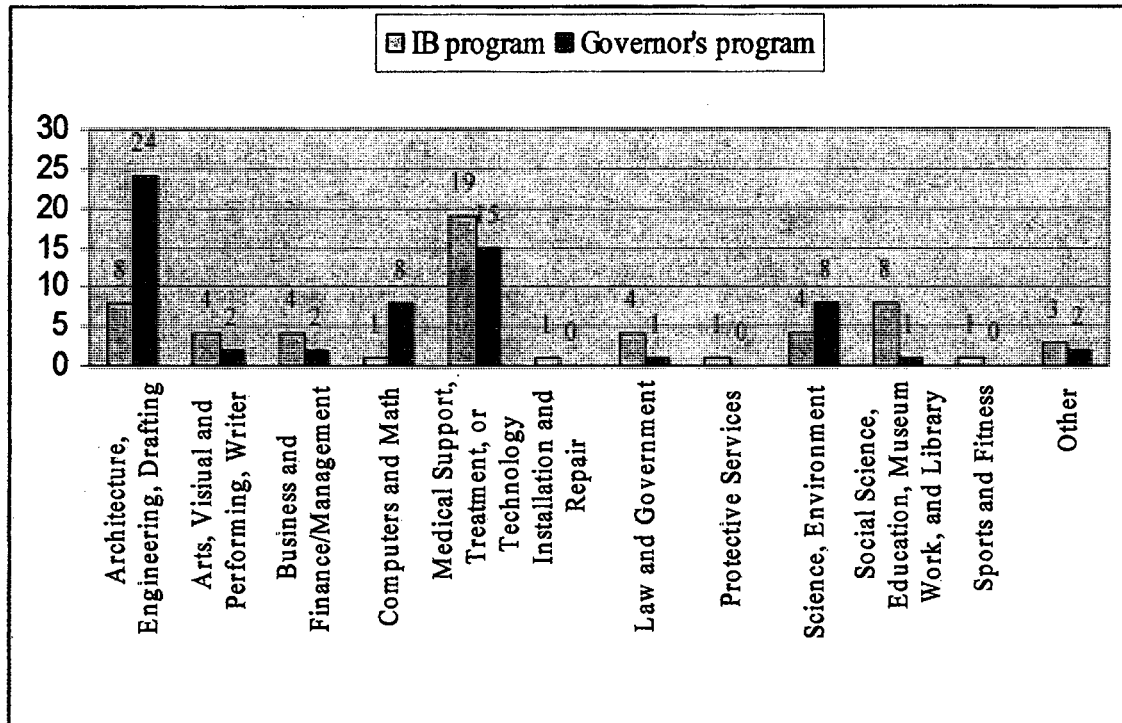
** p < .01

The overall fit of the new model was assessed by comparing -2Loglikelihood (-2LL) before and after including predictors in the model. The comparison of -2LL indicates that the model is predicting the outcome variable more accurately. In this model, -2LL was reduced from 64.09 to 46.29, indicating that the model is predicting outcome variable more accurately. The Cox and Snell R^2 was .137, and Nagelkerke R^2 was .333 ($p < .05$), showing an improved fit of the model to the data.

In the current study, one hundred and twenty-one students (59%) out of 206 students had desired career choices, and Figure 1 shows the details of career preferences of students in both programs. Students in IB programs preferred medical support, medical treatment, or medical technology, architecture, engineering, drafting,

and social science as their future career. Students in the Governor's School Program preferred architecture, engineering, drafting, medical support, medical treatment, or medical technology, and science or environment as their future career. Even though desired careers of some students in the IB programs were not consistent with an academic focus of liberal arts, students in a program with an academic focus of science and technology showed career preferences consistent with the academic focus of their high school program.

Figure 1.



Selected career focus by program.

- c. To what degree do thinking styles relate to students' achievement as measured by PSAT scores?

This question was addressed by using Pearson Product-Moment correlation coefficients since the variables represent interval data. Even though the relationship between thinking styles and academic performances as measured by the PSAT did not demonstrate strong relationships, several statistically significant relationships were identified in the current study. Correlation among variables found that an external thinking style and PSAT reading scores were significantly and negatively related ($r = -.234, p < .01$). Also, an external thinking style and PSAT writing scores were

significantly related ($r = -.207, p < .01$). Outgoing and socially sensitive students tend to have low reading scores and low writing scores in academic performances measured by PSAT.

Correlation analysis also found that a hierarchic thinking style and reading and math scores in PSAT were significantly related ($r = -.16, p < .05$; $r = -.19, p < .01$). Students who liked to set priorities for their work to be done and to be organized in their work tended to have lower reading and lower math scores on the PSAT scores (See Table 12).

Table 12.

Relationship between Thinking Styles and Academic Achievement Measured by PSAT

	Reading	Math	Writing
Liberal/ Progressive	.036	.07	-.06
External	-.23**	-.14	-.21**
Hierarchic	-.16*	-.19**	-.05
Judicial	.044	.035	.052
Legislative/Self-Reliant	.019	.010	-.060

* $p < .05$.

** $p < .01$.

Findings Related to Research Question 2.

The second research question associated with the current study asked, *Are there differences between high-achieving high school males and females with respect to thinking styles?*

To address Research Question 2, Multivariate Analysis of Variance (MANOVA) was conducted to compare means of males and females for different thinking styles. As reported in the Table 13, the inter-correlations between the dependent variables were statistically significant ($p < .05$) and justified the use of MANOVA to reduce Type-I error rates (Weinfurt, 1995).

Table 13.

Variable Correlations

	Liberal/ Progressive	External	Hierarchic	Judicial	Legislative/ Self-Reliant
Liberal/Progressive	1	.42**	.17*	.40**	.79**
External		1	.31**	.28**	.30**
Hierarchic			1	.39**	.15*
Judicial				1	.30**
Legislative/Self-Reliant					1

* $p < 0.05$

** $p < 0.01$

Table 14 provides the mean scores and other descriptive data for each of the thinking styles for the entire sample group. Males preferred the liberal/progressive, judicial, and legislative/self-reliant thinking styles, while females preferred the hierarchic thinking style.

Table 14.

Mean Scores and Standard Deviation for Thinking Styles by Gender

Factors	Male (<i>n</i> = 104)		Female (<i>n</i> = 105)	
	M	SD	M	SD
Liberal/Progressive	5.29	.94	4.77	1.07
External	5.14	1.18	5.16	1.13
Hierarchic	4.68	1.09	5.14	1.10
Judicial	4.44	1.13	4.39	1.05
Legislative/Self-Reliant	5.43	.84	5.16	.82

Table 15 shows the table of MANOVA results. The Wilks's Λ of .86 for effect of gender on the different thinking styles was significant, $F_{(5, 203)} = 6.42, p < .01$. The multivariate $\eta^2 = .14$ indicated 14% of multivariate variance of the dependent variable of thinking styles was associated with gender. Separate univariate ANOVAs on the outcome variables revealed a non-significant independent variable effect on external thinking style, $F_{(1, 207)} = .019, p > .05$, and judicial thinking style, $F_{(1, 207)} = .126, p > .05$.

Based on the results of univariate ANOVA testing, using an alpha level of .05, males preferred the liberal/progressive thinking style more than females, $F_{(1, 207)} = 14.057, p < .01$, and the legislative/self-reliant thinking style, $F_{(1, 207)} = 5.426, p < .05$, while females preferred the hierarchic thinking style more than males, $F_{(1, 207)} = 9.259, p < .01$. So, males appeared to like pursuing change and going beyond existing rules and procedures more than females did. Also, males liked to do things in their own

way and with their own strategies, to make their own rules, and to plan things as compared to females. However, females appeared to work in a more organized way compared to males.

Table 15.

Multivariate and Univariate Analyses of Variance for Different Thinking Styles

Source	Multivariate		Univariate				
	df	F	Liberal/ Progressive	External	Hierarchical	Judicial	Legislative/ Self-Reliant
Gender	1	6.42**	14.06**	.02	9.26**	.13	5.43*
Gender x Thinking Styles	1	2375.35**	5192.13**	4152.00**	42220.62**	3436.80**	8527.17**
<u>MSE</u>			1.02	1.34	1.19	1.19	.69

Note. Multivariate F ratios were generated from Wilks' Lambda statistic.
Multivariate df = 5, 203. Univariate df = 1, 207.

* p < .05

** p < .01.

Findings Related to Research Question 3.

The third research question associated with this study asked, *To what degree are different thinking styles related to high school students' sensitivity toward environmental forces when making a career choice?*

This question was addressed by using PPMC (See Table 16), since variables represent interval data. Based on the results of Pearson correlation statistics ($p < .05$),

there was no statistically significant relationship between thinking styles and students' sensitivity toward environmental forces when making a career choice.

Table 16.

Correlation between Thinking Styles and Students' Sensitivity toward Environmental Forces.

	Parental Force	School Force
Liberal/Progressive	-.063	.002
External	-.021	.108
Hierarchic	-.029	.052
Judicial	.016	-.082
Legislative/Self-Reliant	-.090	-.079

Findings Related to Research Question 4.

The fourth research question associated with this study asked, *How are thinking style preferences of high-achieving students attending a governor's school in science and technology different from those of the high-achieving students participating in International Baccalaureate (IB) programs with a focus on the liberal arts?*

To address Research Question 4, Multivariate Analysis of Variance (MANOVA) was conducted to compare means of students in two different programs for the different thinking styles. As reported in the Table 17, the inter-correlations between the dependent variables were statistically significant ($p < .05$) and justified the use of MANOVA to reduce Type-I error rates (Weinfurt, 1995).

Table 17.

Variable Correlations

	Liberal/ Progressive	External	Hierarchic	Judicial	Legislative/ Self-Reliant
Liberal/Progressive	1	.42**	.17*	.40**	.79**
External		1	.31**	.28**	.30**
Hierarchic			1	.39**	.15*
Judicial				1	.30**
Legislative/Self-Reliant					1

* $p < 0.05$ ** $p < 0.01$

Table 18 provides the mean scores and other descriptive information for each of the thinking styles for the entire survey group. Students in the IB programs preferred hierarchic, external, and judicial thinking styles, while students in a governor's program preferred liberal/progressive and legislative/self-reliant thinking styles. More males than females preferred the liberal/progressive, judicial, and legislative/self-reliant thinking styles, while more females than males preferred the hierarchic thinking style.

Table 18.

