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Thinking Perspective Profiles as a Predictor of Intelligence Analysts' Job Performance.

Curtis Rasmussen
Walden University

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College of Social and Behavioral Sciences

This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
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Abstract

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MA, American Military University, 2012

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Industrial-Organizational Psychology

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Abstract

Empirical research has supported the use of general cognitive ability to predict employee performance; however, studies have accounted for only a fraction of the variance. The current study addressed whether intellectual styles, which describe how individuals habitually acquire and use information, account for a significant portion of the variance in job performance not covered by general cognitive ability. The study followed a quantitative, nonexperimental design with a convenience sample of 77 intelligence analysts from 6 U.S. government agencies and 2 online professional groups. MindTime provided the primary theoretical framework. The International Cognitive Ability Resource, MindTime Profile Inventory™, and Self-Rated Analytic Job Performance Assessment were used to measure general cognitive ability and analytic job performance. Results of multiple linear regression analysis indicated that thinking perspectives profiles are valid predictors of job performance and contribute to the incremental validity of general cognitive ability as a predictor of analytic job performance. However, because of the high degree of collinearity, results were inconclusive. The findings add to the understanding of the relationship between intellectual styles and job performance of knowledge workers, and they reinforce links between industrial-organizational psychology and cognitive psychology.

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Dedication

This dissertation is dedicated to all those who are charged with deriving meaning from incomplete and possibly inaccurate information in an effort to create information used by leaders in the protection of the general public from all manner of threats and hazards.

Acknowledgments

I would like to thank all those who have supported my pursuits, academic and otherwise, over the last 2 decades. Most of all, I would like to thank my family for supporting my endeavors. Aside from my family, I would like to acknowledge the friends and colleagues who supported me, listened to my rants, provided me with sound advice, and opened doors for me. I would love to list everyone by name, but some individuals work in sensitive positions, so to respect their privacy and ensure equitability, I have chosen not to list any names.

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Chapter 1: Introduction to the Study

Job performance, like performance in other aspects of life, is an amalgamation of cognitive (i.e., intelligence) and noncognitive (i.e., personality) factors (Kuncel, Ones, & Sackett, 2010). Dostoevsky (1866) and Sagan (1980) acknowledged the cognitive and noncognitive aspects of human performance in different aspects of life. Kerbel (personal communication, June 23, 2017), the former lead analytic methodologist for the U.S. Defense Intelligence Agency, commented that temporal thinking, a noncognitive ability, is a valuable ability for intelligence analysts. Kerbel further commented that the temporal thinking ability of intelligence analysts is especially valuable in the development of future potentialities, such as the probability that an adversary will conduct a cyberattack.

Kerbel (2014) noted that the U.S. intelligence community has had difficulty identifying analysts who have superior temporal thinking abilities. In his 2007 paper for the National Defense Intelligence College, Moore provided support for Kerbel's assertions when he wrote that regardless of the technological aids developed for analyzing information, the ability of intelligence analysts to develop future potentialities remained the preeminent factor in analytic job performance. The job performance of intelligence analysts, like other knowledge work trades (e.g., software engineer or market analyst), involves a mixture of cognitive (i.e., intelligence) and noncognitive (i.e., personality) factors (Kuncel et al., 2010). General cognitive ability and its relevance to job performance are well-known factors in knowledge work trades (Kuncel et al., 2010). However, what is unclear is the relationship between the ability to develop future potentialities and the job performance of intelligence analysts.

Fortunato and Furey's (2009, 2010, 2012) MindTime theory provided a foundation for describing differences in temporal thinking ability. By using different thinking perspective profiles comprising different combinations of the Past, Present, and Future thinking perspective constructs of the MindTime theory (Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014), I sought to identify the relationship between cognitive and noncognitive factors and the job performance of intelligence analysts. The cognitive factor was general cognitive ability, commonly referred to as intelligence. The noncognitive factors were thinking perspectives and their interactions (e.g., Future/Past thinking perspective interaction), referred to as the thinking perspective profiles that describe how individuals habitually acquire, organize, and use information (Zhang & Sternberg, 2005).

Kozhevnikov (2007) recognized the potential importance of understanding intellectual styles. Kozhevnikov wrote that intellectual style could be the way to identify and describe performance beyond what individuals know about the jobs. Stanovich (2016) noted that despite having similar general cognitive ability, individuals often exhibit differences in their decision-making processes. Blazhenkova and Kozhevnikov (2012) noted that intellectual style could give individuals valuable insight into the workings of their own minds and could give organizations insight into differences between and among members of the workforce, including differences in job performance. Understanding how individuals habitually acquire and use information has the potential to benefit organizations and individuals.

This chapter includes a synopsis of previous studies on general cognitive ability and job performance, intellectual style and performance, and job and academic performance. In addition, the chapter provides a statement of the problem and an explanation of the purpose of the study. Following the foundational information are sections explaining the research hypotheses and definitions of theoretical constructs and terms. In the next section, I discuss the nature and significance of the study. Finally, I discuss the assumptions and limitations of the study, followed by a summary and a brief overview of Chapters 2, 3, 4, and 5.

Background

Selecting the most qualified employees is a critical task to ensure organizational success; employee selection and the study of selection methods are central to industrial psychology (Cascio & Fogli, 2010). Vinchur (2007) found that organizations were using various employee selection methods, so early industrial psychologists brought in scientific methodology grounded in experimental psychology and individual differences measurement to verify the efficacy of selection methods. Intelligence was among the first of the individual differences explored by early industrial psychologists. (Ones, Dilchert, Viswesvaran, & Salgado, 2010). Researchers have studied the relationship between general cognitive ability and job performance for more than 100 years (Ones et al, 2010).

An example of one of the earliest studies was that of Munsterberg (1913), an early industrial psychologist who emphasized empirical methodology. In his study of motormen, Munsterberg found that the motormen with higher general cognitive ability were less prone to accidents than those with lower general cognitive ability. Ghiselli and

Brown (1948) found in their review of 185 studies that general cognitive ability was a valid predictor of performance for skilled positions. By the mid-20th century, researchers had conducted numerous studies of general cognitive ability as a predictor of job performance (Ones et al, 2010).

Hunter and Hunter (1984) wrote that one of their most cited articles was a study on general cognitive ability as a predictor of job performance. They found in their reanalysis of studies from 1920 to 1971 that general cognitive ability was a good predictor for all but the least complex jobs, with validity increasing as the complexity of the jobs increased. Similar to Ghiselli and Brown (1948), Hunter and Hunter found that as job complexity increased, so did the validity of general cognitive ability as a predictor, with the lowest validities for the least complex jobs. Bertua, Anderson, and Salgado (2005) also identified general cognitive ability as a valid predictor of job performance. Cucina et al. (2016) provided further support for general cognitive ability as the dominant predictor of performance when they found that no single factor improved the validity of general cognitive ability for complex jobs and that cognitive ability always added incremental validity to other predictors (e.g., personality).

Although researchers have considered general cognitive ability the single best predictor of job performance, especially for more complex jobs (Becker, Volk, & Ward, 2015; Cucina & Walmsley, 2015; Krumm, Schmidt-Atzert, & Lipnevich, 2014; Schneider & Newman, 2015; Wee, Newman, & Joseph, 2014), measures of general cognitive ability have been found to account only for 25% of the variance in job performance (Cucina et al., 2016; Hunter & Hunter, 1984; Ziegler, Dietl, Danay, Vogel,

& Buhner, 2011); 75% or more of the variance in job performance remains a mystery (Cucina & Walmsley, 2015; Sternberg, Wagner, Williams, & Horvath, 1995).

Schmidt and Hunter (1998) commented that understanding the difference in the practicality of the hiring method involves the utility of the method, which predicts the potential value of the method to organizations as a factor of organizational performance. For example, if all candidates for employment have the same potential for performance, then the utility of any given selection method is zero (Schmidt & Hunter, 1998). However, all potential candidates have different strengths and weaknesses, so selecting the best candidates can increase the overall performance potential of organizations (Schmidt & Hunter, 1998). Selection methods that can help to identify the best candidates can benefit organizations based on the premise that better the employees, the more value they can provide to the organizations (Schmidt & Hunter, 1998). Research providing evidence of the factors that account for a small portion of the remaining variance might contribute valuable information regarding selection methods, especially with an effort to do more with a smaller workforce.

As McKenna (1972) observed, human beings are composed of experiences, abilities, and other factors. General cognitive ability is one portion of the composition that explains only 25% of the variance in job performance (Cucina et al., 2016; Hunter & Hunter, 1984; Ziegler et al., 2011), leaving the rest of job performance unexplained. Identifying some of the remaining variance in job performance could lead to a better understanding of the reasons some people exhibit high performance but others do not. Armstrong, Cools, and Sadler-Smith (2012), as well as Cegarra and Hoc (2005), observed that intellectual style is one of the potential elements of job performance. Armstrong, Cools, et al. and Cegarra and Hoc asserted that intellectual style could help to describe the remaining variance not explained by general cognitive ability. However, researchers have not addressed intellectual style as a predictor of job performance.

Studies of the ways in which people habitually find, interpret, and use information to solve problems have fallen under the general category of the study of styles (Zhang, Sternberg, & Rayner, 2012). The study of styles started with Allport's styles of life (as cited in Zhang et al., 2012). However, unlike cognitive researchers who have favored the Cattell-Horn-Carroll (CHC) theory of intelligence (Lichtenberger & Kaufman, 2013), style researchers have not identified a unifying theory or a small set of unifying theories (Zhang et al., 2012). Instead, style researchers have developed theories and styles that often include similar terminology for different constructs (Zhang et al., 2012). Coffield, Mosely, Hall, and Ecclestone (2004) wrote that terminology in the study of styles could be confusing. In this study, I used the term *intellectual style* from Zhang and Sternberg's (2005) threefold model of intellectual styles when discussing styles generally and the term *specific style construct* when discussing specific styles or results of studies.

One of the issues that has arisen in the study of intellectual styles has been the number of styles with overlapping or similar terms and constructs (Coffield et al., 2004; Zhang et al., 2012). Despite the endemic issues of studying styles, Chan (2010) noted that intellectual styles provide unique information on the ways that individuals perform. Chan wrote that intellectual styles describe what people tend to do, personality describes individuals' typical performance, and measures of general cognitive ability describe individuals' maximal performance. According to Chan, intellectual styles fill the gap between personality and general cognitive ability in relation to performance. Studying intellectual styles could provide insight into job performance not provided by personality or general cognitive ability (Chan, 2010).

Although Armstrong, Cools, et al. (2012) wrote about the potential insights into employee performance, the study of intellectual styles has been limited to Chan (1996); Chilton, Hardgrave, and Armstrong (2005); and Gallivan (2003). These researchers used Kirton's (1976) decision-making styles, which include the innovator and adaptor styles that reside along a continuum. In addition, all three groups of researchers had similar hypotheses: They proposed that employees who had a style similar to the predominant style of the target population would exhibit higher job performance. Employees with decision-making style scores that fit the scores of the target population would exhibit higher performance and those with scores that were different from those of the target population score would exhibit lower performance (Chan, 1996; Chilton et al., 2005; Gallivan, 2003).

Although the studies by Chan (1996), Chilton et al. (2005), and Gallivan (2003) were similar, they had one important difference. Chan and Gallivan each made assumptions about the predominant style of the target populations that they studied. Chan, who had two populations comprising development engineers and staff engineers, assumed that the styles were innovator and adaptor, respectively, whereas Gallivan assumed that the predominant style of his target population was innovator. Chan and Gallivan assumed that a particular decision-making style would relate to higher performance. Conversely, Chilton et al. did not make any assumptions about the decision-making styles of their target population. Rather, they measured their sample taken from a chosen populaiton to determine the predominant style.