Mean Scores and Standard Deviation for Thinking Styles by Program

Factors	IB Program (<i>n</i> = 95)		Governor's Program (<i>n</i> = 114)	
	M	SD	M	SD
Liberal/Progressive	5.01	.99	5.04	1.08
External	5.40	.99	4.94	1.24
Hierarchic	5.08	1.06	4.77	1.14
Judicial	4.42	1.09	4.41	1.09
Legislative/Self-Reliant	5.28	.74	5.31	.92

Table 19 shows the table of MANOVA results. The Wilks's Λ of .94 for effect of program on the different thinking styles was significant, $F_{(5, 203)} = 2.658, p < .05$. The multivariate $\eta^2 = .06$ indicated 6% of multivariate variance of the dependent variable of thinking styles were associated with program. Even though different programs explain only 6% of the variation, the results of univariate ANOVA testing showed statistically significant differences between students in different programs in the mean scores for external and hierarchic thinking styles. Students in IB programs preferred an external thinking style, $F_{(1, 207)} = 8.506, p < .01$, and a hierarchic thinking style, $F_{(1, 207)} = 4.135, p < .05$, over students in the Governor's School Program. High school students attending a program with an academic focus on liberal arts tended to be more people-oriented, outgoing, sharing ideas with others, as opposed to students in a program with an academic focus on science and technology. Also, students

attending a program with an academic focus on liberal arts tended to more systematic and set priorities.

Table 19.

Multivariate and Univariate Analyses of Variance for Different Thinking Styles

Source	df	Multivariate F	Univariate				
			Liberal/ Progressive	External	Hierarchical	Judicial	Legislative/ Self-Reliant
Program	1	2.66*	.03	8.51**	4.14*	.00	.10
Program x Thinking Styles	1	2382.97**	4817.98**	4321.48**	4112.16**	3406.68**	8237.67**
<u>MSE</u>			1.09	1.28	1.22	1.18	.71

Note. Multivariate F ratios were generated from Wilks' Lambda statistic.

Multivariate df = 5, 203. Univariate df = 1, 207.

* p < .05

** p < .01.

Findings Related to Research Question 5.

The fifth research question associated with this study asked, *What influences students' choice of career during high school?* For Research Question Five, two types of questions were asked in order to identify influences on students' career choice—questions about career-related programs in schools specifically, and questions about other important factors influencing students' career choice generally, such as parents' expectations, school career-related programs, extra curricular activities, and so forth.

Influences of Career-Related Programs in High School

As Table 20 demonstrates, students in both programs listed AP courses, dual enrollment, and mentoring as their preferred career-related programs in high school. Students in the IB programs preferred career guidance, workshops for career development, and cooperative education more than students in the governor's program did, while students in the governor's program preferred dual enrollment and mentoring more than students in the IB programs did.

Table 20.

Preferred Career Related Programs by Respondents

	IB Program			Governors' School Program		
	1 st Choice	2 nd Choice	3 rd Choice	1 st Choice	2 nd Choice	3 rd Choice
Career Guidance	18	27	13	2	5	24
AP Courses	46	25	12	37	34	19
Dual enrollment	3	4	4	42	35	20
Workshop for Career Development	4	2	6	1	1	1
Cooperative Education	3	3	16	1	1	2
Internship	6	10	9	6	9	9
Job Shadow	2	4	4	0	5	3
Mentoring	7	10	14	19	17	28
School-sponsored Enterprise	1	1	1	0	3	1
Tech Prep	3	3	7	5	2	6

Figure 2 shows students' least-preferred career-related program; career guidance by counselors, workshops or sessions, and tech prep were the top three least-preferred career-related programs in high school. Thirty-eight (18%) of the students responded that they did not like career guidance by counselors, and 24 students (17%)

responded that they did not like workshops or sessions. Also, 20 students (10%) responded that tech prep were the least-preferred career-related programs. All responses were typed, organized by categories of career-related programs, and interpreted. A grounded theory approach was used in which each response was read independently (Creswell, 1994). The key points were selected from the text, and grouped into similar concepts under different types of career-related programs.

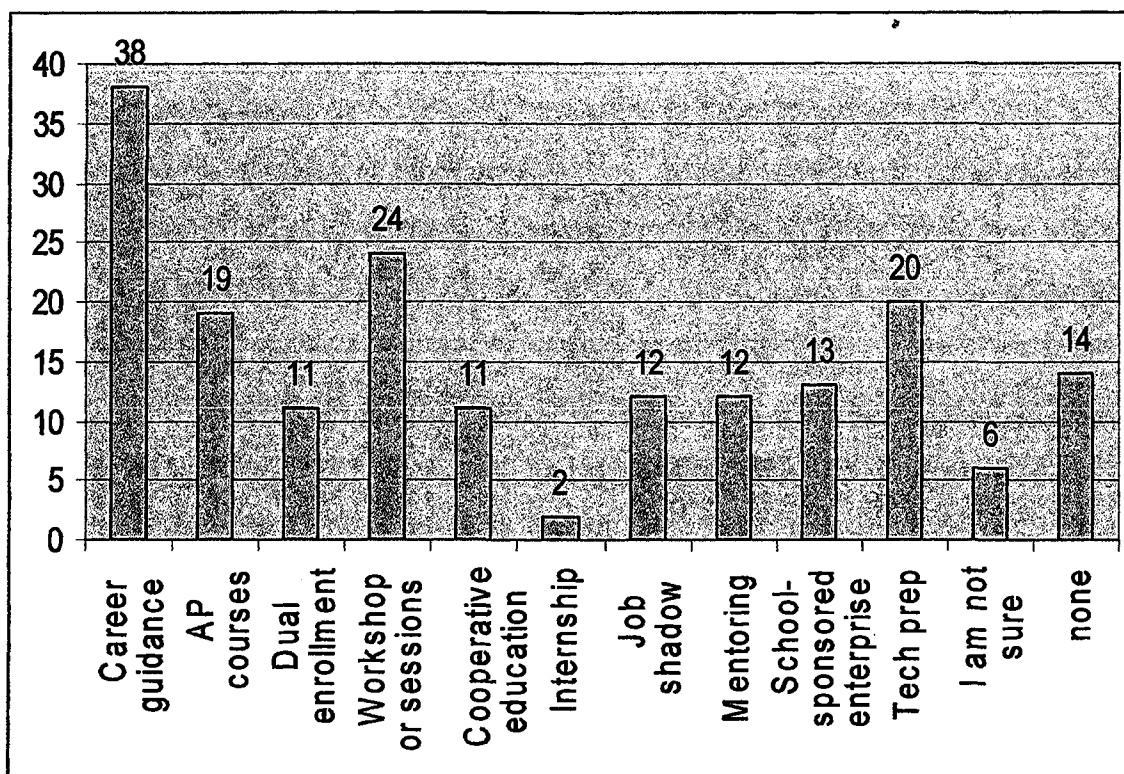
From the data (See Appendix A), career guidance counselors appeared not to be helpful in guiding students toward careers, and displayed a lack of knowledge about careers as well as about students' interests or talents. Counselors had low expectations for students and were not careful enough in offering accurate and in-depth career related information to students. In addition, students mentioned that counselors exhibited a lack of confidence in their own work, disseminated false and inaccurate information, and tended to push students into career paths that didn't interest the students.

In terms of workshops, workshops were not effective because they provided a minimal amount of exposure to the actual profession; they provided no field-work experience; they were uninformative, boring, and too general; they did not match the individual students' specific needs; and they tended to focus only on less ambitious careers. In addition, schools did not provide an adequate number of workshops to help students in their career decision making, and the workshops they did provide were redundant.

Among career-related programs, students could not make a connection between academic subject-related programs, including AP courses and dual enrollment, and future careers. Students considered that those academic subject-related programs are just rigorous programs, which allow them to obtain college credits. Also, students in IB programs had a hard time fitting the AP courses into the IB schedule.

As programs for providing actual field experiences in various careers, students who did not like mentorships, mentioned that mentoring is not effective in terms of required time versus learning, and not rigorous enough. However, internships and tech-prep were too specific since many students don't really yet have a defined career focus. Also, some students felt that job shadowing and cooperative education are time consuming because job shadowing does not provide actual job experience like a mentorship or internship, and cooperative education limits career experience to one professional area. In addition, school-sponsored enterprises do not provide valuable experiences but provide only limited career experience, such as sales work. As a common reason for not preferring a specific career-related program, students mentioned no prior experience (See Appendix A).

Figure 2.

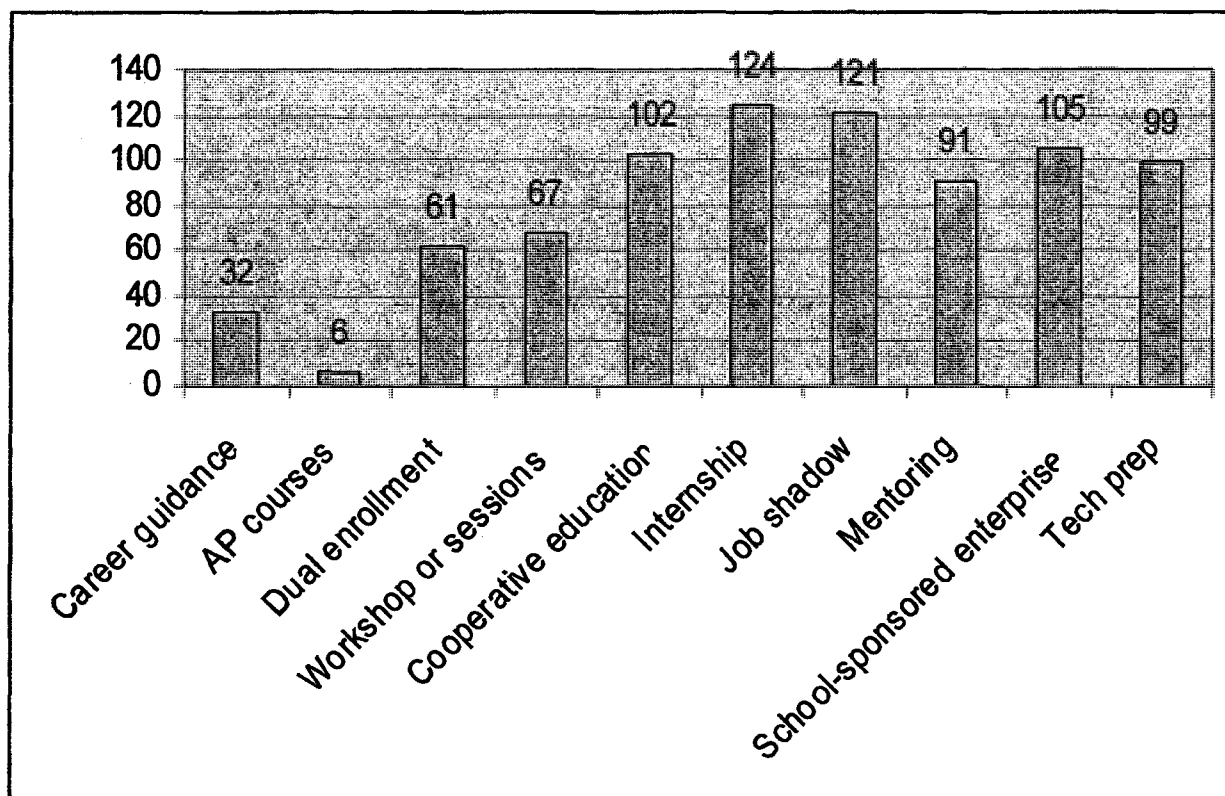


The least preferred programs by respondents.