According to Chilton et al. (2005), the assumptions made by Chan (1996) and Gallivan (2003) were major limitations of their studies. Chilton et al. also wrote that the assumptions made by Chan and Gallivan likely contributed to both researchers failing to find statistically significant relationships between decision-making style and job performance. Chilton et al., who measured their sampel for predominant style, found a statistically significant relationship between decision-making style and job performance.

Chilton et al. (2005) found that their sample of the set population had a predominantly adaptor style. They determined that the closer individuals' scores were to those of the target population on the decision-making style continuum, the more likely it would be that the individuals would exhibit superior job performance. Conversely, as individuals' scores moved away from the median score of the target population on the continuum, the more likely it became that the individuals would exhibit poor job performance (Chilton et al., 2005). Consequently, Chilton et al. provided evidence supporting the concept promoted by other researchers such as Chan (2010).

Although Chilton et al. (2005) were the only researchers to provide evidence supporting a relationship between intellectual style and job performance, other evidence involving academic performance has been presented by education researchers. For example, Zhang (2001, 2004) had findings similar to those of Chilton et al. (2005). Zhang (2001) found that thinking style had validity as a predictor of academic performance. In her study of university students from Mainland China, Zhang (2001) reported that executive style was a valid predictor of academic performance. Zhang (2001) also found that (a) external style had validity as a predictor of the performance of students in physics; (b) local and internal styles had validity as predictors of the academic performance of students enrolled in the course Use of English; (c) judicial, hierarchical, and legislative styles had validity as predictors of the academic performance of students in Chinese literature; and (d) liberal style had validity as a predictor of the academic performance of students in geography.

In 2004, Zhang reported that hierarchal style had validity as a predictor of the academic performance of Hong Kong secondary students in classes that ranged from biology to Chinese history. Zhang also found that for students in the design and technology class, monarchic style had validity as a predictor of academic performance. Educational researchers such as Zhang have provided evidence supporting the relationship between intellectual style and performance, including job performance.

Although the study of intellectual style could provide insight into job performance, Coffield et al. (2004) cautioned that the study of intellectual style is not without several confounding issues. One confounding issues in studying the relationship between intellectual style and performance or any other factor is the number of constructs (Coffield et al., 2004; Nielsen, 2012; Rayner, Roodenburg, & Roodenburg, 2012). For example, Coffield et al. identified 71 style models, and Nielsen (2012) noted that hundreds of articles from the past decade have included a variety of style constructs. As researchers such as Coffield et al. have observed, the number of constructs is confusing.

In addition, many intellectual styles have constructs that overlap or are similar, despite being named differently (Zhang et al., 2012). The similarity of constructs might create confusion, especially when researchers attempt to compare research results (Coffield et al., 2004; Zhang et al., 2012). The subject of intellectual styles and style research has often been confusing and has lacked consistency (Zhang et al., 2012).

Coffield et al. (2004) noted that many styles have had an insufficient theoretical basis to warrant research or use. For example, some style taxonomies have drawn on theories developed by Piaget, Jung, and Dewey, whereas others have lacked a basic theoretical foundation (Coffield et al., 2004). However, some styles that have a basic theoretical foundation deviate from the basic theoretical foundation, especially when operationalized (Coffield et al., 2004). Because some styles have a weak theoretical basis or lack one completely, the items in the instruments used to measure intellectual style can contain faulty items and exhibit low reliability (Fitzgerald & Hattie, 1983). A style with a strong theoretical basis helps to link the style to other relevant research and ensure that the style criterion has empirical relevance (Reynolds, 2007). I used the MindTime theory, which has a strong theoretical foundation (Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014), .

Fortunato and Furey (2012) provided empirical evidence of the different aspects of the MindTime theory, such as the validity of the construct. However, Furey and Fortunato noted that no studies had addressed the relationships between performance and the different theoretical propositions comprising Past, Present, and Future thinking perspectives. The current study addressed the lack of research on thinking perspective as a predictor of performance.

The current study helped to address the following limitations in the literature on intellectual styles and predictors of job performance: (a) the lack of studies on the relationship between intellectual style and job performance; (b) the lack of methodological, rigorous studies on intellectual style and job performance; and (c) the limited number of empirical studies with a strong theoretical foundation identified by (Coffield et al., 2004). I conducted this study to examine the validity of thinking perspective profiles, including individual thinking perspective constructs (e.g., Future, Present, Past) and thinking perspective interactions, in which individuals exhibit equal or nearly equal levels of two or more thinking perspectives (Fortunato & Furey, 2009, 2010, 2012) as a predictor of intelligence analysts' job performance. In addition, to address methodological issues in the literature on intellectual style as a predictor of job performance, I did not assume that a specific thinking perspective profile was related to superior job performance; rather, I used a quantitative analysis to determine the relationships and their statistical significance. Finally, I addressed shortcomings related to the use of intellectual styles with weak theoretical foundations by using the MindTime theory, which has a sound theoretical basis (Fortunato & Furey, 2009, 2010, 2012).

Problem Statement

Welch (2005) asserted that hiring the right people for the right jobs is difficult, and that having the right people in the right jobs is critical to optimal organizational performance. Selecting the right individuals often involves the use of a measure of general cognitive ability, such as the Wechsler Adult Intelligence Survey (WAIS) or the Graduate Record Examination (GRE). According to Kerbel (personal communication, June 23, 2017), selecting the right people to fill positions as intelligence analysts requires identifying candidates with not only superior cognitive ability but also the ability to develop future potentialities using temporal thinking. However, the WAIS and the GRE do not measure temporal thinking ability; in particular, they do not measure how individuals habitually use temporal thinking.

Hunter and Hunter (1984), as well as Cucina et al. (2016), found that general cognitive ability has the highest validity of different predictors of job performance across a spectrum of jobs. However, general cognitive ability only explains 25% of the variance in job performance (Hunter & Hunter, 1984). Researchers have concluded that 75% of variance in job performance remains largely unexplained (Cucina & Walmsley, 2015; Cucina et al., 2016). Other predictors, such as personality, have varied validity as predictors, but none approaches general cognitive ability, and none adds incremental validity to general cognitive ability as a predictor (Cucina et al., 2016). Schmitt (2014) explained that regarding personality as a predictor of job performance, factors other than intelligence are context specific. The perceived importance of intelligence analysts' temporal thinking ability (J. Kerbel, personal communication, June 23, 2017; Kerbel, 2014; Moore, 2007; Walton, 2010) has contextual relevance to their job performance; however, the actual relevance of temporal thinking ability to the job performance of intelligence analysts has not been the subject of studies.

As Kerbel (2014), Moore (2007), and Walton (2010) have described, analytic work is best suited to individuals who have the ability to develop accurate future potentialities using temporal thinking (Suddendorf & Corballis, 2007). Intellectual styles, particularly the thinking perspective profiles on the MindTime theory (Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014), have the potential to identify individuals with the most applicable profiles to perform analytic tasks. The lack of research on intellectual styles should be of interest to industrial-organizational (I/O) psychologists (Chan, 2010) who have sought to provide scientifically based methods to select the right people to fill positions (Cascio & Fogli, 2010). However, few researchers outside of education have explored the relationship between intellectual style and job performance. The focus on positions in which analysis is conducted presents a unique opportunity to study populations, whose job tasks are fundamentally mental processes involving the acquisition and use of information (Heuer, 1999).

The lack of research on the relationship between intellectual style, especially as it relates to temporal thinking, and job performance has resulted in a gap in the knowledge of I/O psychologists and human resource (HR) professionals concerning the selection of individuals for positions that require the completion of tasks involving the development of future potentialities. The lack of research also has limited the number of potential tools that I/O psychologists and HR professional have to select the most appropriate candidates. Consequently, I/O psychologists, HR professionals, and organizations with analytic positions lack methods to assess the potential job performance of candidates in tasks involving temporal thinking.

Purpose of the Study

The purpose of the study was to determine whether analytic job performance is different based on individuals' thinking perspective profiles. Researchers have not provided empirical evidence of the ways that analysts (e.g., intelligence analysts) view and use information, which Heuer (1999), Marsh (2013), and Moore (2007) asserted are critical to analytic job performance. The current study provided empirical data to address the lack of research on the relationship between intellectual style and job performance, with an emphasis on analytic job performance. This study helped to address the shortcoming of traditional cognitive ability assessments (e.g., WAIS, GRE) that emphasize different cognitive abilities (e.g., verbal ability, mathematical ability) but ignore temporal thinking, an important factor for occupations engaged in complex decision making and sense making, such as intelligence analysts (J. Kerbel, personal communication, June 23, 2017).

An effort was made to determine the validity of thinking perspective profiles as predictors of intelligence analysts' job performance. Assessing thinking perspective profiles helped to establish whether different habitual approaches to the acquisition and use of information are related to analytic job performance. Thinking perspective profiles are intellectual styles from the theory of MindTime (Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014) that are focused on temporal thinking and how individuals habitually use different temporal perspectives when problem solving or sense making.

Research Questions and Hypotheses

The study was guided by two research questions (RQs):

RQ1: Does thinking perspective profile (i.e., Past, Present, and Future thinking) predict intelligence analysts' job performance?

H_{01}: Thinking perspective profile does not predict intelligence analysts' job performance.

H_{a1}: Thinking perspective profile predicts intelligence analysts' job performance.

RQ2: Does thinking perspective profile (i.e., Past, Present, and Future thinking) add incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance?

H_{02}: Thinking perspective profile does not add incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance.

H_{a2}: Thinking perspective profile adds incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance.

Definitions of Theoretical Constructs

I used one theoretical construct and two conceptual lenses. The MindTime theory, the theoretical construct, provided the framework to describe how the participants habitually perceived and processed information, along with how they interacted with their environment (see Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014). As the only theoretical lens in the study, the MindTime theory served as the basis for the comparison between general cognitive ability and intellectual style.

The first conceptual lens was the CHC theory of intelligence (see McGrew, 2009; Schneider & McGrew, 2012). Lichtenberger and Kaufman (2013) described the CHC theory of intelligence as the most commonly used theoretical basis to measure general cognitive ability. I used the CHC theory of intelligence as a conceptual lens to provide readers with foundational information about the theoretical underpinnings of the most common cognitive instruments. The WAIS (Furnham & Mansi, 2014; Schneider & McGrew, 2012) and the 16-item International Cognitive Ability Resource (ICAR16) are based on the CHC theory of intelligence (Furnham & Mansi, 2014; Schneider & McGrew, 2012). Use of the CHC theory of intelligence (see Schneider & McGrew, 2012) enhanced the theoretical basis of this study through the establishment of a theoretical foundation commonly used in cognitive research.

Similar to the CHC theory of intelligence (Schneider & McGrew, 2012), Zhang and Sternberg's (2005) threefold model of intellectual styles was not operationalized. The threefold model of intellectual styles was the second conceptual lens that provided a framework for comparing different intellectual styles taxonomies with each other based on empirical research (see Zhang & Sternberg, 2005). The threefold model provided a framework for the comparison of results from seemingly dissimilar empirical studies in Chapter 2, such as the studies conducted by Chilton et al. (2005) and Zhang (2001, 2004).

Nature of the Study

I used a quantitative, nonexperimental design. According to Garson (2013c), quantitative, nonexperimental designs do not include control groups, randomized samples, or the manipulation of the independent variables (IVs). Because the participants in my study were analysts working in organizations that could not afford lengthy disruptions within their workforces, assigning groups and manipulating the IVs was not possible, making a quantitative, nonexperimental research design the most appropriate design for this study (see Garson, 2013c).