Figure 3 identifies programs that students did not experience in high school.

Many students responded that they had not experienced an internship ($n=124$, 60%), job shadowing ($n=121$, 58%), a school-sponsored enterprise ($n=105$, 51%), cooperative education ($n=102$, 49%), tech prep ($n=99$, 48%), or mentoring ($n=91$, 44%).

Figure 3.



Programs that have not experienced by respondents.

Important Factors Influencing Students' Career Choice

Students listed the following as the most important factors that have influenced their choice of a possible future career. Based on the responses from students (See Table 21), their own interests, and the family environment such as parental expectations or a family job, were important factors influencing students' career choices. Most students mentioned their own interests and their parents' expectations

together, indicating that parents tended to develop students' talent and career interests based on the students' interests.

In addition to students' interest and family environment, various programs, including extracurricular activities, school classes or program, mentorship, and internship, were influencing factors for students' career choices. Also, personal experiences, books, and their own research about career were important for career decision making of high achieving high school students. Sixteen students (8%) mentioned that expected income or motivation for success were also influencing factors for career decision making.

Table 21.

Results about the Most Important Factors That Have Influenced Students' Choice of A Possible Future Career

Factors	Frequency	Percentage
My own interests and love for a subject	75	36%
Parents' expectation	64	31%
Family job	39	19%
Extracurricular activities	34	16%
School classes or program	31	15%
Personal experiences	11	5%
Expected income	11	5%
Books and own research about career	6	3%
Mentorship	5	2%
Teacher	5	2%
Motivation for success	5	2%
Ability	4	2%
Job availability	2	1%
Media	1	0.5%
Internship	1	0.5%

Table 22 demonstrates that students' educational experiences during high school affected their career plans the most. Since students considered an interest in a specific subject as an important factor in choosing their future career, classes

targeting specific subjects of interest, or programs such as the IB or Governor's School Programs focus on specific areas, were the most influential educational experiences that affected the choice of a future career. Also, respondents preferred career related programs such as extracurricular activities, volunteering experiences, mentorship, field trips, job shadow, and internship. However, 9 % of students mentioned that they did not have any preferred career related educational experiences.

Table 22.

Results about the most influencing Educational Experiences Related to Students' Future Career

Factors	Frequency	Percentage
Classes in specific interested subjects or programs such as IB or governor schools focusing on specific areas	122	58%
Extracurricular activities and volunteering experiences	24	11%
None	18	9%
Mentorship	12	6%
Teacher	8	4%
Personal interests and passion for a specific subject	7	3%
Field trips	6	3%
Job shadow	2	1%
Friend	1	0.5%

Lack of developed teaching/advanced topics in the high school itself	1	0.5%
internship	1	0.5%
Being exposed to college biology early	1	0.5%

Summary of Findings

After thinking styles of high-achieving students and career choices were examined, this study found the following results.

Summary of Findings Related to Research Question 1

To what degree do thinking styles relate to the career development of high-achieving high school students?

- 1) In terms of the relationship between students' college choice and the thinking styles of high-achieving students, a judicial thinking style and a legislative/self-reliant thinking style were significantly related to the students' consideration of college. Students with a judicial thinking style tended not to consider general college prestige as an important factor for their college choice, and students with a legislative/self-reliant thinking style tended to consider their current GPA as an important factor in their college choice.
- 2) Thinking styles were significant predictors of desired careers in math and computers and social science. Students who did not have an external thinking style were predicted to choose a career in math and computers; however,

external thinking style was a predictor for students choosing social studies as a desired career. Also, students, who had higher reading scores, had lower external thinking styles and lower hierarchic thinking styles, and students, who had higher writing scores, had lower external thinking styles. Furthermore, students, who had higher math scores, had lower hierarchic thinking styles.

Summary of Findings Related to Research Question 2.

Are there differences between high-achieving high school males and females with respect to thinking styles?

- 3) There was a significant effect of gender on the different thinking styles. More males than females preferred the liberal/progressive thinking style and the legislative/self-reliant thinking style, while more females than males preferred the hierarchic thinking style.

Summary of Findings Related to Research Question 3.

To what degree are different thinking styles related to high school students' sensitivity toward environmental forces when making a career choice?

- 4) Using Pearson correlation statistics, there was no statistically significant relationship found between thinking styles and students' sensitivity toward environmental forces when making a career choice.

Summary of Findings Related to Research Question 4.

How are thinking style preferences of high-achieving students attending a governor's school in science and technology different from those of the high-

achieving students participating in International Baccalaureate (IB) programs with a focus on the liberal arts?

- 5) Based on the results of MANOVA and follow-up univariate ANOVA testing, there were statistically significant mean differences between students in the two different programs for external and hierarchic thinking styles. Students in IB Programs preferred an external thinking style and a hierarchic thinking style than did students in the Governor's School Program.

Summary of Findings Related to Research Question 5.

What influences students' choice of career during high school?

- 6) Students in both programs listed AP courses, dual enrollment, and mentoring as their preferred career-related programs in high school. However, students in the IB programs preferred career guidance, workshops for career development, and cooperative education more than students in the Governor's School Program, while students in the Governor's Program preferred dual enrollment and mentoring.
- 7) Students' least-preferred career-related programs were career guidance by counselors, workshops or sessions, and tech prep. Thirty-eight (18%) of the students responded that they did not like career guidance by counselors, and 24 students (12%) responded that they did not like workshops or sessions. Also, 20 students (10%) responded that tech prep were the least-preferred career-related programs.

- 8) For programs that students did not experience in high school, almost a majority of students responded that they had not experienced an internship (60%), job shadowing (58%), a school-sponsored enterprise (51%), cooperative education (49%), tech prep (48%), or mentoring (44%).
- 9) Students listed their own interests, and the family environment such as parental expectations or a family job as important factors influencing their career choices. Most students mentioned their own interests and their parents' expectations together, indicating that parents tended to develop students' career interests based on the students' interests.
- 10) Students considered an interest in a specific subject, classes targeting specific subjects of interest, or programs such as the IB or Governor's School Program's focus on specific areas as the most influential educational experiences that affected the choice of a future career.

CHAPTER FIVE

Discussion, Conclusions, and Implications

The current study was designed to investigate the relationship between thinking styles and career development of students, and the factors influencing high-achieving students' career development in order to explore how thinking styles are associated with high achieving students' career development. The main purpose of considering different thinking styles was to match ways of thinking to the different types and areas of working in the real world in order to maximize individual's abilities and interests. As the research framework, the current study was based on Sternberg's 13 thinking styles within 5 dimensions of mental self-government, but used a revised instrument to measure thinking styles. Black and McCoach (2008) revised Sternberg's thinking style categories to provide better measurement, and suggested just five thinking styles: liberal/progressive, external, hierarchic, judicial, and legislative/self-reliant. Details of the five thinking styles are explained as follows. First, people with a liberal/progressive thinking style like and do not fear change. They are comfortable with ambiguous situations and do not pursue stability. Liberal/progressive thinkers look for unfamiliar situations and environments, both in their personal life and work. Second, external thinkers tend to be sociable and outgoing. External thinkers like to share ideas, work with other people and work by exchanging ideas. Third, hierarchic thinkers have to set priorities and make "to-do" lists. They like to be systematic and organized when they work, so they can be good

workers in any institution; but educators and bosses have to make sure that they are actually doing the work, rather than just making lists. Fourth, judicial thinkers like to judge people, others' work and situations. They also like to analyze reasons, evaluate strategies and plans, and compare and contrast among various works. Fifth, legislative/self-reliant thinkers like to do things in their own way and with their own strategies. They like to make their own rules and plan things, so they do not like to receive orders. They want to decide on policies or what work to do rather than following others' policies or orders.

In addition to thinking styles, factors influencing high-achieving high school students' career development, the influences of career-related programs in high school and important factors on students' career choice were explored in this study. Chapter Five presents a final summary of the research study. The information in this chapter is organized into five sections: (a) discussion of the findings, (b) conclusions, (c) implications for practice, (d) implications for future research, and (e) summary.

Discussion of Findings

Thinking styles and career development

This study examined the relationship between thinking style and career development, and the following conclusions were reached. The results of this study showed that students who have a dominant judicial thinking style, that is, those who like to compare and rate ideas or viewpoints, do not consider the general prestige of a college to be an important factor in choosing a college. Since judicial thinkers like to make their judgments based on comparing and contrasting several types of

information (Sternberg, 1997), they may develop their own criteria based on a comparison of their various types of information, such as majors and minors, location, size of the student population, costs, financial assistance, faculty, social life, and college requirement, so that general college prestige may not be the critical factor in considering their choice of a college.

Also, the results of this study suggest that legislative/self-reliant people tend to consider their current academic record, such as GPA, to be an important factor in choosing a college. Since legislative/self-reliant people like to rely on their own ideas and strategies (Sternberg, 1997; Black & McCoach, 2008), they may consider their current academic record to be an important factor in formulating a strategy based on admission criteria in order to gain college admission, or they may think that GPA is one of the strategies that they can control when they choose a college.

In choosing a college, aside from different thinking styles reflecting different strategies, high-achieving students considered their future career goals as the most important factor in choosing a college. This indicates that students are aware of the importance of career development when they choose a college. As Super's (1957) vocational development theory suggested, high school students are in the process of developing their vocational goals. Also, students considered the prestige of a college and department as important factors for their choice. Even though specific interests and desired future career goals were more of a driving force for college choice of high-achieving students, as Duffy and Sedlacek (2007) mentioned, prestige was also a critical factor related to future career goals, an indication that people often think

prestige is followed by advanced training for their future career through well-known faculty members or better courses in their interests areas.

In predicting students' desired careers with different thinking styles, thinking styles were predictors in terms of the desired career choice of high-achieving students in this study. However, the current study was not consistent with a previous study by Zhang and He (2003). According to Zhang and He's study of 193 college students in Hong Kong, both students having internal and students with external thinking styles favored studying Internet technology-related work. Students having an external thinking style showed more use of graphic and multi-media work as well as of both basic and advanced level operations, while students with internal thinking style did not show more usage of specific technical operations than that of other thinking styles. However, students with both higher internal thinking style and students with external thinking styles showed more favorable attitudes toward the use of computing and information technology in education as measured by the Computing and Information Technology scale (Zhang & He, 2003). Their study showed that students with an external thinking style reported significantly more knowledge and use of computing and information technology, however, the results of the current study showed that students with external thinking styles do not choose computer and math area for their desired career. One possible explanation for this result is that computer- and mathematics-related work requires enduring long working hours and a heavy work load in order to recognize, examine, and use even the basic principles in solving technical problems. Also this field tends to promote working individually, rather than

cooperatively, when addressing difficult problems (Career Overview, 2004; Lounsbury, Studham, Steel, Gibson, & Drost, 2009).

One interesting descriptive finding from this study was that 56% of students desiring careers in the medical support, treatment, or technology ($n=19$) were enrolled in International Baccalaureate (IB) programs. This indicates that those students were not enrolled an optimal program for their desired career, and more appropriate career counseling may be needed to provide prior to high school. The IB program curriculum focuses on intercultural understanding and is designed to provide more education in foreign language, speech, and writing (International Baccalaureate Organization, 2009), rather than providing science-focused curriculum such as a Governor's School Program does. If career guidance is not effective in providing appropriate career-related services as well as in choosing an appropriate academic program, students may struggle in high school and college to improve their abilities and identify the career area to which they are best suited. Simpson and Kaufmann's (1981) study showed that 55 % of the 322 respondents among presidential scholars undertook the wrong academic major in college. This may result in a waste of time and expense for individuals, as well as society.

Compared to students in IB programs, students in the Governor's School Program desired architecture, engineering, drafting, medical support, medical treatment, or medical technology, and science or environment for their future career. Students in a program with an academic focus of science and technology showed career preferences consistent with the academic focus of their high school program.

This indicates that a high school program with an academic focus on science and technology identifies students based on their academic focus better than IB programs did. Some of the differences in programs were signaled by their admissions criteria. The Governor's School Program required that students take advanced math courses to be admitted, but IB programs required only general GPA scores for admission to the program (Virginia Department of Education, 2008; United Nations International Schools, 2008).

Also, the current study revealed that an external thinking style was a good predictor for a career in the area of social science. Many careers in social science, such as human resources professional, politician, psychologist, and social worker, require interpersonal skills in the work place, so that students having an external thinking style may be attracted to a career in social science. The current study did not identify other thinking styles as critical predictors for a future desired career in social science, as Zhang's (2001) study did. Zhang found that Hong Kong secondary students who had judicial or hierarchical thinking styles preferred social sciences and humanities as their careers. One possible explanation for this discrepancy in results between the current study and Zhang's study might be cultural differences. Differences in the job and academic environments between Hong Kong and the United States might have caused different predictions in career areas with different thinking styles.

In addition to the college choices and desired career areas associated with thinking styles, the current study sought to identify thinking styles that may benefit high-achieving secondary school students in terms of academic performance by

exploring the relationship between students' achievement, as measured by PSAT scores, and thinking styles. Several previous research studies explored the relationship between thinking styles and academic performance. Among studies, Zhang (2001) concluded that creativity-generating thinking styles tended to be negatively related to academic achievement in school. However, the current study showed that the external thinking style is not beneficial for academic performance measured by PSAT scores. High school students who were people-oriented and outgoing had lower reading and lower writing scores on the PSAT in this study. These results suggest that instructional methods need to address different thinking styles. For students who like to share ideas and interact with others, group discussion work based on their reading will help them to increase critical thinking through reading. Also, seminar-type group discussion work prior to writing on a topic will help their thinking process for writing.

This result of the current study was similar to the results of a previous personality-related study by Millott (1974). Millott's study showed that students with higher introvert and intuitive personality scores demonstrated higher reading scores, which converge with results of the current study. One possible explanation for these results is that extroverts may like talking as a way of communication while introverts prefer reading and writing to other means of communication. Therefore, students who are outgoing and people-oriented might not do well in reading and writing compared to students with lower scores on an external thinking style.

Another result of the current study suggested that students with higher scores on a hierarchical thinking style showed lower academic performance on reading and

math measured by scores on PSAT. Characteristics of a hierarchic thinking style might explain the current study's results. Hierarchic people, who like to be systematic and organized, and to set priorities for work to be done, may not be good at tests with a short time allotted, such as the PSAT, because they need time to organize themselves. Also, people with hierarchic thinking styles may tend to do only work that is given to them, rather than pursuing new ideas or solutions. Therefore, they might not do as well in reading and math on the PSAT, which requires critical thinking.

The results of the current study were contradictory in this regard with previous research. Zhang (2001) found that students with a hierarchical thinking style tend to demonstrate higher academic achievement, but results of this study suggest that students with higher scores on a hierarchical thinking style showed lower academic performance on reading and math measured by scores on the PSAT. This conflict with previous research may be caused by different assessments of academic achievement. Zhang's study used overall GPA as an academic performance measurement, but the current study used PSAT scores, which measured performances in three different areas of reading, writing, and math. Since previous research suggest that differences in thinking styles exist among different disciplinary areas (Gridley, 2007), more studies should be conducted to understand individual differences in different domains. Also, Zhang's study and this study measured academic achievement in different cultural settings, so perhaps cultural differences also may

produce different outcomes related to the relationship between thinking styles and academic performances.

In summary, results of the current study propose that thinking styles were related to college choices and academic performance of high achieving students, and may be predictors for students' desired career choices, based on the data analysis of thinking styles as predictors for students' career choices. The results of the current study suggest that educators, parents, and counselors need to consider students' thinking styles when they provide career development education and services.

Thinking Styles and Gender

In U.S. colleges and universities, women constitute only 30 percent of physical science and 20.2 percent of engineering majors who earn doctoral degrees (U.S. Department of Education, 2008). These data support the conclusion that women are underrepresented in the science and engineering fields, even though their participation has been steadily increasing. As reasons for this imbalance in gender in the fields of science and engineering, Scott and Mallinckrodt (2005) claimed discouragement with occupational sex-role stereotypes, the lack of positive female role models, and low social support. Sternberg (1997) also argued that individual differences would exist between males and females, and presented style differences to be considered. Sternberg (1997) believed that style differences between men and women can be socialized within the culture, regardless of whether people recognize it or not. For example, the differential treatment of boy and girl babies based on traditional sex roles from the time they are born may cause them to have different thinking styles as they

grow up, because society has different opinions about acceptable behavior between genders. Grant (2000) also showed that female gifted students who had interests in mathematics and science changed their career aspirations due to negative experiences during their schooling.

Sternberg (1997) believed that thinking style differences exist between males and females, with males more likely to be rewarded for a legislative, internal, liberal style, and females more likely to be rewarded for an executive or judicial, external, conservative style. Even though this study did not examine how males and females are rewarded differently because of traditional sex roles in our society; and how those different rewarding impact on different thinking styles between males and females, the results of the current study show that males are good at responding to unexpected situations since they were more comfortable with ambiguous situations than females. Also, males have a tendency to give orders and make policies rather than receive orders and follow existing policies. In addition, males like inventing math problems rather than solving math problems in books; designing science projects rather than experimenting with prepackaged materials; writing alternative endings to existing stories rather than remembering the individual events in existing stories; giving orders rather than receiving them; deciding on company policy rather than being told to follow company policy.

Also, the results of the current study showed that females need more specific instructions than males since females have more of a hierarchic thinking style than males. Because they tend to work in an organized way, females can be good

performers in hierarchic institutions like schools. These results are consistent with previous research on gender difference; males are assertive and open to ideas whereas females are agreeable and conscientiousness. Therefore, males tend to try new methods and find new strategies to solve problems, and work based on their ideas and strategies when doing a task whereas females like to order ideas and things to do by perceived importance (Corty, 2005). Another previous research study by Cross, Neumeister, and Cassady (2007) provided descriptive information about psychological types in a sample of 931 gifted adolescents who entered two-year residential programs in their junior year of high school. They used the Myers-Briggs Type Indicator (MBTI) to explore patterns of psychological type, and found that gifted males were more likely to be oriented toward introversion, while females reported higher affiliations with extraversion. However, the current study did not show statistically significant differences in external thinking style scores between male and female students.

Thinking Styles and Sensitivity toward Environmental Forces

Environmental forces play an important role in students' career decision, as is shown in Whitmarsh, Brown, Cooper, Hawkins-Rodgers, and Wentworth's (2007) research. In their study, females who had careers in female-dominated professions (teachers and social workers) indicated that they had been discouraged from selecting a career in the gender-neutral areas (professors, physicians, and attorneys) because of others' perceptions that women could not succeed in gender-neutral careers. Since many researchers have addressed the dynamic interaction between individual

characteristics and contextual factors that contribute to an individual's career development (Lent, Brown, & Hackett, 1994; Helwig, 2008), this study attempted to identify whether specific thinking styles are more related to the sensitivity toward environmental forces when students make a career decision. Even though the results of this study did not demonstrate a strong relationship between thinking style and the students' sensitivity toward the environmental forces of parents and schools, Helwig's (2008) longitudinal career development study indicated that parents (especially mothers) were influential factors in students' career development during the high school period. Adults in Helwig's sample thought back to their high school experiences, and responded that parents were the most influential for their career development. Even though participants in the current study responded that their interests were the most influential factor for their career choices, students also considered parental influences as a critical factor for their career choices. Thirty-one percent of participants in the current study responded that parents' expectation was an important factor influencing their career choices, and 19 percent of participants responded that family job was an influencing factor for their career choices. This indicates that family environment is one of the most important factors for students' career choices.

Thinking Styles and Programs with Different Academic Focus

In addition to thinking style differences between males and females, this study set out to explore thinking style differences of students who are attending different programs which have different academic foci. The results of the current study showed

that high school students attending a program with an academic focus of liberal arts tend to be people-oriented, outgoing, and share ideas with others in comparison to students in a program with an academic focus of science and technology. Therefore, these students need information about a variety of career possibilities utilizing their talents of people interaction. In addition, students attending a program with an academic focus of liberal arts tended to be systematic and organized when they pursue solutions to problems in comparison to students in a program with an academic focus of science and technology. This indicates that students in IB programs may need specific guidance and detailed information to help them be prepared for their career development.