The target population comprised individuals engaged in analytic tasks that involved risk, threat, and future predictive analysis. Because of the wide range of job performance factors, I assessed only factors associated with analytic tasks such as risk, threat, or future predictive analysis. In addition, because access to a large target population of analysts was unlikely, participants were obtained through convenience sampling. The study incorporated four data collection instruments: a demographic survey; the ICAR16, used to measure general cognitive ability (Condon & Revelle, 2014); the MindTime Profile Inventory™, used to measure Past, Present, and Future thinking perspectives (Fortunato & Furey, 2010, 2012); and the Self-Rated Analytic Job Performance Assessment (SAJPA), developed to measure job performance with a rating scale based on knowledge, skills, abilities, and other traits of intelligence analysts.

Definitions of Terms

The following terms were operationally defined for the purposes of this study:

Analyst: An individual in an occupation that involves tasks such as the collection, analysis, and evaluation of information from different sources to facilitate the development of reports and briefs on subjects such as terrorism and risk (O*NET OnLine, 2016). Titles of analyst positions can include intelligence analyst, criminal analyst, intelligence research specialist, cyber analyst, and risk analyst (O*NET OnLine, 2016).

Cognitive ability: The ability to understand task performance requirements and task end states, especially concerning largely mental tasks (e.g., writing a dissertation), according to Carroll (1993).

Decision-making style: The intellectual style that individuals prefer to solve problems and use information. Decision-making styles fall under the umbrella term of intellectual styles (Kirton, 1976).

General cognitive ability: A statistically derived factor often written as *g* that correlates with other types of cognitive abilities, such as general fluid intelligence and general crystallized intelligence, and encompasses the ability of individuals to engage in decision-making activities and complex thinking (Carroll, 1993).

Intellectual style: An umbrella term "that encompasses the meanings of all major 'style' constructs" such as learning style, cognitive style, and decision-making style, all of which describe how individuals habitually acquire and use information (Zhang & Sternberg, 2005, p. 1). The term also comes from Zhang and Sternberg's (2005) threefold model, which is a way to compare the constructs of different styles.

Intelligence: An observable attribute that can consist of (a) higher level components such as abstract reasoning and decision making, (b) attributes valued by a culture, and (c) executive processes such as the detection of complex patterns (Sternberg & Berg, 1986).

Intersubjectivity: The ways that concepts relate to one another based on an agreed construct of concepts, especially when defining new concepts and understanding the ways that the new concepts relate to earlier concepts (Reynolds, 2007).

Job performance: Clusters of key tasks identified during the course of a job analysis that define various performance dimensions within a specific job category (Borman, Bryant, & Dorio, 2010).

Mind styles: A style construct that describes how individuals perceive and order information (Gregorc, 1982).

Mode of thinking: A style construct that describes the preferred manner with which individuals view and use information analytically or holistically, or integrate analytic and holistic processes (Torrance, 1988).

Structure of intellect: A style construct that describes the ways that individuals prefer to frame and subsequently solve problems (Guilford, 1956).

Thinking style: A style construct comprising 13 individual style constructs associated with Sternberg's (1988) theory of mental self-government, which describes the ways that individuals address different problems and information.

Thinking perspective: A style construct of observable patterns of perceptual and cognitive mental activity made up of Past, Present, and Future thinking based on symbolic representations of temporal realities (Furey & Fortunato, 2014).

Thinking perspective profile: The patterns of Past, Present, and Future thinking that individuals use when interacting with their environment (Fortunato & Furey, 2012).

Assumptions

The first assumption was that the voluntary nature of participation did not bias the study. The second assumption was that all of the job positions occupied by the volunteers had similar requirements regarding knowledge, skills, and abilities. The third assumption was that the volunteers did not receive any assistance in answering any of the survey questions beyond reasonable accommodation (e.g., questions and answers read for an individual with macular degeneration).

Because of the largely compartmentalized nature of intelligence analysis, with analysts separated into different specialties in different organizations, a large and homogeneous target population did not exist (Walton, 2010). One assumption that cut across all three assumptions was that all analysts shared common skills, abilities, and tasks. For example, this study focused on individuals occupying analytic positions that included tasks requiring (a) the validation and integration of threat and hazard data (e.g., terrorists, cyberactors, and hurricanes) from multiple sources; (b) the collection and analysis of data and information from criminal, terrorist, and hazard databases; (c) the preparation of written reports, maps, and charts and the conduct of briefings on the analyzed data; (d) the study of activities and trends relating to terrorism, national security threats, and natural hazards; (e) collaboration with representatives from government and private organizations to share information and coordinate analytic activities; and (f) the drawing of conclusions based on data that often are incomplete and have different degrees of accuracy (O*NET OnLine, 2016). Regardless of specific analytic discipline (e.g., open source analyst, risk analyst), I assumed that the factors chosen for this study were representative of the common tasks, skills, and knowledge required of the individuals occupying analytic positions.

Scope and Delimitations

This study focused on a specific target population (i.e., intelligence analysts) and on specific aspects of that population, which limited potential generalizability of the results. The focus was based on the discipline of intelligence analysts involving knowledge work assessing future probabilities. Intelligence analysts represent a large and unstudied discipline, with an estimated 117,000 people working as intelligence analysts (O*NET OnLine, 2016) and no publicly available studies of the population. Studying a population that had not been studied previously gave me the opportunity to expand scientific knowledge andimproving the knowledge of different disciplines for I/O psychology researchers. However, generalizability of the findings was limited.

The scope of this study was further limited by the number of job performance factors assessed. Because factors that relate to job performance can range from personal relations to the operation of equipment and systems, I used only a limited set of factors related to cognitive ability and the acquisition and use of information. The factors used were derived from the knowledge, skills, and abilities list from O*NET (2016). Ten factors from the 308 factors listed by O*NET were used: (a) validate known intelligence; (b) gather, analyze, correlate, or evaluate information from a variety of sources; (c) prepare written reports and presentations based on research and analysis of intelligence data; (d) reading comprehension; (e) active listening; (f) critical thinking; (g) inductive reasoning; (h) problem sensitivity; (i) deductive reasoning; and

(j) analytical thinking. Other factors such as teamwork were not considered. The generalizability of the results was limited to jobs with similar performance factors.

I used the MindTime theory as a foundational component even though other intellectual styles existed. One of the key reasons behind the use of the MindTime theory was that it has a solid theoretical foundation. Although focusing on the MindTime theory limited generalizability of the results, the inclusion of the threefold model of style research allowed for a cross-style comparison of results.

Overall, this study had limited generalizability based on the target population of intelligence analysts and the use of the MindTime theory. However, because of the lack of studies on the discipline of intelligence analyst, and more specifically of predictors of job performance, coupled with the number of workers in the discipline, these limitations were reasonable. Although the use of the MindTime theory limited the generalizability of the results, the incorporation of the threefold model of style research mitigated that limitation. Although this study had a narrow scope, the findings provide valuable knowledge on a largely unstudied topic and unstudied discipline.

Limitations

The study had six limitations. First, the generalizability of the results was limited to target populations that matched the established criteria for volunteers in the study. Second, the results were limited in generalizability to analytic tasks. Job tasks outside of those studied could have indicated different relationships between intellectual style and job performance. The third limitation was that the diversity of organizations represented by the participants precluded direct application of the results to any single organization.

The fourth limitation involved convenience sampling: The sample might not have represented the target population accurately. The fifth limitation arose from the use of a self-reported job performance instrument, in which the potential existed for self-presentation bias and response style bias. Because job performance data came from the study participants and were susceptible to biases, the accuracy of the data was a limitation of the study design. The sixth limitation involved the inability of the study design to indicate causality. Because I used a nonexperimental, cross-sectional design, the results could not establish causality.

Significance

According to Chan (2010), intellectual style (i.e., what people tend to do) fills a gap between personality (i.e., what people typically do) and general cognitive ability (i.e., maximal performance). Understanding what people tend to do could provide insight into the habits that support analytic job performance. Because this study focused on analytic occupations (e.g., intelligence analysts) that involve acquiring and using large amounts of information (see Heuer, 1999), it was important to determine whether a particular thinking perspective profile related to better job performance.

Results of this study will contribute to understanding the relationship among general cognitive ability, intellectual style, and job performance that is of particular value to analytic communities. As Marsh (2013) and Moore (2007) noted, researchers have not described how analysts view and use information, which is important in understanding analytic job performance and selecting the best analyst candidates. The results of this study help to (a) increase the knowledge of job performance factors in I/O psychology and HR communities, (b) account for variance in analytic job performance not accounted for by general cognitive ability, (c) determine whether differences in analytic job performance are based on individuals' thinking perspective profiles, and (d) increase knowledge of analytic job performance factors.

Results of the study might have three positive social change benefits. First, the findings might add to the current understanding of the workings of the human mind as applied to job performance in positions that involve knowledge work. Second, the results might provide evidence of thinking perspective profiles as a potential alternative to general cognitive ability, which is associated with adverse impact (Outtz & Newman, 2010), as a selection factor for knowledge workers. Finally, the results might help to link I/O psychology research to cognitive psychology research.

This study also provided empirical evidence that thinking perspective profiles add incremental validity to general cognitive ability as a predictor of analytic job performance. For more than 100 years, researchers have provided empirical evidence of the validity of general cognitive ability as a predictor of job performance (Krumm et al., 2014; Munsterberg, 1913; Schneider & Newman, 2015). However, no researchers had addressed whether intellectual style adds incremental validity to general cognitive ability as a predictor of job performance. Empirical evidence did not exist on whether intellectual style adds to the validity of general cognitive ability and helps to explain the 75% variance in job performance (Cucina & Walmsley, 2015; Cucina et al., 2016) not explained by general cognitive ability alone.

Summary and Transition

More than 100 years of research has been conducted on the relationship between general cognitive ability (intelligence), an indication of maximal performance (Chan, 2010), and job performance, but only three studies had addressed the relationship between intellectual style and job performance. Even though Cegarra and Hoc (2005) noted that research into intellectual styles could benefit the field of I/O psychology, few had chosen to do so. Education researchers have recognized the potential benefit of identifying the relationship between intellectual style and academic performance (Kordjazi & Ghonsooly, 2015; Zhang, 2001, 2004), but few had conducted studies. Bernardo, Zhang, and Callueng (2002) indicated that a relationship between intellectual style and job performance likely exists. Evidence from education researchers has supported the notion that intellectual style might have value in describing variance in job performance. The current study addressed the call from Cegarra and Hoc as well as Chan for I/O psychologists to study the relationship between intellectual style and job performance.

Results of the study will add to the limited literature on the relationship between intellectual style and job performance. This study provided empirical evidence indicating a relationship between analytic job performance and thinking perspectives. This study also provided empirical evidence showing whether thinking perspective profiles add incremental validity to general cognitive ability as a predictor of analytic job performance. This study will help to expand the understanding of I/O psychologists and

HR personnel about the relationships among intellectual style, general cognitive ability, and job performance.

Chapter 2 provides a review of the literature separated into five sections. The first section includes the introduction, literature research strategy, and a general overview of the theoretical and conceptual lenses used in the study. The second section includes an overview of the CHC theory of intelligence and a review of the literature on general cognitive ability and job performance. The third section presents a review of empirical literature about general cognitive ability, intellectual style, and performance on measures of reasoning. The fourth section is an overview of the threefold model of intellectual styles, intellectual style terms and taxonomies, intellectual style and academic performance, and intellectual style and job performance. The final section includes a discussion of the MindTime theory and the conclusion.