In terms of relationships between thinking styles and disciplines, Zhang (2001) found that different disciplines require different styles; social sciences and humanities require either a judicial or hierarchical thinking style, whereas natural sciences tend to require either an executive or conservative thinking style. However, the current study did not find differences in judicial thinking style between students enrolled in different programs. In science area, Park, Park, and Choe (2005) studied the relationship between thinking styles and scientific giftedness among 176 high school students in Korea. They found that liberal, conservative, and judicial styles were positively related to scientific giftedness, as measured by the Scientific Giftedness Inventory (SGI; Shim & Kim, 2003). However, the current study did not show differences between students enrolled in different programs for liberal and

judicial styles. Their studies did not identify the relationship between external thinking styles and different disciplines of liberal arts or science.

Factors Influencing Students' Choice of Career

Influences of career-related programs in high school

Students in the current study responded that they liked subject-related programs, such as AP courses and dual enrollment among career-related programs, career guidance, and mentoring that supported their career choices. This finding indicates that advanced courses are beneficial for students' career development, and that counseling aspects such as career guidance and mentoring are also effective for students' career development. As Colangelo, Assouline, and Gross (2004) discussed, taking advanced courses might allow students to take interesting and in-depth courses, which can help them to develop their career paths. Therefore, in-depth knowledge in various subjects should be provided through advanced academic courses to help students to identify their passion and career aspirations.

In terms of different academic foci, high school students attending a program with an academic focus of liberal arts liked career guidance services, workshops for career development, and paralleling their academic and vocational studies with a job in a related field. Compared to students in a program with an academic focus of liberal arts, students in a program with an academic focus of science and technology liked dual enrollment and mentoring among various career-related programs. This indicates that in-depth academic knowledge and mentoring are important for students in the Governor's School Program so that they need to be connected to appropriate

mentors, depending on their desired career. Karcher (2005), who studied 77 students to identify the effects of mentorship, found that students who had mentors improved their self-management skills, social skills, and self-esteem. Even though Karcher studied younger children (fourth and fifth graders) than the current study, the study identified the mentors' critical role in terms of self-management, social skills, and self-esteem. Those improved skills also might contribute to young adolescents' career development by improving self-management skills, social skills, and self-esteem.

On the other hand, high school students attending a program with an academic focus of liberal arts wanted more connections between academic knowledge and real job situations. Academic courses like dual enrollment are also advantageous to students in both high school and college because it allows them to start their college learning early and saves money for college.

In addition to responding to the question about preferred career-related programs, many students also mentioned in a separate question that they did not like career guidance programs, career-related workshops, tech-prep, or course-related programs. In terms of career guidance programs, participants mentioned that counselors lacked specific knowledge, had low expectations, false or inaccurate information, and lacked knowledge about students among high school counselors. Even though students appeared to have difficulties in career decision-making because of the lack of information (Brown & Krane, 2000; Lent, Nota, Soresi, & Ferrari, 2007), the current study showed that guidance counselors did not provide enough career-related information to students for their career choices.

Consequently, workshops for career education should be designed to deal with specific information such as surveying students to decide the workshop's themes, providing self-assessment opportunities to identify students' talents and preferences, and providing opportunities to meet experts in various professional fields in order to address students' specific needs for information. In addition, differentiated career-related services will help both students and participating individuals or institutions to have valuable experiences.

Even though students understood that academic subject-related programs such as AP courses were important to develop their career development, they commented that academic subject-related programs did not support their career-specific experiences. Instead, many students considered academic courses as opportunities to earn college credits rather than making connections between academic knowledge and specific actual career experiences. Therefore, career education should be connected to academic courses so that students may recognize the importance of academic knowledge for their future careers. McCash (2006) also stressed the importance of career education rather than considering only academic subject-related courses for students' career preparation. McCash believed that students should become career researchers in order to provide a foundation for their own actions, based on their age, personality, geography, chance, gender, socio-economic class, ethnicity, and life course. He provided a 15-credit module entitled "Career Development" for second-year undergraduates and produced a deepened understanding of career development among the students as a result of considering which theory aided them in interpreting a

vocational role. If students can make the connection between academic content and practical work in the real world, they will understand better the value of academic learning. The current study's results suggest that students need to make the connection between academic courses and the practices of an actual career field for their proper career development. As Diemer and Blustein (2007) suggested, career counselors need to be able to guide students in connecting an appropriate vocational future with appropriate career goals. They suggested that specific career-related education, including connecting students to work, developing vocational identity, guiding them to make a commitment to a chosen career, and supporting the salience of the chosen career, may help adolescents to have an appropriate career path.

Further, participants in this study expressed their need for actual hands-on experiences, and making connections between subject-related courses and actual career experiences rather than general workshop sessions. This result complies with the previous study of Lent, Nota, Soresi, and Ferrari (2007). They studied 354 senior students in Italy and believed that realistic academic major previews would provide useful information about students' career choices. They provided free, voluntary guidance activity organized by the counseling center, which allowed students to experience the university setting and a class session on a topic of the students' choosing. Students chose a beginning course related to desired major in college in order to experience actual college learning related to their future career. Then, they measured the subject matter knowledge, interest, self-efficacy, and outcome expectations before and after academic major preview. They found that students

showed a significant increase in subject matter knowledge. Also, students identified gaps between what they expected and real academic experiences. Students showed decreased interest, and expectations; however, the more knowledgeable students reported higher levels of interest, self-efficacy, and outcome expectation. Lent, Nota, Soresi, and Ferrari's (2007) study indicated that realistic experience helped students adjust their expectations and interests based on more knowledge and experience in career areas. Participants in the current study expressed the need for an academic major preview type of hands-on experience in order to obtain more accurate information related to their career choices.

Important factors influencing students' career choice

As previous research discussed (Gottfredson, 1981; Holland, 1996), students' interest in a subject was the main factor influencing students' career choice. Gottfredson (1981) stressed the importance of vocational interests in developing a self-image leading to a selected career path. About 36 percent of respondents in this study mentioned that their own interests and love for a subject were the most important factors influencing their career choice. As many researchers have addressed, intrinsic motivation plays one of the most important roles in creative works and achievements (Amabile, 1983; Piirto, 2004); and the current study's results demonstrate that high-achieving high school students choose their career based on their interests. Csikszentmihalyi (1996) explained intense interests in a subject or an intellectual activity with flow theory, which states that as people enjoy activity in a highly-focused state, which is called "flow experience" (p. 110), their capacities can

extend to novel and original activities. This flow experience is involved in the high concentration needed for some activity, so that people in a flow experience forget their worries, fear of failure, and self-consciousness, which can lead to creative performances. Therefore, various career-related programs should encourage students' interests in a subject.

In addition, those students' intense interests and passion for a subject seemed to interact with environmental factors such as parental expectations, family job, extracurricular activities, school classes or programs, personal experiences, expected incomes, teachers and mentors, and their motivation for success. Therefore, high school students need information about expected income within different careers and expected social positions for different career paths, also.

The results of this study did not support the conclusion that thinking styles are associated with sensitivity toward environmental forces when students make career choices; however, parental role and school environment appear to be vital factors influencing the career development of the participants, as previous research has also presented (Ferreira, Santos, Fonseca, & Haase, 2007; Palmer & Cochran, 1988; Wigfield, Battle, Keller, & Eccles, 2002). In this study, 31 percent of the total participants ($n=64$) responded that parents' expectations were an important factor, and 19 percent of participants mentioned the family job as an influencing factor in their choice of career. Also, extracurricular activities, such as robotics club and business courses in summer, provided by parents (16% of participants) were important factors for students' career choices. Those results indicate that parents' roles are critical for

students' career as well as talent development. As Bloom (1985) found in his study of 120 talented individuals, parents' involvements in students' areas of interest, and their temporal, financial, and emotional support, were important to highly talented students' career development.

In terms of school environment, 59 percent of participants responded that classes in specific areas of interest, or programs such as the IB or governor's school program, which provided a focus on specific areas helped students to decide on a future career. However, the results of the current study indicate that many students may not receive appropriate career guidance when they chose their high school program. In this study, 19 students attending IB programs focusing on liberal arts, compared with 15 students in the Governor's School Program focusing on science and technology, desired a future career in the medical support, medical treatment, or medical technology even though the medical area requires scientific knowledge. Also, eight students in IB programs desired architecture, engineering, drafting as their future careers. This indicate that those 27 students attending IB programs who desire the medical support, medical treatment, medical technology, architecture, engineering, or drafting may have had more benefits if they were guided to attend a Governor's School Program having an academic focus on science and technology in order to have opportunities for clinical experiences or engineering related experiences through career-related programs such as mentorship, internship, or volunteer work.

Conclusion

Career decision-making processes are not simple to explore; however, high achieving adolescents' career decision-making has significant implications for their personal and occupational satisfaction throughout their lifespan. Therefore, the purpose of the present study was to examine thinking styles and factors influencing students' career decision-making in order to enhance understanding of high achieving students' career development.

The current study showed that a judicial and a legislative/self-reliant thinking style was significantly related to the students' choice of college. Students with a judicial thinking style did not consider the general college prestige as an important factor in their college choice, and students with a legislative/self-reliant thinking style tended to consider their current GPA as an important factor in their college choice.

External thinking style was a predictor for those choosing the social sciences as a desired career area. Also, students having an external thinking style could be predicted not to choose math and computers as their desired career.

In terms of the relationship between thinking styles and achievement, as measured by PSAT scores, this study showed that students with higher external thinking style scores showed lower reading scores and lower writing scores, and students with higher hierarchic thinking style scores showed lower reading scores and lower math scores. That is, thinking styles were related to academic performances measured by PSAT scores, so that it may be appropriate to take into account students'

thinking styles when educators plan to develop intervention programs to improve students' reading and math.

Results of the study also showed differences between males and females on thinking styles. Also, students attending different programs demonstrated different thinking styles. More males than females preferred the liberal/progressive thinking style and the legislative/self-reliant thinking style, while more females than males preferred the hierarchic thinking style. Also, more students in IB programs preferred an external thinking style and a hierarchic thinking style than did students in a Governor's School Program.

In terms of different thinking styles and high school students' sensitivity toward environmental forces when making a career choice, this study showed that thinking styles were not related to students' sensitivity toward environmental forces. Students decided their career paths primarily by depending on their interests and passion for a subject. However, students' interests in a subject would not have been developed without additional environmental influences, such as those from parents, family, and school. Students listed their own interests, and the influence of family environment characteristics such as parental expectations or a family job as the most important factors influencing students' career choices. Most students mentioned their own interests and their parents' expectations together, indicating that environmental influences interact with students' interests and passion, and drive them toward a specific career path.

Students in the IB programs preferred career guidance, workshops for career development, and cooperative education more than students in the governor's program did, while students in the governor's program preferred dual enrollment and mentoring more than students in the IB programs did. One possible explanation for this result is that IB programs focus on developing inquiring, knowledgeable, and caring young people through intercultural understanding and respect while the governor's program focuses on providing rigorous academics in science and technology and providing scientific research experiences with their faculty members. Therefore, IB programs happen to put more efforts into providing career guidance and introduce various types of careers to students, whereas a Governor's School Program focuses on mentoring and dual enrollment for more in-depth knowledge.

Also, the least appreciated career-related programs were career guidance by counselors, workshops or sessions, and tech prep. Specifically, students complained about ineffective career-related services from guidance counselors because they are not capable enough to provide in-depth career-related information depending on each student's needs. Also, it appeared that schools did not provide various career-related programs for high-achieving high school students. Many students responded that they had not experienced an internship, job shadowing, a school-sponsored enterprise, cooperative education, tech prep, or mentoring.

Students considered an interest in a specific subject, classes targeting specific subjects of interest, or programs such as the IB or governor's schools' focus on

specific areas to be the most influential educational experiences that affected the choice of a future career.

Implications for Practice

The current study set out to explore how thinking styles are related to college decision-making, career decision-making, gender, and different programs, and to examine the factors that influenced career planning and development among high-achieving students.

The data show that thinking styles are a factor in students' career decision-making. Also, thinking styles are different between male and female students, and among students enrolled in different programs. If students' thinking styles are different, counselors, teachers, parents should recognize these differences for students' optimal career choices. The leaders in designing advanced high school programs need to set specific requirements to recruit students who fit each of advanced programs, depending on their academic focus. Also, schools can provide various assessments, including thinking style assessment, to identify students' preferences and talents to maximize their abilities and prepare for their future careers. Also, information about various careers, such as expected income within different careers and expected social position for different career paths, also will help students to identify their future careers. However, some students in the current study mentioned that counselors tried to change students' opinions on majors and colleges. Since academic and career advising play an important role in students' career decisions, counselors need to

consider individual styles and backgrounds, such as gender or parental environment, and to bridge students' characteristics and backgrounds with their future career goals.

In order to provide effective career counseling for students, guidance counselors need to enhance the close relationship with students to understand students' individual differences, background of students, and interests and talents of students in order to provide more effective career counseling. Guidance counselors need to seek various ways to help students, such as providing career-related instruments to clarify students' styles and interests, developing a comprehensive career resource library, and developing an alumni career connections network. In addition, counselors can develop an effective mentoring program such as the Research Science Institute (RSI) program sponsored by the Massachusetts Institute of Technology (MIT) and the Center for Excellence in Education (CEE). The RSI program selects students based on their interests and motivation toward their projects, knowledge of math and science research, and achievements in their science classes. Once students are selected, they are invited to the residential summer program, and experience and learn from first-class professors (Feng, 2007). This type of mentorship program provides valuable career-related experiences and in-depth subject knowledge to high-achieving students.

To provide optimal career-related education for students, schools provide many different career-related programs from academic subject-related programs. Workshops for career education should be designed in a way to deal with more specific information such as surveying students to decide workshop themes, providing self-assessment opportunities to identify students' talents and preferences, and

providing opportunities to meet experts in the various professional fields in order to address students' specific needs for information. Also, educators and policy makers need to find out the reasons for students disliking counselors' guidance, career-related workshops, and tech prep so that they may develop effective career-related services based on students' needs. Since internships and tech-prep were too specific for students who don't really yet have a defined career focus, differentiated career-related services depending on the formation of students' career aspirations will help both students and participating institutions to have valuable experiences.

Among these many career-related programs, guidance counselors are one of the most accessible supports for students. Therefore, increased professional development for counselors is essential in order to provide appropriate career-related guidance for students. Most of all, counselors need to possess in-depth knowledge about various types of careers, and counseling techniques for developing relationships with students to know about students' individual differences and interests. If counselors have enough knowledge about careers and students' individual styles as well as academic interests, they may provide more organized support to address an individual's needs.

Also, schools should invest more effort in connecting academic courses with career achievement, and try to provide high quality experiences in terms of career-related education or volunteer experiences. For example, by developing partnerships with the workplace to incorporate workplace skills into academic classes, schools could provide worksite visits, regular meetings with counselors and workplace

mentors, and summer curriculum workshops in order to make a connection between the academic class and career experiences, and to provide high-quality, career-related experiences. Thoroughly designed out-of-school experiences and various career related programs may lead students to the optimum career paths based on students' fields of interest.

In addition to school environment, students' interests in and motivation toward a specific subject are critical elements for their career development. Therefore, identifying students' interests, talents, and style preferences is important to encourage their career development. Developing and providing supplemental educational opportunities such as the Study of Mathematically Precocious Youth (SMPY) at Johns Hopkins University will provide optimal opportunities to develop students' abilities and address their preferences. The SMPY was designed to provide individualized and unique educational paths for math prodigies with in-depth content knowledge (Brody, 2007; Swiatek, 2007). This type of talent search also will provide career-related services for students in accordance with their interests and talents.

Implications for Future Research

Several areas are identified for future research in thinking styles and career development for high-achieving students. One is a study of the development of more accurate instruments that can measure the psychometrics of thinking styles. It appears from previous research that there are not enough accurate and reliable instruments by which thinking styles could be measured. Many researchers (c.f., Black & McCoach, 2008), who studied thinking styles, used The Thinking Style Inventory (1997) as an

instrument. However, Black and McCoach could not find statistical support for the use of full-scale. Even though they provided a revised Thinking Style Inventory with statistical support, which is used in the present study, their results were limited to scores from a single sample of high school students from four high schools.

Therefore, they suggest that researchers and practitioners should be more thoughtful when they have to make important educational decisions considering thinking styles, indicating that more accurate instruments representing the psychometrics of thinking styles should be developed in the future for more fruitful research results.

Another critical area to be explored is the style difference among experts in different disciplines. Even though this present study was designed to examine different thinking styles of high-achieving adolescents in programs with different academic foci, the students would have had the chance to change their career focus after entering or completing college. However, experts who are actively working in a specific discipline have already experienced a career development process to achieve their current professional status. Therefore, exploring thinking styles of experts in different disciplines may provide a better picture for different thinking style preferences in students.

In addition, a cross-cultural comparison of thinking styles would identify cultural influences on the development of thinking styles. Previous research in different countries has produced different outcomes concerning style preferences, but no research comparing students from different cultures was identified by the researcher. Comparison among students from different cultures would provide

valuable information about how educators develop career-related education and counseling programs differently in various countries. Also, exploring how environmental differences cause different thinking styles of individuals would provide valuable information about understanding an appropriate educational environment for high-achieving students.

Another area to be explored may be the career development of gifted females. Since gender is related to thinking styles, understanding thinking styles of gifted females and the career development pattern of gifted females will provide valuable information to provide better career-related service for gifted females. How could female career development be encouraged in different disciplinary fields? And how could gifted females have different patterns within the same career? Answering these questions would provide grounds for supporting female gifted students in choosing appropriate career paths in nontraditional fields, rather than restraining decision-making within traditional sex role choices. Whitmarsh, Brown, Cooper, Hawkins-Rodgers, and Wentworth (2007) examined the career planning, career decision-making, and work history of women in both female-dominated (teachers and social workers) and gender-neutral (professors, physicians, and attorneys) careers, and identified patterns of career change by women. According to their study, women who changed their careers to a gender-neutral one originally had chosen a female-dominated career before or upon completing college, but changed their career to a gender-neutral one due to encouragement from spouses and mentors at a later stage of

life. Another study, focusing on early female career-related education, may yield interesting results in respect to the factors influencing female career development.

A longitudinal study of the career choices of gifted students also would provide helpful insights about how gifted female students identify their desired career choices, what kinds of intervention might help gifted female students choose without limiting themselves within traditional sex roles, and what kinds of barriers exist for the career development of gifted female. This current study provided some limited information as to the preferences of female students' thinking styles related to male students' thinking styles for the exploration of high-achieving students' career choices. Beyond this study, systematic in-depth studies of gifted students from early childhood through adolescence would contribute to providing fruitful ground for new growth in the development of theory, which could, in turn, convince policymakers to support career development programs for gifted students.

Summary

Even though research examining career decision making processes is not simple to conduct, understanding gifted adolescents' career decision-making will have implications not only for individuals but also for society, so that studies related to gifted students' career development should be encouraged and disseminated. This study intended to add new information about career decision-making for high-achieving students' associated thinking styles, as well as factors influencing their career development. The conclusion from the present study is that career development for high-achieving adolescents should take thinking styles into consideration in order

to provide the optimum support in making career-related decisions. Specifically, career-related programs in high schools should be adjusted based on students' needs, rather than simply providing general career programs.

The findings demonstrate the importance of students' interests and passion for a subject for their career decision-making, suggesting that career-related programs should provide specific experiences, based on interests and needs. In addition, results of this study also showed that students' interests in a subject would not have been developed without additional environmental influences, such as those from parents, family, and school. Environmental influences interact with students' interests and passion, and drive them toward a specific career path. Hence, parents, teachers, and guidance counselors should all recognize their critical roles in high achieving students' career development.

Appendix A

Reasons for Not Preferring a Specific Program

Program	Comments for not preferring a specific program	Frequency
Career guidance	• Not help	17
	• Lack of specific knowledge	6
	• Counselors don't know about students' interests and talents	4
		4
	• Don't have enough time to help	3
	• Push into career path that I don't want	2
	• Low expectation of the counselors	2
	• Student need to decide	1
	• Biased or not care	1
	• No confidence	1
	• False and inaccurate information	
Workshop	• Not effective	6
	• No work field experience	4
	• Boring	4
	• Not match with individual's specific needs	2
	• Geared toward less ambitious careers	2
	• Don't have enough	2
	• Redundant	2
	• Too general	1
	• Provide least amount of exposure to the actual profession	1
Tech-prep	• Too specific	5
	• Lack of flexibility while choosing an occupation	5
	• No experience of Tech-prep	3
	• Lack of connection between college and high school career education	2
		2
	• Boring	1
	• Not enough learning	1
	• Lacks hands on activity	1
	• A lot of students don't really have a defined career focus	1
Mentoring	• No experience of it	3
	• Takes too much and no learn that much	3
	• Missing class time	1
	• Not excited	1

Program	Comments for not preferring a specific program	Frequency
	<ul style="list-style-type: none"> • Similar to school sponsored enterprise • Rules are too tight • Not rigorous 	1 1 1
Job shadowing	<ul style="list-style-type: none"> • No actual job experience (just observing) • Mentorship and internship is better • Too short period of time • No experience of job shadowing 	9 1 1 1
Dual Enrollment	<ul style="list-style-type: none"> • Just for college credits • Too much pressure • Not related to a job • No experience of dual enrollment 	3 2 2 1
Cooperative education	<ul style="list-style-type: none"> • No experience of cooperative education • Time consuming • Limited choice and limited education • Focused on one career • No need for cooperative education 	4 3 2 1 1
Internship	<ul style="list-style-type: none"> • Too specific • Extra job work 	1 1
School sponsored enterprise	<ul style="list-style-type: none"> • No use for school sponsored enterprise • Scary to get into an enterprise • No different than getting a job • No experience of school sponsored enterprise • Not a lot of leaves in chance • Mostly sales work (no valuable experiences) • No interest • Not helpful • No relationship to career development 	2 2 2 2 1 1 1 1 1
I am not sure	<ul style="list-style-type: none"> • No experience related to career education • Not available in schools 	4 2

Appendix B

Matrix of Findings by Interpretations and Implications

RQ1: To what degree do thinking styles relate to the career development of high-achieving high school students?