Chapter 2: Literature Review

Schmidt and Hunter (1998) and other researchers (e.g., Cucina et al., 2016; Ziegler et al., 2011) observed that general cognitive ability is one of the best predictors of job performance, with validities that range from .21 to .72 (Ree, Earles, & Teachout, 1994). However, general cognitive ability accounts for only 25% of the variance in job performance (Cucina et al., 2016; Hunter & Hunter, 1984; Ziegler et al., 2011). Researchers (e.g., Cortina, Goldstein, Payne, Davison, & Gilliland, 2000; DeGroot & Kluemper, 2007). have sought to identify different variables, one of which is personality, to explain the remainder of the variance. One potential variable that could explain some of the residual variance is intellectual style (i.e., thinking perspective), which describes how individuals process and apply information (Blazhenkova & Kozhevnikov, 2012; Zhang & Sternberg, 2005). However, as Chan (2010) and Zhang (2013) found, few researchers have conducted studies about intellectual style in relation to specific occupations and/or job performance. After an extensive review of the literature, I did not find any studies on the predictive validity of thinking perspective as a type of intellectual style. Thinking perspective refers to specific patterns of perceptual and cognitive mental activity that follow from how individuals use their episodic and semantic memory systems to ensure biological survival. This study had two purposes: (a) to examine whether thinking perspective profile predicts job performance, and (b) to determine whether thinking perspective moderates the relationship between general cognitive ability and job performance. Findings might provide relevant information regarding the relationship among general cognitive ability, intellectual style, and job performance in the workplace.

I separated the literature review into five topic sections. The first section is a review of empirical literature on general cognitive ability and job performance. The second section is a brief overview of intellectual style taxonomies. The third section is a review of literature about intellectual style and academic performance, which represents the richest source of literature on intellectual style as a predictor of performance. The fourth section is a review of literature about intellectual style and job performance. The fifth section is an overview of the MindTime theory. Also provided in Chapter 2 is a summary of gaps in the relevant literature. Using implications from previous research and an assessment of gaps, I include evidence of the need for more research involving the relationship among general cognitive ability, intellectual style, and job performance.

Literature Search Strategy

The two-stage search for relevant literature was related to the main research topics of (a) general cognitive ability and job performance, and (b) intellectual style and job performance. The first stage involved a search of key terms using online databases. Searches involved groups of keywords (e.g., *thinking style*, *job performance*) from the list of keywords related to each of the main topics. The first stage involved searches of the following databases: PsycINFO, Thoreau Multi-Database Search, Academic Search Complete, ProQuest Central, and Science Direct. The searches also included two limiters to ensure the reliability of the sources and reduce the number of sources that only tangentially used the keywords. The first limiter was the "peer review" limiter, which helped to ensure that all of the results were from peer-reviewed sources. The second limiter involved setting the search field to "abstract" so that the search engine would search only abstracts for the two keyword groups.

Search engines were set to sort the results based on relevance. For the search engines, setting the search to sort results to "list by relevance" causes the search algorithm to rank documents first by the number of times the keyword or keywords appear in the text (Jindal, Bawa, & Batra, 2014). The search engine lists documents in descending order with the document that includes the keyword or all of the keywords, with the most occurrences of the keyword or keywords first (Jindal et al., 2014). Next, the search engine lists documents with words that relate (i.e. synonyms) to the keyword or keywords (Jindal et al., 2014). Reviews of results included the first 100 relevant sources.

The search for literature for general cognitive ability and job performance included one to two keywords from each of the keyword groups. The first keyword group included (a) *cognitive*, (b) *ability*, (c) *intelligence*, and (d) *mental*. The second keyword group included (a) *job*, (b) *occupation*, and (c) *performance*. The search returned more than 3,000 sources from the combined databases. Of the 3,000 sources, only eight empirical articles were related to cognitive ability and job performance, including five meta-analytic studies.

Eight articles from a keyword search that returned several thousand might seem very low. However, a keyword search for sources about general cognitive ability and job performance involving searches with a single keyword such as *intelligence*, even when combined with the keywords *job performance*, returned numerous articles about emotional intelligence. For example, a keyword search of the Science Direct databases for *intelligence* and *job performance* returned 28 sources. Of the 28 sources, 23 involved emotional intelligence, which left five articles. Of the five remaining articles, only the article by Kuncel et al. (2010) involved intelligence as a predictor of job performance. However, the article by Kuncel et al. was a literature review that addressed only general cognitive ability (intelligence) and job performance in broad terms. Consequently, the combination of keywords contributed to the search results and finding eight articles applicable to the study.

As in the first-stage search for relevant literature, I used one to two keywords selected from each keyword group for the search for the topic of intellectual style and job performance. The first keyword group included (a) *intellectual*, (b) *thinking*, (c) *learning*, (d) *cognitive*, and (e) *style*. The second keyword group included (a) *job*, (b) *occupation*, and (c) *performance*. The search returned more than 4,000 sources, only one of which matched the subject. Most of the search results that involved performance were articles about academic performance; I later expanded search parameters to include articles about intellectual styles and academic performance that could apply to the study.

Zhang (2013) found, as I did, that keyword searches did not produce a large number of results. Zhang identified 52 sources from her keyword search that covered a broader subject area than my search because she was searching for keywords related to intellectual styles and jobs. Zhang used a chain-of-citations search technique, also known as the snowball technique, to increase the number of sources that she could draw from.

The second stage of the literature search involved a chain-of-citations search (Garson, 2013d). The articles identified during the first stage of the literature search and books identified from prior research provided the seed material for the chain-of-citations search. For each of the sources, the procedure Garson described provided the method for identifying appropriate sources. The next step consisted of a review of each of the sources for appropriateness, including identifying empirical sources that provided original empirical research or a meta-analysis of research related to the research topics. The process was repeated five times for a five-level deep search.

The second-stage search resulted in the identification of an additional three literature sources for the topic of cognitive ability and job performance. Although 11 sources for general cognitive ability and job performance might seem very low, especially when researchers such as Schmidt (2002) have reported that thousands of studies exist, many of the sources included unpublished or limited-access studies. For example, Hunter (1983) used data from 515 validation studies conducted by the U.S. government over 40 years that often are not available to the public. In addition, many of the researchers referenced similar research articles, such as Hunter and Hunter's (1984) article, and often did not reference unique works. I confirmed this search problem with J. Cucina (personal communication, January 13, 2016). Although I did not have a large number of empirical sources, many of the sources that I located were meta-analyses that provided ample support for the assertion of the validity of general cognitive ability for predicting job performance.

The second-stage search for articles relating to intellectual style and job performance resulted in the identification of two more empirical studies. Moreover, one additional article addressing a study involving intellectual style and person-organization fit, which provided support for Chilton et al.'s (2005) findings, came to light. In addition, the second-stage search elicited another six empirical articles that addressed the intellectual style differences of individuals in different occupations. I added articles to the literature review because they provided tangential support for the studies conducted by Chan (1996) and Chilton et al.

Theoretical Construct and Conceptual Lenses

One theoretical construct and two conceptual lenses underpinned this study. The first conceptual lens was the CHC theory of intelligence, one of the most commonly studied and used theories of intelligence (Furnham & Mansi, 2014; McGrew, 2009; Schneider & McGrew, 2012). Several of the most common clinical cognitive instruments (e.g., the WAIS) follow the CHC theory of intelligence, and researchers consider it a consensus psychometric model because of its frequent use (Furnham & Mansi, 2014; McGrew, 2009; Schneider & McGrew, 2012).

The second conceptual lens was Zhang and Sternberg's (2005) threefold model of intellectual styles. The threefold mode of intellectual styles provided a framework for comparing the different constructs (e.g., mind style, decision-making style, etc.) describing how individuals habitually acquire and use information for decision-making and problem-solving activities. The use of the threefold model allowed me to compare studies addressing different styles.

The theoretical construct used was the MindTime theory (Fortunato & Furey, 2009; Furey & Fortunato, 2014), which is a way to describe how human beings perceive and process information and interact with their environment. The MindTime theory provided two valuable elements for this study, namely, a foundation for the identification and description of noncognitive factors related to job performance, and a strong theoretical basis for the study.

General Cognitive Ability Literature

Cognitive ability has a rich history in psychology as one of the most studied topics (Wasserman, 2012). Cognitive ability is one of the most common topics of research in I/O psychology, and numerous researchers have found it to be one of the best, if not the best, predictor of job performance (Cucina et al., 2016; Ghiselli, 1973; Hulsheger, Maier, & Stumpp, 2007). Because of the rich history of research involving cognitive ability and job performance, I reviewed a select number of articles retrieved from a variety of databases (e.g., PsycINFO). I also focused on research articles that involved meta-analyses to provide the widest range of studies. The review includes articles from a wide date range as well as meta-analytic studies to capture the best possible assortment of information to illustrate the validity of cognitive ability as a predictor of job performance.

Frankfort-Nachmias and Nachmias (2008) wrote that using a theoretical lens for a study is the basis for gaining a general understanding and presenting the operational definitions. In turn, having a general understanding and operational definitions enhances the ability of researchers to discuss aspects of their studies in efficient and precise ways

(Frankfort-Nachmias & Nachmias, 2008). A theoretical lens also facilitates the replication of research because it provides a foundation for describing the phenomenon. For example, some researchers have viewed cognitive ability through the lens of Spearman's two-factor theory of intelligence, which has constructs different from those in the CHC theory of intelligence (Stankov, 2005). Even with their being differences, these theories have similar terms (e.g., general cognitive ability) that provide a theoretical lens to promote a common understanding. Using a theoretical lens also promotes the organization of past findings and helps to identify gaps in the literature (Schneider & McGrew, 2012). This identification of gaps is especially pertinent, given that as Scarr (1986) wrote, intelligence can comprise a single factor or many factors.

The CHC theory of intelligence evolved from combining Cattell and Horn's *Gf-Gc* and Carroll's three-stratum theories of intelligence (McGrew, 2009; Newton & McGrew, 2010; Schneider & McGrew, 2012). McGrew (2009) wrote that the CHC theory of intelligence had separated cognitive abilities into three different strata that formed a pyramid shape, with first-stratum abilities forming the base, second-stratum abilities in the middle, and third-stratum ability (general cognitive ability) as the capstone.

First-stratum cognitive abilities include 70 narrow cognitive abilities (Furnham & Mansi, 2014; Newton & McGrew, 2010) such as "induction," which is the "ability to discover underlying characteristics (e.g. rule, concept, principle, process, trend, class membership) that underlie a specific problem" (McGrew & Evans, 2004, p. 6). The second stratum of the pyramid includes: (a) general fluid intelligence, (b) general crystallized intelligence, (c) general knowledge, (d) visual-spatial abilities, (e) auditory processing, (f) short-term memory, (g) long-term storage and retrieval, (h) cognitive processing speed, (i) decision time, (j) psychomotor speed, (k) quantitative knowledge, (l) reading/writing, (m) psychomotor abilities, (n) olfactory abilities, (o) tactile abilities, and (p) kinesthetic abilities (McGrew & Evans, 2004; Schneider & McGrew, 2012). The third stratum, which forms the capstone of the pyramid, is general cognitive ability.

Three factors supported the decision to use the CHC theory of intelligence. The first factor was the viewpoint of cognitive science researchers. Several cognitive science and education researchers have considered the CHC theory of intelligence a state-of-the-art psychometric theory (Gomes, de Araujo, Ferreira, & Golino, 2014; McGrew, 2009; Sternberg, 2012). The second factor was the recognition by researchers that the CHC theory of intelligence is the most validated structural model in existence (McGrew & Evans, 2004). For example, Carroll’s (1993) exploratory analysis of 460 cognitive ability data sets provided empirical evidence that supported Carroll’s three-stratum theory of intelligence, a key component of the CHC theory of intelligence. The third factor was the prevalence of cognitive ability instruments that used the CHC theory of intelligence as their theoretical foundation (Newton & McGrew, 2010). For example, such instruments as (a) the WAIS (4^{th} ed.), (b) the Woodcock-Johnson III Tests of Cognitive Abilities, and (c) the Stanford-Binet Intelligence Scales use the CHC theory of intelligence as their theoretical foundation (Newton & McGrew, 2010). Consequently, the CHC theory of intelligence provided a strong theoretical lens backed by research, researchers, and instruments on a scale that most other theories cannot match.