RQ1a: To what degree do thinking styles relate to different factors that influence college choice?

Findings	Interpretation	Implications
Students with a judicial thinking style tended not to consider general college prestige as an important factor for their college choice.	Students who like to compare and contrast did not think that general college prestige itself was important for their college choice.	Students who like to compare and contrast need various types of information such as majors and minors, location, size of the student population, costs, financial assistance, faculty, social life, and college requirements to compare and contrast.
Students with a legislative/self-reliant thinking style tended to consider their current GPA as an important factor in their college choice.	Students who like to work based on their ideas and strategies thought that their own current GPA was important for their college choice.	Students who like to work based on their own ideas and strategies need entrance requirement information from colleges, and need guidance for

		balancing their future career goals and meeting entrance requirements for college choices.
Students considered future career goals as the most important factor in their college choice.	High school students thought that future career goals were important reasons for choosing colleges.	High school students think that colleges provide better preparation for their desired careers. High school students need to clarify their career goals.
Financial aspects were also major concerns of high-achieving students	High school students thought that scholarship opportunities and financial aid possibilities were important for choosing colleges.	Students need information about scholarships and financial aid from colleges and various financial sources to support college expenses.
College and departmental prestige were major concerns of high-achieving students when choosing a college.	High school students thought that future career goals were important reasons to choose college.	High school students think that colleges provide better preparation for their desired careers. High school students need to clarify their career goals.

RQ1b: How are thinking styles related to desired career choice?

Findings	Interpretation	Implications
<p>The estimated odds that students with high external thinking style scores would choose a social science as a desired career were 3.10 times greater than students with low external thinking style scores.</p>	<p>High school students who were people-oriented, outgoing, and socially more sensitive, preferred the social science area for their future career.</p>	<p>High school students who like to work with others need information about various career possibilities in the social science areas, utilizing their people-oriented preferences and talents.</p>
<p>The estimated odds that students with high external thinking style scores would choose a computer and math area as a desired career were 73% less than students with low external thinking style scores.</p>	<p>High school students who were people-oriented and outgoing did not prefer the computer and math areas for their future career.</p>	<p>One possible explanation for this result is that computer- and mathematics-related work requires enduring long working hours and a heavy work load in order to recognize, examine, and use even the basic principles in solving technical problems, and tends to promote working individually, rather than cooperatively, when addressing</p>

		difficult problems. External thinking style people need more information about careers utilizing their people-oriented preferences and talents.
Students in IB programs preferred medical support, medical treatment, or medical technology, architecture, engineering, drafting, and social science as their future career.	High school students in the program with a liberal arts focus desired medical support, medical treatment, or medical technology, architecture, engineering, drafting, and social science for their future career.	Identification of students' career aspirations, talents, and individual differences needs to be the basis for students' choices of specific high school programs. Career-related education prior to high school for high-achieving students will help students to choose appropriate high school programs.
Students in Governor's School Program preferred architecture, engineering, drafting, medical support, medical treatment, or medical technology, and science or environment	Students in a program with an academic focus of science and technology desired architecture, engineering, drafting, medical support, medical treatment, or medical	High school students in a program with an academic focus of science and technology showed career preferences consistent with the academic focus of their high school program.

as their future career.	technology, and science or environment for their future career.	
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RQ1c: To what degree do thinking styles relate to students' achievement as measured by PSAT scores?

Findings	Interpretation	Implications
External thinking style and PSAT reading scores were significantly and negatively related.	High school students who were people-oriented and outgoing were not good at reading.	For students who like to share ideas and interact with others, group discussion work based on their reading will help them to increase critical thinking through reading.
An external thinking style and PSAT writing scores were significantly related.	High school students who were people-oriented and outgoing were not good at writing scores.	For students who like to share ideas and interact with others, seminar-type group discussion work prior to writing on a topic will help their thinking process for writing.

<p>A hierarchic thinking style and reading scores in PSAT were significantly related.</p>	<p>People who like to be systematic and organized in their solutions to problems were not good at reading scores in PSAT scores.</p>	<p>Hierarchic people who like to be systematic and organized in their solutions to problems have an advantage in most school work since they set priorities for their multiple work and perform the tasks in a systematic way. However, they are not good at tests with short time allotted like the PSAT because they need time to organize themselves. Therefore, schools or colleges should provide various assessments to identify the talents of students with hierarchic thinking styles rather than considering only time-limited testing.</p>
<p>A hierarchic thinking style and math scores in PSAT were significantly related.</p>	<p>People who like to be systematic and organized were not good at math scores on the PSAT.</p>	<p>Hierarchic people who like to be systematic and organized in their solutions to problems are not good at tests with short time allotted like the</p>

		<p>PSAT because they need time to organize themselves. Therefore, schools or colleges should provide various assessments to identify the talents of students with hierarchic thinking styles rather than considering only time-limited testing.</p>
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RQ2: Are there differences between high-achieving high school males and females with respect to thinking styles?

Findings	Interpretation	Implications
<p>Males preferred the liberal/progressive thinking style more than females.</p>	<p>Males liked to go beyond existing rules and procedures and sought to maximize change more than females.</p>	<p>Males are good at responding to unexpected situations since they are more comfortable with ambiguous situations than females. Also, males have a tendency to overturn the establishment more than females. Even though people with a liberal/progressive thinking style may produce more new solutions, teaching how to make careful arguments for the status quo is also necessary in our society.</p>
<p>Males preferred the legislative/self-reliant thinking style more than females.</p>	<p>Males liked to do things in their own way and with their own strategies as compared to females. Males liked to make their own rules and plan things more than females did.</p>	<p>Males like inventing math problems rather than solving math problems in books; designing science projects rather than experimenting with prepackaged materials; writing alternative endings to existing stories rather than</p>

		remembering the individual events in existing stories; giving orders rather than receiving them; deciding on company policy rather than being told to follow company policy.
Females preferred the hierarchic thinking style more than males.	Females liked to be more systematic and organized in their solutions to problems than males.	Females need more specific instructions than males. Females can be good performers in hierarchic institutions and schools. However, teachers should make sure that female students perform by depending on their priorities rather than just by making lists.

RQ4: How are thinking style preferences of high-achieving students attending a governor's school in science and technology different from those of high-achieving students participating in International Baccalaureate (IB) programs with a focus on the liberal arts?

Findings	Interpretation	Implications
Students in IB programs preferred an external thinking style to students in the Governor's School Program.	High school students attending a program with an academic focus of liberal arts tended to be people-oriented, outgoing, sharing ideas with others, as opposed to students in a program with an academic focus of science and technology.	High school students attending a program with an academic focus of liberal arts need information about a variety of career possibilities utilizing their talents of interaction among people and preference to be involved with others.
Students in IB programs preferred a hierarchic thinking style to students in the Governor's School Program.	High school students attending a program with an academic focus of liberal arts tended to be systematic and organized in their solutions to problems in comparison to students in a program with an academic focus of science and technology.	High school students attending a program with an academic focus of liberal arts need more specific and systematic career-related guidance to help them to approach the desired areas for future careers.

RQ5: What influences students' choice of career during high school?

Influences of Career-Related Programs in High School

Findings	Interpretation	Implications
Students listed AP courses, dual enrollment, and mentoring as their preferred career-related programs in high school.	Students liked academic courses for advanced learning such as AP and dual enrollment as a career-related program.	In-depth knowledge in various subjects should be provided through advanced academic courses to help students to identify their passion and career aspirations.
Students in the IB programs preferred career guidance, workshops for career development, and cooperative education more than students in the governor's program did.	High school students attending a program with an academic focus of liberal arts liked career guidance services, workshops for career development, and paralleling their academic and vocational studies with a job in a related field.	High school students attending a program with an academic focus of liberal arts need connections between academic knowledge and real job situations.
Students in the governor's program preferred dual enrollment and mentoring more than students in the IB	Students in a program with an academic focus of science and technology liked dual enrollment and	In-depth academic knowledge and mentoring are important for students. Students need to be connected to

<p>programs did.</p>	<p>mentoring among various career-related programs.</p>	<p>appropriate mentors, depending on their desired career. Also, dual enrollment in both high school and college is advantageous to students because it allows them to start their college learning early and saves money for college.</p>
<p>Career guidance by counselors, workshops or sessions, and tech prep were the top three least-preferred career-related programs in high school.</p>	<p>Students did not like career guidance by counselors, workshops or sessions, and tech prep.</p>	<p>Educators and policy makers need to find out the reasons for students disliking counselors' guidance, career-related workshops, and tech prep. Educators need to develop effective career-related services based on students' needs.</p>
<p>Guidance counselors appeared to be not helpful in guiding students toward careers, and displayed a lack of knowledge about careers as well as</p>	<p>Guidance counselors did not have enough knowledge about the variety of careers, and did not have enough understanding of individual differences</p>	<p>Career counselors need professional development to advance their knowledge of a variety of professional careers and to improve their skills in</p>

about students' interests or talents.	in talents and preferences.	counseling for a better understanding of high performing students.
Workshops were not effective because they provided a minimal amount of exposure to the actual profession; they provided no field-work experience; they were uninformative, boring, and too general; they did not match the individual students' specific needs.		Workshops for career education should be designed in a way to deal with more specific information such as surveying students to decide workshop themes, providing self-assessment opportunities to identify students' talents and preferences, and providing opportunities to meet experts in the various professional fields in order to address students' specific needs for information.
Among career-related programs, students could not make a connection between academic subject-related programs, including AP courses and dual enrollment, and future careers.		Curriculum should be designed to make connections between academic knowledge and utilizing this knowledge in the real world to let students understand the value of