Measures of General Cognitive Ability for Employee Selection

Farr and Tippins (2010) wrote that since the inception of I/O psychology, one of the central fields of study has been the selection of employees. Vinchur (2007) noted that employee selection not only is a central field of study in I/O psychology but that it also predates I/O psychology, being one of the factors that led to the development of I/O psychology. Vinchur asserted that early psychologists, who focused on industrial activities, concentrated on the ways that individual differences could affect functional, business-related outcomes such as production.

Over the next century, psychologists and later I/O psychologists evaluated many different predictors of performance (Farr & Tippins, 2010; Vinchur, 2007). From the early years of the 20th century until the 1960s, general cognitive ability was the focus of job performance predictor research in the United States (Farr & Tippins, 2010; Vinchur, 2007). Starting in the 1960s, the emphasis shifted from general cognitive ability to personality as a predictor of job performance (Vinchur, 2007).

Measures of general cognitive ability fell out of favor with organizations in the United States starting in the 1970s (Ones et al., 2010). However, by the late 1990s, upwards of 50% of surveyed organizations ($N = 959$) still used some measure or indication of general cognitive ability (Ryan, McFarland, Baron, & Page, 1999). According to Richardson and Norgate (2015), to date, one of the more common ways to assess general cognitive ability is through the use of surrogate measures that include tests such as the GRE rather than traditional psychometric measures such as the WAIS. Ones et al. (2010) wrote that the number of measures of general cognitive ability likely ranges into the hundreds and spans the gamut from well-known measures (e.g., GRE, WAIS) to organizationally derived measures.

Aside from tests such as the GRE, other surrogate measures of general cognitive ability exist. These measures can include situational job tests and assessment centers (ACs; Dilchert & Ones, 2009; Ones et al., 2010). Dilchert and Ones (2009) found in their study of ACs that the problem-solving dimension from the AC assessment correlated with general cognitive ability ($N = 4856$, $r = .32$) with an overall correlation of .43 ($N = 5419$) = 4,856, $r = .32$).

Although traditional measures of general cognitive ability might have fallen out of favor with organizations regarding the selection of employees, it does not mean that the measures are not used. Measures such as situational job tests and ACs as predictors of job performance still relate to general cognitive ability. The study of general cognitive ability and its relationship to other possible predictors of job performance is still important.

Increasing Incremental Validity of General Cognitive Ability

As already mentioned, the study of selection methods occupies prominence in I/O psychology. Within the realm of employee selection, Ovidiu (2015) remarked that improving selection methods is a prime concern. Although general cognitive ability remains the best overall predictor of job performance (Cucina et al., 2016), researchers should continue to research other potential predictors (Cucina, Gast, & Su, 2012). For example, Ovidiu found that measures of personality added incremental validity ($\Delta R^2 = .268$, $F[3,30] = 7.010$, $p = .001$) to general cognitive ability ($N = 36$, $r = .462$,

$p < .5$) as predictors of job performance. However, Ovidiu noted that his results likely resulted from the specificity of his approach and, as Ones, Viswesvaran, and Dilchert (2005) noted, context can affect validity. For example, for some jobs, specific factors (e.g., conscientiousness, extraversion) might have greater validities, but for other jobs, they might not (Ovidiu, 2015).

In regard to intelligence analysts, thinking perspective profiles have the potential to be a specific factor that could add incremental validity to general cognitive ability as a predictor of job performance. Kerbel (personal communication, June 23, 2017), a researcher at National Intelligence University specializing in intelligence analysis, noted the importance of temporal thinking to analytic performance. However, to date, there has been a paucity of research either supporting or refuting Kerbel's assertion. Even with the lack of directly relevant research, some research exists that provides a modicum of support for the concepts that temporal thinking and thinking perspective profiles are relevant predictors of analytic performance. For example, Poore, Forlines, Miller, Regan, and Irvine (2014), in their study of prediction, aggregation, display, and elicitation project participants, found that intellectual style was a poor predictor of forecasting accuracy by itself, with Brier scores (BS) ranging from insignificant ($n = 835$) to .16 ($n = 838$, $p < .001$). Instead, Poore et al. found that intellectual style was a better predictor of forecasting confidence (BS = -.09, $p < .05$) than general cognitive ability was, which was insignificant. Poore et al. concluded that combining a measure of general cognitive ability with a measure of intellectual style would better predict forecasting ability through the mitigation of forecasting confidence bias.

Another study that supported the notion of the applicability of intellectual style as a predictor of job performance was Mellers et al.'s (2015) investigation of 743 individuals engaged in forecasting activities. Similar to Poore et al. (2014), Mellers et al. found that intellectual style was a predictor of forecasting ability, albeit a weak predictor. Mellers et al. found that open-minded intellectual style predicted forecasting accuracy (BS = -.10, t[742] = -2.51, $p < .01$). They also found that the best forecasters not only scored higher on measures of general cognitive ability than others, who were above average, but also exhibited a higher level of the open-minded intellectual style. Studies by Mellers et al. and Poore et al. have provided some support for the notion that intellectual style has validity as a predictor of performance.

General Cognitive Ability and Job Performance

Researchers for more than 100 years have determined that general cognitive ability is one of the best predictors of job performance (Ghiselli, 1973; Hulsheger et al., 2007; Hunter & Hunter, 1984; Ree & Earles, 1992; Ree et al., 1994). For example, Cucina, Su, Busciglio, and Peyton (2015) determined that general cognitive ability tests ($r = .51$) had validity beyond other methods for predicting job performance, such as (a) job knowledge tests ($r = .48$); (b) unstructured interviews ($r = .38$); (c) work sample tests ($r = .33$); and (d) college grade point average (GPA; $r = .32$). Hence, general cognitive ability has been identified by researchers as one of the best, if not the best, predictor of job performance.

More than 100 years ago, Munsterberg (1913) investigated the cognitive ability and job performance of the motormen who controlled electric streetcars. The common elements in streetcar accidents, coupled with the number of cities that had streetcars, was the impetuous for Munsterberg's study. He stated that in general, motormen were not careless; rather, he asserted that they did not possess the necessary cognitive ability to avoid potential accidents. Munsterberg determined that cognitive ability was related to the ability to determine and react to potential signs of danger. He found that the motormen who scored better on his time-based, nonverbal instrument were more likely to react appropriately if the potential for an accident increased. Consequently, participants with better cognitive ability were more likely to have better performance.

In another early paper, Ghiselli and Brown (1948) conducted a review of 185 studies of the validity of general cognitive ability and job performance among different occupations. They identified eight occupations in the literature: clerical workers, supervisors, salesmen, salesclerks, protective service, skilled workers, semiskilled workers, and unskilled workers. They found that cognitive ability had the highest validity for skilled workers, with a median validity of .55, followed by supervisors (median validity .40), clerical workers (median validity .35), salesmen (median validity .33), protective services (median validity .25), semiskilled workers (median validity .25), unskilled workers (median validity .08), and salesclerks (median validity -.09).

Ghiselli and Brown (1948) used *z* scores and calculated medians from the different *z* scores to compare the results of data sets from different studies. Although their technique was unusual, they found, like later researchers (e.g., Ree et al., 1994) would, that general cognitive ability was a valid predictor of job performance for most occupations. Consequently, Ghiselli and Brown noted that general cognitive ability would be an effective method to select candidates for some jobs like clerical workers, but not for others such as salesclerks. Their results also indicated that job complexity or other factors could potentially limit the validity of measures related to job performance.

Ghiselli (1973) analyzed data from the literature on cognitive ability and job performance. The purpose of his study was to provide a summary of research about the validity of cognitive ability for personnel selection. Ghiselli collected reports of occupational validity tests from 1920 through 1971 and noted that they reported validity as a correlation coefficient between test and criterion scores for job performance. To analyze the data, he calculated the mean of the validity coefficients for each of the 20 tests, 21 occupations, and two criteria. Ghiselli found that general cognitive ability was a valid predictor of managerial occupations (r = .29), clerical occupations (r = .37), sales occupations (r = .19), protective occupations (r = .23), service occupations (r = .26), vehicle operators (r = .15), trades and crafts (r = .25), and industrial occupations (r = .20). Ghiselli concluded that all occupations had at least one measure that had moderate validity. Subsequently, he determined that cognitive ability testing could benefit organizations in their selection of candidates. He also noted that even though cognitive measures did not always have high validity, they were valid for all occupational groups.

Hunter and Hunter (1984) presented their results of the reanalysis of raw data from previous studies. One of the reanalyses came from a paper that Hunter presented to the Personnel Testing Council of Metropolitan Washington at its May 1981 meeting. They reported Hunter's reanalysis of Ghiselli's (1973) data from his analysis of studies of cognitive ability and job performance that ranged from 1920 to 1971. After correcting for criterion unreliability and range restriction, Hunter reported that the mean validity of general cognitive ability ranged from .27 to .61. The corrected range was different from Ghiselli's findings of -.03 to .52. Hunter and Hunter also reported the following findings by job group for general cognitive ability: managerial occupations (r = .53), clerical occupations (r = .54), sales occupations (r = .61), protective occupations (r = .42), service occupations (r = .48), vehicle operators (r = .28), trades and crafts (r = .46), and industrial occupations (r = .37). Consequently, the use of improved statistical methods by Hunter on Ghiselli's data added to the wealth of research supporting the validity of general cognitive ability as a predictor of job performance.

Like Ghiselli (1973) and many other researchers, Pearlman, Schmidt, and Hunter (1980) conducted an analysis of data from several studies to determine the validity of general cognitive ability in predicting job performance. For their study, Pearlman et al. analyzed data from 698 studies that encompassed five categories of clerical jobs. Of the five categories of clerical jobs, Pearlman et al. found that general cognitive ability provided good validity for the prediction of job performance for typing (N = 4,847, r = .24); computing (N = 4,432, r = .23); and public service (N = 718, r = .21) occupations. Consequently, they determined that general cognitive ability was the best predictor of job performance across different occupations, with a higher validity (r = .21 - .26) than other predictors (e.g., performance tests r = .21 - .24).

Researchers had already provided support for the concept that general cognitive ability was a valid predictor of job performance before Hunter (1983) conducted a validation study of different jobs listed in the U.S. Employment and Training Administration's (1980) *Dictionary of Occupational Titles*. However, unlike most prior researchers, Hunter factored in job complexity, which the *Dictionary of Occupational Titles* included. For his two-stage study, Hunter used data from 425 validation studies on the General Aptitude Test Battery that took place over a 40-year span.

In the first stage of his study, Hunter (1983) validated the five systems of job classification "for their capacity to predict the correlation between cognitive, perceptual and psychomotor abilities and job performance" (p. 1). From this first stage, Hunter found that job complexity was the relevant dimension that differentiated all of the jobs. For the second stage, he separated jobs from the data sets into the five categories based on overall job complexity, ranging from the most complex jobs (Category 1) to the least complex jobs (Category 5). He noted that the *Dictionary of Occupational Titles* rated jobs on three dimensions (i.e., data, people, and things), with the rating based on expected worker functioning in each dimension. He wrote that the rating for each dimension typically related to the complexity of the task. For example, Hunter, at the time he wrote the article, the *Dictionary of Occupational Titles* of the U.S. Employment and Training Administration (1980) listed the task of "mentoring" as Category 1 (the most complex), and the task of "serving" as Category 5 (least complex) rating. After he separated the jobs, Hunter noted that there were 17 Category 1 jobs (N = 1,114), 36 Category 2 jobs (N = 2,455), 151 Category 3 jobs (N = 12,933), 201 Category 4 jobs (N = 14,403), and 20 Category 5 jobs (N = 1,219). He found the following average true validities: Category 1 jobs (r = .56), Category 2 jobs (r = .58), Category 3 jobs (r = .51), Category 4 jobs (*r* = .40), and Category 5 jobs (*r* = .23).

Hunter (1983) determined that his results supported the notion that job complexity affected the validity of general cognitive ability in predicting job performance. He stated that although general cognitive ability predicted job performance across all job categories, "validity drops off sharply for low levels of job complexity" (p. 36). However, his statement did not match his results: Validity went up from Category 1 to Category 2 for unknown reasons. Even though he had inconsistent conclusions compared to his stated results, his stated results supported the notion that job complexity affected the validity of general cognitive ability in predicting job performance.

One of the most commonly cited articles on the validity of general cognitive ability as a predictor of job performance was that of Ree et al. (1994), who selected their participants (*N* = 1,036) from individuals who had completed the Armed Services Vocational Aptitude Battery Form 11, 12, or 13. The selected participants also had completed basic military and follow-on technical training. Ree et al. sorted the participants by occupation. They found that general cognitive ability was a good predictor of performance across seven different occupations. They found the following results for the different occupations studied: (a) air traffic control operator (*n* = 164, *r* = .21); (b) precision measurement equipment laboratory specialist (*n* = 126, *r* = .72); (c) avionics communications specialist (*n* = 74, *r* = .68); (d) aerospace communications specialist (*n* = 211, *r* = .37); (e) jet engine mechanic (*n* = 174, *r* = .34); (f) information systems radio operator (*n* = 111, *r* = .31); and (g) personnel specialist (*n* = 172, *r* = .49). Consequently, Ree et al. determined that general cognitive ability was a valid predictor of job performance. However, even though general cognitive ability was a good predictor of performance, it still only accounted for .21 to .72 of the total variance.

Salgado, Anderson, Moscoso, Bertau, and de Fruyt (2003) conducted a Eurocentric meta-analysis of studies that involved general cognitive ability and job performance. Salgado et al. noted that because of the prevalence of use, cognitive ability tests for the selection of employees in the European community and the potential for a reduction in subgroup differences warranted more research. In addition, they hypothesized that because of the American-centric nature of the published meta-analytic studies, a lack of empirical support existed to generalize the findings of the studies to the European community. Hence, Salgado et al. stated that one of their primary objectives was to provide a European community-focused meta-analytic study on the relationship between general cognitive ability and job performance.

Salgado et al. (2003) analyzed 102 papers on validity comprising 120 samples with the criterion of job performance ($N = 1,900$). After correcting for validity and assessing range restriction and predictor and criterion reliability, the researchers analyzed studies on the predictive validity of general cognitive ability and specific cognitive abilities. They found that general cognitive ability ($N = 9,554$, $r = .29$, $p = .62$) exhibited excellent validity as a predictor of job performance. Consequently, Salgado et al. determined that general cognitive ability remained the best predictor of job performance across workers in the European community in a range of occupations. They also noted that, even though cognitive abilities showed validity for predicting job performance, cognitive abilities were not on par with general cognitive ability. Salgado et al. provided solid empirical evidence that supported the earlier findings of Ree et al. (1994) of the superiority of general cognitive ability as a predictor of job performance.

In a study similar to that of Salgado et al. (2003), Bertua et al. (2005) focused on United Kingdom-centric studies of the predictive validity of cognitive ability tests. They studied the validity of general cognitive ability in predicting job performance for different occupations. They sought to determine whether the predictive validity of general cognitive ability and cognitive ability tests explained a significant portion of the variables of job performance and whether general cognitive ability was generalizable across occupational groups.

Bertua et al. (2005) identified 56 United Kingdom-centric literature sources that held 283 samples. Of the 283 samples that they identified, 60 samples ($N = 13{,}262$) involved the criterion of job performance. The researchers found in their first round of analysis that general cognitive ability tests ($N = 2{,}469$, $r = .22$, $p = .48$) had good validity in predicting job performance. Like Ree et al. (1994) before them, Bertua et al. found that predictive validity varied by occupation. Bertua et al. found that tests of general cognitive ability ($N = 1{,}381$, $r = .39$, $p = .64$) had the best predictive validity for the engineer group.

Bertua et al. (2005) wrote that the second highest validity for measures of general cognitive ability ($N = 295$, $r = .35$, $p = .59$) involved the professional occupational group. General cognitive ability measures ($N = 1{,}674$, $r = .32$, $p = .47$) had the lowest predictive validity for the driver occupational group. For the remaining groups, they found the following predictive validity of general cognitive ability measures by occupational group: (a) clerical ($N = 1{,}989$, $r = .33$, $p = .55$); (b) skilled ($N = 3{,}086$, $r = .14$, $p = .55$);

(c) miscellaneous ($N = 7{,}258$, $r = .33$, $p = .55$); and (d) operator ($N = 4{,}322$, $r = .32$, $p = .54$).

Overall, Bertua et al. (2005) determined that general cognitive ability and cognitive ability tests were valid predictors of job and training performance in a United Kingdom-centric context. The researchers also determined that their results were comparable to the results of U.S.-centric and Eurocentric meta-analytic studies. Finally, the researchers determined that based on their findings, job complexity affected the predictive validity of general cognitive ability, with the predictive validity of general cognitive ability increasing as job complexity increased.

In 2007, Hulsheger et al. reported the results of two of their studies. Their first study involved the meta-analysis of studies of the validity of general mental ability in predicting job and training performance in Germany. Their second study was a moderator analysis to determine whether job complexity acted as a moderator for the predicative validity of general cognitive ability. Hulsheger et al. used 54 sources that included 90 independent samples with the criterion of training success ($N = 11{,}969$) and nine independent samples with job performance as the criterion ($N = 746$) for their studies. They found that general cognitive ability measures were valid predictors of training ($N = 11{,}969$, $r = .312$, $p = .467$, 90% credibility value [CV] = .272-.661) and job performance ($N = 746$, $r = .333$, $\rho = .534$, 90% CV = .296-.770).

For their second study, Hulsheger et al. (2007) used regression analysis with jobs separated into three skill levels: low, medium, and high. Hulsheger et al. determined that general cognitive ability had higher validity for low-complexity jobs ($N = 4{,}931$, $r = .351$,

p = .520, 90% CV = .471-.677) than either medium- (N = 5,510, r = .293, p = .452, 90% CV = .250-.654) or high-complexity jobs (N = 11,089, r = .187, p = .299, 90% CV = .181-.413). Consequently, they determined that job complexity acted as a moderator.

Like previous studies, Hulsheger et al.'s (2007) study reinforced the concept that occupational complexity moderates the validity of general cognitive ability. However, their study, although supporting the concept that occupation moderates validity, demonstrated contrary findings, where the validity of general cognitive ability was higher for low-complexity occupations. Consequently, their method of grouping occupations together rather than identifying specific occupation groups could have affected their results. Their results demonstrated the potential importance of using specific occupations. For example, combining jobs that require complex thinking and jobs that require complex actions involving hand-eye coordination could result in skewed results.

In a recent meta-analytic study, Ziegler et al. (2011) conducted a German-centric, meta-analytic study of the operational validity of general cognitive ability for predicting training success. For their study, they included only literature from primary studies that provided general cognitive ability results and used specific cognitive ability tests (e.g., Hochster-Intelligenztest). Ziegler et al. used Hunter and Schmidt's (2000) meta-analytic formulas to analyze samples from two categories of occupations (low complexity and medium complexity), totaling eight different occupational groups. The low-complexity occupational group that Ziegler et al. studied comprised chemical skilled workers (N = 239), pharmaceutical technicians (N = 45), electronic technician occupations

(*N* = 93) and mechanic occupations (*N* = 68). The medium-complexity occupational group included chemical laboratory workers (*N* = 143), biology lab assistants (*N* = 71), office communication assistants (*N* = 40), and foreign language correspondence clerks (*N* = 72).

Ziegler et al. (2011) found that general cognitive ability (*N* = 712, *r* = .28, *p* = .65, 95% CI = .49-.81) remained the best predictor of performance. They also found that general cognitive ability (*N* = 388, *r* = .18, *p* = .62, 95% CI = .40-.84) provided the best validity for the low-complexity occupations. For the medium-complexity occupations, Ziegler et al. found that general cognitive ability (*N* = 324, *r* = .23, *p* = .72, 95% CI = .50-.94) provided good validity for predicting performance. However, Ziegler et al. stated that because their analysis included only four studies, any interpretation required caution. Ziegler et al., like previous researchers (e.g., Ree et al., 1994), found that the validity of general cognitive ability varied by occupation.

Summary: General Cognitive Ability and Job Performance

The researchers who conducted the reviewed articles found that (a) general cognitive ability was a valid predictor of job performance, (b) general cognitive ability only accounted for 25% of the variance in job performance, and (c) the validity of general cognitive ability varied by job complexity (Krumm et al., 2014; Schmidt & Hunter, 1998; Schneider & Newman, 2015; Ziegler et al., 2011). Researchers also have found that general cognitive ability is a better predictor of job performance than other predictors such as personality and prior job experience for most occupations (Cucina et al., 2015; Ree & Earles, 1992; Ree et al., 1994). However, one area of investigation for which little research exists lies in examining the extent to which intellectual style predicts job performance above that of cognitive ability.

Intellectual Styles Literature

The field of intellectual styles, which encompasses constructs that describe how people habitually acquire information and solve problems, has a complicated history that arguably started with Allport's (1937) "styles of life" (as cited in Zhang et al., 2012). Since Allport's book, *Personality: A Psychological Interpretation*, was published, hundreds of researchers have studied intellectual styles and the ways that intellectual styles relate to different aspects of life, particularly academic performance (Zhang et al., 2012). Despite such a long history, researchers of intellectual style have not yet developed "interconnected philosophical and theoretical foundations" (Zhang et al., 2012, p. 1). Subsequently, a plethora of intellectual styles exists as researchers have developed their terms (e.g., *cognitive style*, *mode of thinking*) and constructs, some of which overlap, but others do not (Zhang et al., 2012).

Despite the conceptual premise that individuals use their cognitive abilities differently, few I/O psychologists have conducted research examining intellectual style as a predictor of performance and as a method of candidate selection. Several researchers (e.g., Armstrong, van der Heijden, & Sadler-Smith, 2012; Kirton & De Ciantis, 1986) have expressed their belief that intellectual style does hold promise for candidate selection and strategic workforce planning. One key use of intellectual style is to predict candidates' potential job performance, much like general cognitive ability is used.

However, to date, few researchers have studied the relationship between intellectual style and job performance.

The study of intellectual styles has presented many challenges to researchers, including comparing findings involving different style constructs (Nielson, 2012; Zhang & Sternberg, 2005). To mitigate some of the potential challenges, the section in this literature review on intellectual styles includes (a) a description of Zhang and Sternberg's (2005) threefold model of intellectual styles, (b) descriptions of five taxonomies that fall under the umbrella term *intellectual style*, (c) empirical literature reviews, and (d) a penultimate section that facilitates a side-by-side comparison of different studies on intellectual style and job performance. I have also provided reviews of studies of job and academic performance.