<p>Students considered that those academic subject-related programs are just rigorous programs, which allow them to obtain college credits.</p>		<p>academic knowledge for their future careers.</p>
<p>Students in IB programs had a hard time fitting the AP courses into the IB schedule.</p>		<p>The AP course schedule should be more flexible to allow students in the IB program to take courses.</p>
<p>Students who did not like mentorships mentioned that mentoring is not effective in terms of required time versus learning, and not rigorous enough.</p>		<p>Guidance counselors and educators need to understand students' needs and preferences in mentorship activities to match them with appropriate mentors. Educators need to try to obtain a variety of mentors to address individual needs.</p>
<p>Internships and tech-prep were too specific since many students don't really yet have a defined career focus.</p>		<p>Differentiated career-related services depending on the formation of students' career aspirations will help</p>

<p>Also, some students felt that job shadowing and cooperative education is time consuming because job shadowing does not provide actual job experience like a mentorship or internship. Some students did not like cooperative education because it limits career experience to one professional area.</p>		<p>both students and participating institutions to have valuable experiences.</p>
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Important Factors Influencing Students' Career Choice

Findings	Interpretation	Implications
<p>Students listed their own interests, and the family environment such as parental expectations or a family job as the most important factors influencing their choice of a possible future career.</p>		<p>Students' passion for a specific subject was the most important factor for high achieving students' career choices. Most students mentioned their own interests and their parents' expectations together, indicating that parents tended to develop students' talent and career interests based on the students' interests. Most critical elements for career development should be encouraging students to identify their interests and talents. Career guidance and teachers need to assess students' talents and interests thoroughly.</p>
<p>In addition to students' interests and family environment, various programs, including extracurricular activities, school classes or program, mentorship, and</p>		<p>Partnerships with communities will help students to have a variety of educational experiences and information outside of school, which will lead students to</p>

internship, were influencing factors for students' career choices.		identify their interests.
Sixteen students (8%) mentioned that expected income or motivation for success were also influencing factors for career decision making.	High school students were motivated by future economic stability and success in their career areas.	High school students need information about expected income within different careers and expected social positions for different career paths.

STATEMENT	1	2	3	4	5	6	7
9. I like to play with my ideas and see how far they go.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. When faced with a problem, I use my own ideas and strategies to solve it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. When working on a task, I like to start with my own ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I like to check and rate opposing points of view or conflicting ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I feel happier about a job when I can decide for myself what and how to do it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I like situations where I interact with others and everyone works together.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. I prefer tasks or problems where I can grade the design or methods of others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. When trying to make a decision, I rely on my own judgment of the situation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. I like projects that allow me to look at a situation from a new perspective.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I like situations where I can use my own ideas and ways of doing things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. I like to set priorities for things I need to do before I start doing them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I like situations where I can try new ways of doing things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. When starting something, I like to make a list of things to do and to order the things by importance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. When making a decision, I try to take the opinions of others into account.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

STATEMENT	1	2	3	4	5	6	7
23. In talking or writing down ideas, I like to have the issues organized in order of importance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. I like projects in which I can work together with others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. In a discussion or report, I like to share ideas and get input from other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. I like to challenge old ideas or ways of doing things and to seek better ones.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. I like situations where I can compare and rate different ways of doing things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. When working on a project, I like to share ideas and get input from other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. In dealing with difficulties, I have a good sense of how important each of them is and what order to tackle them in.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. I enjoy work that involves analyzing, grading, or comparing things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. I like projects where I can study and rate different views or ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. I like to take old problems and find new methods to solve them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix D

A Questionnaire related to career choices and students' sensitivity toward environmental forces

Instruction: Please answer all of the questions below.

Part I. Demographics

1. Gender

Male Female

2. What is your current PSAT score?

Critical Reading _____ Math _____ Writing

3. What is your age? _____

4. Which type of high school program are you in?

IB program Governor's school program

Part II. Impact of school program on career choice

5. Have you decided on your future career?

- Yes No

a. If yes, what is your selected career focus?

- Architecture, Engineering, or Drafting
- Arts, Visual and Performing, Writer
- Business and Finance/Management
- Computers and Math
- Construction
- Medical Support, Treatment, or Technology
- Installation and Repair
- Law and Government
- Office and Administrative Support
- Personal Care and Culinary Services
- Production
- Protective Services
- Sales
- Science, Environment
- Social Science, Education, Museum Work, and Library Science, Media and Communication
- Sports and Fitness
- Transportation
- Other (Please explain) _____

b. If no, what career focus may you be interested in? (check all that apply)

- Architecture, Engineering, or Drafting
- Arts, Visual and Performing, Writer
- Business and Finance/Management
- Computers and Math
- Construction
- Medical Support, Treatment, or Technology
- Installation and Repair
- Law and Government
- Office and Administrative Support
- Personal Care and Culinary Services
- Production
- Protective Services
- Sales
- Science, Environment
- Social Science, Education, Museum Work, and Library Science, Media and Communication
- Sports and Fitness
- Transportation
- Other (Please explain) _____

6. What kinds of career development programs exist in your school? Check all that apply.

- Career guidance from school guidance counselors
 - AP courses
 - Dual enrollment
 - Workshop or sessions for information about career development
 - Cooperative education (alternate academic and vocational studies with a job in a related field)
 - Internship (work for an employer for a short time to learn about a specific occupation)
 - Job shadow (follow an employee at the workplace for one or more days to learn about a job)
 - Mentoring (paired with an employee who helps students master specific skills and knowledge over time.)
 - School-sponsored enterprise (produce goods or offer services to be purchased or used by others, usually involved in managing the enterprises)
 - Tech prep (take a planned program of study with a defined career focus)
 - Other (Please explain)
-

7.

a. What do you like the most about programs in schools related to career development? List in order of preference your three favorite career related programs (1=most favored).

- Career guidance from school guidance counselors
 - AP courses
 - Dual enrollment
 - Workshop or sessions for information about career development
 - Cooperative education (alternate academic and vocational studies with a job in a related field)
 - Internship (work for an employer for a short time to learn about a specific occupation)
 - Job shadow (follow an employee at the workplace for one or more days to learn about a job)
 - Mentoring (paired with an employee who helps students master specific skills and knowledge over time.)
 - School-sponsored enterprise (produce goods or offer services to be purchased or used by others, usually involved in managing the enterprises)
 - Tech prep (take a planned program of study with a defined career focus)
 - Other (Please explain)
-

- b. From the above list of programs, what do you like the least? And why?
- c. From the above list of programs, what kinds of programs have you not experienced?
8. What are the most important factors that have influenced your choice of your possible future career? (For example, parents expectation, school career related programs, extra curricula activities, etc) And how these factors influenced you?
9. What kinds of educational experiences related to future career during high school affected your career plans the most?

Part III. College Choice

10. What is the most important factor for you making a college choice? Rank order the three most important factors (1 = most important).

- General college prestige
- Specific department prestige
- Proximity
- Financial aid
- Scholarship
- Current GPA
- Future career goal
- Diversity
- Other (Please explain) _____

Part IV. Career choices' Sensitivity toward Environmental Force

Instruction: Please rate how strongly you agree or disagree with the following statements. Please mark only one response choice per question.

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I will choose my career because of my previous extra curricular activities provided by parents.				
2. My mother's expectations motivated me to decide my desired career.				
3. My father's expectations motivated me to decide my desired career.				
4. I will consider my mother's preferred choice when I choose my career.				
5. I will consider my father's preferred choice when I choose my career.				
6. My mother advised me to choose my current desired career focus.				
7. My father advised me to choose my current desired career focus.				
8. My teachers' expectations helped me to decide my current desired career.				
9. My guidance counselors' expectations helped me to decide my current desired career.				
10. My friends' expectations helped me to decide my current desired career.				
11. I follow teachers' advice when I choose my career goals.				
12. I follow a guidance counselor's advice when I choose my career goals.				
13. I will choose my career because of my previous courses from school related to the desired career.				

Appendix E

Consent Form for Participation in a Research Study

Investigators: Mihyeon Kim

Study Title: The Relationship between Thinking Style Differences and Career choice for High Achieving Students

1. Invitation to Participate in a Research Study
You are invited to participate in this research The Relationship between Thinking Style Differences and Career choice for High Achieving Students
2. Purpose of the Research Study
The purpose of this study is to identify thinking style preferences of high achieving students, and to determine the relationship between thinking styles and career choices between students attending a governor's school specializing in science and technology and students attending an IB program focused on liberal arts. This study will also examine if thinking styles are related to the career choices within different disciplines. Furthermore, this study will examine how students with different thinking styles have different sensitivities to environmental forces.
3. Description of Procedures
Participation in this study involves completing questionnaires. There are no anticipated risks to participation. The only inconvenience is the time that the participants spend completing the questionnaires.
4. Benefits
The primary benefit of participation is the opportunity to contribute to research about understanding different thinking styles and career choice of high achieving students.
5. Confidentiality
The questionnaires that the students complete will be anonymous; no one will have access to participants' names. IDs will be used instead of names and no names will be used in any articles or reports about this research study. Completed questionnaires will be kept in a locked file cabinet in a secure office for the duration of the study and for an additional five years in case of potential need for verification. This is done to protect your privacy and to ensure the confidentiality of your responses.
You should also know that The College of William and Mary Institutional Review Board (IRB) may inspect study records, but these reviews will only focus on the researchers and not on your responses or involvement. The IRB is a group of people that reviews research studies to make sure they are safe for participants.
6. Voluntary Participation
You do not have to be in this study if you do not want to. If you agree to be in the study, but later change your mind, you may drop out at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.
7. Do You Have Any Questions?
Take as long as you like before you make a decision. We will be happy to answer any question you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact Mihyeon Kim at 757-221-2362 (mxkim3@wm.edu) or IRB representative Tom Ward (tjward@wm.edu).

Assent (Participant):

I have read this form and I would like to participate in this study of The Relationship between Thinking Style Differences and Career choice for High Achieving Students. I understand that I may change my mind at any time and not participate. I also understand that I will not be punished in any way if I decide not to participate. My signature also indicates that I have received a copy of this consent form.

Signature of Participant: _____

Date: _____

Signature of Primary Investigator

Phone

Consent (Parent or Guardian):

I have read this form and decided that my son/daughter may participate in this study of The Relationship between Thinking Style Differences and Career choice for High Achieving Students. Its general purposes, the particulars of involvement and possible hazards and inconveniences have been explained to my satisfaction. My signature also indicates that I have received a copy of this consent form.

Signature of Parent or Guardian: _____

Date: _____

Signature of Primary Investigator

Phone

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