Conceptual Lens: The Threefold Model of Intellectual Styles

In developing their threefold model, Zhang and Sternberg (2005) coined the term *intellectual styles*, a generic term for any style, especially those in the threefold model, which helps to minimize confusion about the numerous style terms that exist. Along with the term intellectual styles, Zhang and Sternberg established three criteria for the inclusion of a style, such as Kirton's (1976) decision-making styles, in the threefold model of intellectual styles (henceforth referred to as the threefold model). First, Zhang and Sternberg included only styles considered influential in styles literature. Second, they included only empirically based, operationalized styles. Third, they included only styles tested against another style construct.

For their threefold model, Zhang and Sternberg (2005) established three categories of style constructs (Types I, II, and III). Type I consists of constructs that include cognitive complexity and nonconformity. Type II includes style constructs that indicate cognitive simplicity and conformity. Type III includes qualities of Types I and II constructs, such as realistic and investigative. The threefold model categorizes style types (e.g., mind style, decision-making style, etc.) into these three basic style constructs: Types I, II, and III (Zhang & Sternberg, 2005).

Specific styles such as Kirton's (1976) decision-making styles typically incorporate two or more style constructs (e.g., adaption and innovation). Consequently, each style can have constructs in two or three of the categories used in the threefold model. For example, Kirton's innovation style is a Type I style, whereas his adaption style is a Type II style. Consequently, Gregorc's (1979) concrete-random style, which is a Type I style, is comparable to Kirton's innovation style. Thus, by using the threefold model, I can compare studies that use different styles.

Intellectual Styles: Terms and Taxonomies

As noted earlier, the field of intellectual styles, arguably started with Allport's (1937) use of "styles of life" (Cassidy, 2004; Sternberg & Grigorenko, 2001). However, as Riding, Grimley, Dahraei, and Banner (2003) noted, the concept of styles likely started with Galton (1883). Regardless of who or when the concept or the field of intellectual styles came into being, terms such as learning style, thinking style, mind style, decision-making style, and intellectual style have come into use.

Among the different style terms, the four most familiar style terms are cognitive style, learning style, teaching style, and thinking style (Nielsen, 2012). Nielsen (2012) wrote that people often associate different style terms such as cognitive style with an explicit taxonomy. However, the terms can apply to several different taxonomies (Nielsen, 2012). In a literature search, Nielsen found 1,323 articles containing the term cognitive style. Nielsen noted that the three most commonly referenced taxonomies in the cognitive style literature were field dependence-independence styles (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962); conceptual tempos (Kagan, Rosman, Day, Albert, & Phillips, 1964); and adaptor-innovator styles (Kirton, 1976). In a search of articles containing the learning style concept, Nielsen found 1,198 articles with 25 different conceptualizations of learning style. A search of literature containing the words teaching style returned 223 articles (Nielsen, 2012). The majority of the articles involved the conceptualization of teaching style, that is, how teachers presented information and provided feedback to students (Nielsen, 2012). However, a few articles included conceptualizations of teaching style as the students' preferred style of being taught (Nielsen, 2012). For the 174 articles that included the words thinking style, Nielsen found that Sternberg's (1988) theory of self-government and criminal thinking styles (Walters, 1995) were the principal conceptualizations. Consequently, confusion can occur because of the plethora of different definitions and uses of similar terms (Peterson, Rayner, & Armstrong, 2009).

Peterson et al. (2009), in an effort "to establish their understanding of cognitive style and learning styles as a phenomenon," surveyed style researchers (N = 94; p. 519).

They also sought to develop consensus definitions for cognitive style and learning style. They found that 66% of those surveyed agreed with the following definition of cognitive style:

> Cognitive styles are individual differences in processing that are integrally linked to a person's cognitive system. More specifically, they are a person's preferred way of processing (perceiving, organizing and analyzing) information using cognitive brain-based mechanisms and structures. They are partly fixed, relatively stable and possibly innate preferences. (p. 520)

Peterson et al. (2009) also found that 40.9% of respondents agreed with the following definition of learning style: "Learning styles are an individual's preferred ways of responding (cognitively and behaviorally) to learning tasks, which change depending on the environment or context" (p. 520). Peterson et al. noted that even though they had provided a foundation for the development of a common definition, the need still existed for further development to ensure that researchers have shared core conceptualizations.

As several researchers (e.g., Nielsen, 2012; Peterson et al., 2009) have mentioned, the field of styles involves terms conceptualized and used in different ways. To minimize any potential confusion over the definitions of terms, following are brief explanations of the five common taxonomies that fall within the threefold model. Table 1 includes the style constructs, individual styles within each construct, threefold model style type, and a description of each style.

Decision-making style. Kirton (1976) based his decision-making style on his adaptor-innovator theory. Kirton noted how individuals prefer to solve problems and use information that “can be located on a continuum ranging from an ability to ‘do things better’ to an ability to ‘do things differently,’ and the ends of this continuum are labeled ‘adaptive’ and ‘innovative,’ respectively” (p. 622). Kirton further stated that individuals with an adaptor style (Type II) prefer to adhere to existing paradigms and that individuals with an innovator style (Type I) prefer to go against paradigms. Thus, individuals with an adaptor style prefer to follow rules and procedures, whereas individuals with an innovator style do not.

Kirton (2003) wrote that adaptor or innovator styles contextually relate to the dynamics of the environment (i.e., ambiguous projects), so a best style or score on the continuum does not exist. In addition, because the adaptor and innovator styles reside on a continuum, the styles of individuals can range from somewhat innovative or adaptive to highly innovative or adaptive (Kirton, 2003). Hence, the fit between an individual’s style and the predominant style of the environment is potentially important (Kirton, 2003).

Mind styles. Gregorc (1979) based his mind styles concept on the findings from the hundreds of interviews that he conducted. Gregorc incorporated two dimensions into his mind styles concept, namely, perceptual quality and ordering ability. According to Gregorc (1982), perceptual quality describes the ways individuals develop an understanding of information. Perceptual quality includes the facets of concrete and abstract (Gregorc, 1982). Individuals who have a concrete perceptual quality tend to prefer information gathered through their five senses, whereas individuals who have the abstract perceptual quality tend to prefer information that they develop through reflective thought (Gregorc, 1982).

As in his perceptual quality dimension, Gregorc (1982) included two facets in ordering ability, namely, sequential and random dimensions (Gregorc, 1982). Individuals with a sequential ordering ability prefer to order and use information in a sequential manner, whereas individuals with a random ordering ability prefer to use their instincts in the ordering and use of information (Gregorc, 1982). Gregorc described four styles that come from the two facets of perceptual quality and ordering ability dimensions: (a) concrete sequential (Type II), individuals who prefer practical and ordered approaches; (b) abstract sequential (Type III), individuals who prefer analytic and rational approaches; (c) abstract random (Type III), individuals who prefer analytic and spontaneous approaches; and (d) concrete random (Type I), individuals who prefer practical and spontaneous approaches (Coffield et al., 2004; Gregorc, 1982). Gregorc noted that although individuals have a dominant style, they can use any style based on any number of situational factors, eventually returning to their dominant style.

Mode of thinking. Mode of thinking comes from Torrance's (1988) style of learning and thinking concept. The modes of thinking include analytic (left brain), holistic (right brain), and integrative (whole brain; Torrance, 1988; Torrance, McCarthy, & Kolesinski, 1988). According to Torrance et al. (1988), individuals can have a dominant brain hemisphere (right or left), or they can use the whole brain in an integrative manner. People with a right brain dominance, called the holistic mode of thinking, use intuition to process information and are good at processing spatial information (Torrance, 1988; Torrance et al., 1988; Zhang, 2002). Individuals with a left-brain dominance (analytic mode of thinking) prefer using defined processes for learning and using information (Torrance, 1988; Torrance et al., 1988). Individuals who habitually use the analytic and holistic modes of thinking have an integrative (whole brain) mode of thinking (Torrance, 1988; Torrance et al., 1988).

Structure of intellect. Guilford's (1950, 1956) structure of intellect is an early style that has continued to endure. Sternberg and Grigorenko (2001) contended that Guilford used Thurstone's (1938) theory of primary mental abilities as a foundational theory for his structure of intellect. Guilford (1956) included the two dimensions of divergent thinking and convergent thinking into the structure of intellect. Guilford (1956) noted that divergent thinkers (Type I) do not subscribe to a rigid manner of problem solving and often only restrict their answers by self-imposed limitations. For example, an individual with a divergent thinking style might desire to solve a problem in a novel manner but would avoid the novel solution because it could result in friction between team members. Conversely, convergent thinkers (Type II) adhere to proven problem-solving methods to develop a single best solution (Guilford, 1950, 1956). Consequently, divergent-thinking individuals often are more creative than convergent-thinking individuals (Guilford, 1956; Sternberg & Grigorenko, 2001).

Thinking styles. Sternberg (1988) developed his thinking styles from his theory of mental self-government. Sternberg separated the 13 styles associated with the theory of self-government into five dimensions (i.e., function, form, level, scope, and leaning). The function dimension of Sternberg's theory of mental self-government includes the legislative (Type I), executive (Type I), and judicial styles (Type I). Sternberg found that individuals with a legislative style enjoy creating and establishing rules. Individuals with an executive style like following rules and implementing processes and programs (Sternberg, 1988; Sternberg & Grigorenko, 1997). Individuals who have a judicial style enjoy judging and analyzing existing rules and processes (Sternberg, 1988; Sternberg & Grigorenko, 1997). People with the legislative style prefer working on tasks that require inventive approaches (Sternberg, 1988; Zhang & Sternberg, 2005).

Sternberg (1988) incorporated four form dimensions into his theory of mental self-government. The first two styles in the form dimension are the monarchic (Type II) and oligarchic (Type III) styles. Individuals with the monarchic style prefer to focus on single tasks, whereas individuals with the oligarchic style prefer working on several nonprioritized tasks (Sternberg, 1988; Zhang & Sternberg, 2005). The last two styles in the form dimension are the hierarchical (Type I) and anarchic (Type III) styles (Sternberg, 1988; Sternberg & Grigorenko, 1997). Individuals with the hierarchical style prefer working on prioritized tasks, whereas those with the anarchic style enjoy tasks that they can work on as they see fit (Sternberg, 1988; Zhang & Sternberg, 2005).

The level dimension of Sternberg's (1988) theory of mental self-government includes two styles (i.e., local and global). Individuals with the local style (Type II) prefer tasks that have explicit and set details. Those with the global style (Type I) enjoy tasks that include abstract ideas and the "big picture" (Sternberg, 1988; Zhang & Sternberg, 2005). Along with the level dimension, the theory of mental self-government has a scope dimension (Sternberg, 1988; Sternberg & Grigorenko, 1997; Zhang & Sternberg, 2005) that consists of the internal (Type II) and external (Type II) styles. Individuals with the internal style prefer independent tasks, whereas those with the external style prefer collaborative tasks (Sternberg, 1988; Zhang & Sternberg, 2005).

The leaning dimension is the last of the five dimensions of Sternberg's (1988) theory of mental self-government and has the last two of the 13 styles (liberal and conservative). Individuals with the liberal style (Type I) prefer ambiguous and novel tasks over well-defined tasks (Sternberg, 1988; Zhang & Sternberg, 2005). People with the conservative style (Type II) like tasks that require adherence to existing rules and procedures (Sternberg, 1988; Zhang & Sternberg, 2005).

Sternberg and Grigorenko (1997) wrote that people possess sets of styles rather than a single style, as with Kirton's (1976) decision-making style. Moreover, individuals flexibly employ their styles, adjusting styles based on task demand. Sternberg and Grigorenko hypothesized that the styles possessed by individuals could change over time. However, no researchers to date have provided empirical evidence that individuals' preferred styles change over time.

Summary: Intellectual Styles Literature

This section on intellectual styles literature presented overviews of Kirtons's (1976) decision-making styles, Gregorc's (1979) mind styles, Torrance's (1988) mode of thinking, Guilford's (1950, 1956) structure of intellect, and Sternberg's (1988) thinking styles, which fall under the Zhang and Sternberg's (2005) threefold model. All of the intellectual styles had constructs supporting the common concept that the ways that individuals acquire and use information is linked integrally to their cognitive abilities (Peterson, 2009). The constructs vary significantly in attempting to achieve the similar end state of describing individual variations regarding problem-solving and decision-making activities that involve acquisition and use of information (see Table 1). However, the Zhang and Sternberg's threefold model provided a framework for comparing the various intellectual style constructs used in the research presented in the following sections that focus on intellectual styles coupled with academic and job performance.

Table 1

Intellectual Style Constructs, Types, and Descriptions

Style construct	Individual style	Type	Description
Decision-making style (Kirton, 1976)	Innovator	I	Characterized as undisciplined, thinking tangentially, approaching tasks from unsuspected angles
	Adaptor	II	Characterized by precision, reliability, efficiency, discipline and conformity
Mind style (Gregorc, 1979, 1982)	Abstract sequential	III	Preference for analyzing situations and applying logic to solving problems; Prefers working alone and stimulating environments; Lack of preference for repetition, rules, and regulations; Expressing emotions, sentimentality, and being diplomatic is difficult
	Concrete sequential	II	Preference for order, structure, following directions, and predictability; Lack of preference for working in groups, using their imagination, and dealing with abstract ideas
	Concrete random	I	Prefers experimentation and trial and error, and intuition to solve problems; Likes to take risks; Avoids environments that are restrictive, limited, routine, and details
	Abstract random	III	Preference for establishing relationships with others, bringing harmony to groups, and participation in group activities; Lack of preference for competition, working in restrictive environment, working with exact details
Mode of thinking (Torrance, 1988; Torrance et al., 1988)	Holistic (right brain)	I	Understanding a system by sensing its large-scale pattern and attention paid to relationships between objects and the field. Preference for explaining and predicting events based on relationships; Processes information in an intuitive manner
	Analytic (left brain)	II	Understands a system by thinking about its parts and how they work together; Attention is given to the attributes of an object and its categorical assignment. Preference for rules; Processes information in an analytic manner
	Integrative (whole brain)	III	Processes information in an interactive and dynamic manner

Table 1 Cont'd

Style construct	Individual style	Type	Description
Structure of intellect (Guilford, 1950)	Convergent	II	A type of thinking that focuses on coming up with a single well-established answer to a problem; Oriented toward deriving the single best answer or solution to a question or problem
	Divergent	I	Ability to think across and generate ideas across disciplines; A creative approach to problem-solving
Thinking style (Sternberg, 1988)	Legislative	I	Preference for tasks, projects, and situations that require creating, formulating, and planning ideas, strategies for problem-solving, and products
	Executive	II	Preference for tasks, projects, and situations that provide clear instructions, guidelines, and structures
	Judicial	I	Preference for tasks, projects, and situations that require evaluation, analysis, and the judgment of ideas and things
	Hierarchical	I	Preference for tasks, projects, and situations that allow for the distribution of attention to hierarchical goals
	Oligarchic	III	Preference for tasks, projects, and situations that allow for the distribution of attention to multiple competing goals
	Monarchic	II	Preference for tasks, projects, and situations that allow for allocation of attention to one goal
	Anarchic	III	Preference for tasks, projects, and situations that allow for flexibility as to how one distributes one's attention
	Global	I	Preference for tasks, projects, and situations that involve abstract ideas and big picture thinking
	Local	II	Preference for tasks, projects, and situations that involve working with concrete details
	Internal	III	Preference for tasks, projects, and situations that involve working alone
	External	III	Preference for tasks, projects, and situations that involve working with others
	Liberal	I	Preference for tasks, projects, and situations that involve novelty and ambiguity
	Conservative	II	Preference for tasks, projects, and situations that adhere to existing rules and procedures

Intellectual Style and Academic Performance

Academic researchers have actively pursued intellectual style research (Nielsen, 2012). Zhang (2013) identified more than 2,000 abstracts involving intellectual style and academic performance. Accordingly, 15 articles about academic performance and intellectual styles (e.g., Zhang, 2001) were included to augment the three articles on job performance and academic style (e.g., Chan, 1996). The addition of articles on intellectual style and academic performance provide a depth of information not possible by limiting the literature review to articles on intellectual style and job performance.

Although articles on intellectual style and academic performance are a valuable source of information, they have limitations for use in job performance research. For example, Zhang (2013) wrote that academic performance is different in two ways from job performance. First, academic performance has a subject-specific focus (e.g., algebra performance), whereas job performance includes all facets of a job (Zhang, 2013). Second, academic courses are time bound with set start and end dates, but jobs often do not have set end dates (Zhang, 2013). Consequently, the applicability of academic research results has had limited applicability to workplace research.

The sheer number of different intellectual styles can complicate comparisons of research results (Nielsen, 2012; Zhang, 2013). To aid in comparing results, I grouped studies based on whether the intellectual style fell within the threefold model, or not. In addition, articles within the threefold model include the style (e.g., judicial) and the corresponding style type (e.g., Type I) to further aid in comparing results.

Of the eight articles that I reviewed, five included styles from the threefold model. The six articles that mentioned a style not included in the threefold model all used Kolb's (1976) construct of learning style. Of the five articles that used styles from the threefold model, one involved Gregorc's (1979) thinking styles; one involved mode of thinking (Torrance et al., 1988); and the remaining articles involved Sternberg's (1988) theory of self-governance. Aside from covering four intellectual style constructs, the reviewed articles also included a variety of academic subjects, including social science, education, science, and math. Consequently, the articles provided a cross-section of academic subjects and intellectual styles.

Threefold Model Style Research

I included the five articles that featured intellectual styles covered by the Zhang and Sternberg's (2005) threefold model in the literature review. Similar to results obtained from a review that used Kolb's (1976) construct of learning style, articles that used styles from the Zhang and Sternberg's threefold model were far from conclusive. Of the nine articles reviewed, the authors of two articles (Figg, Rogers, McCormick, & Low, 2012; Kok, 2014) reported that they did not find a statistically significant relationship between intellectual style and academic performance. The authors of the five remaining articles did report statistically significant findings.

Bernardo et al. (2002), using Sternberg's theory of self-government, found that executive style (Type II) had a positive correlation with GPA ($r = .17$, $p < .01$). Bernardo et al. concluded that students with an executive style were more likely to have higher overall GPAs. Ross, Drysdale, and Schulz (2001) found statistically significant relationships between intellectual style and academic performance, similar to the relationship that Bernardo et al. identified. However, where Bernardo et al. identified that a Type II style correlated positively with academic performance, Ross et al., using Gregorc's mind style theory, found that students in an introductory course on computers ($N = 805$) with the Type I style, had the highest mean course GPA (2.95). Ross et al. also found that students in a computer applications course ($N = 168$) with an abstract-sequential style (Type III) had the highest mean course GPA (3.72; see Table 2). Thus, Bernardo et al. and Ross et al. found that intellectual style related to performance, even though each style related differently with course and sample.

In their study of Iranian language students ($N = 53$) in an English language program, Kordjazi and Ghonsooly (2015) provided further support for the concept that intellectual style relates to academic performance. Using Torrance et al.'s (1988) mode of thinking theory, they found that analytic-dominant, or left brain-dominant (Type II), students performed better than students with other styles on antonym ($M = 3.93$, $SE = .40$, $p < .05$); translation ($M = 4.08$, $SE = .39$, $p < .05$); and synonym tests ($M = 4.42$, $SE = .37$, $p < .05$). Kordjazi and Ghonsooly also found that holistic-, or right brain-dominant (Type I), students had the best performance of an image test ($M = 4.53$, $SE = .37$, $p < .05$). Consequently, Kordjazi and Ghonsooly wrote, "It is perfectly obvious that the format of tests in relation to the cognitive style of a person influences her/his performance" (p. 700), which indicates the relevance of context regarding performance and intellectual style. Thus, Kordjazi and Ghonsooly surmised that a contextual relationship between intellectual style and performance based on test format existed. However, because Kordjazi and Ghonsooly presented only indicators of a contextual relationship, more research is required before making a more definitive determination of contextual relationships.

Zhang (2001, 2004) provided further support for the concepts that a relationship exists between intellectual style and academic performance. In the earlier article, Zhang (2001) studied university students from mainland China ($N = 236$) and Hong Kong

($N = 123$) to determine whether intellectual style could predict academic performance. Zhang assessed Hong Kong students for performance in physics, English, Chinese literature, and geography classes; she assessed the mainland Chinese students only for overall academic performance.

Zhang (2001) found that executive style (Type II) predicted low overall academic performance ($\beta = -.13$, $p < .01$) for the mainland Chinese students. She also found that five of the 13 styles predicted lower course scores for Hong Kong students. She reported that (a) the judicial style (Type I) predicted lower course scores in Chinese literature ($N = 69$, $\beta = -.43$, $p < .01$); (b) the liberal style (Type I) predicted lower course scores in geography ($N = 69$, $\beta = -.26$, $p < .05$); (c) the local style (Type II) predicted lower course scores in English ($N = 206$, $\beta = -.22$, $p < .01$); (d) the legislative style (Type I) predicted lower course scores in Chinese literature ($N = 69$, $\beta = -.28$, $p < .05$); and (e) the external style (Type III) predicted lower course scores in physics ($N = 53$, $\beta = -.36$, $p < .01$). Of all the styles, she found that only the internal (Type III) and hierarchical (Type I) styles predicted positive course performance. She found that the internal style (Type III) predicted higher course scores in English ($N = 206$, $\beta = .24$, $p < .01$) and the hierarchical style (Type I) predicted higher course scores in Chinese literature ($N = 69$, $\beta = .30$, $p < .01$).

Zhang (2004) reported findings from a later study that she conducted with secondary students from Hong Kong ($N = 250$) that used a similar methodology to the 2001 study. As with her previous study, Zhang was trying to determine whether intellectual style predicted students' course performance. Zhang assessed students from the following courses: (a) art and design, (b) biology, (c) Chinese history, (d) Chinese language, (e) chemistry, (f) computer literacy, (g) design and technology, (h) economics and public affairs, (i) English, (j) geography, (k) history, (l) integrated science, (m) mathematics, (n) music, (o) physics, and (q) religious studies. She wrote that hierarchical style (Type I) predicted higher student academic performance in biology ($\beta = .26, p < .05$); Chinese history ($\beta = .18, p < .01$); Chinese language ($\beta = .16, p < .01$); computer literacy ($\beta = .27, p < .001$); English ($\beta = .19, p < .01$); geography ($\beta = .22, p < .001$); history ($\beta = .27, p < .001$); integrated science ($\beta = .22, p < .01$); religious studies ($\beta = .21, p < .01$); and economics and public affairs ($\beta = .25, p < .001$). In addition, she found that judicial style (Type I) predicted higher student academic performance in chemistry ($\beta = .26, p < .05$); mathematics ($\beta = .16, p < .05$); and physics ($\beta = .23, p < .05$). Finally, she reported that monarchic style (Type II) predicted higher student academic performance in design and technology ($\beta = .28, p < .01$).

Based on her findings, Zhang (2004) made two conclusions. First, she concluded that a relationship generally did not exist between ability and intellectual style after finding that only two of 26 partial correlations indicated a significant relationship between ability and intellectual style. Second, she determined that "the present findings have clearly revealed the domain specificity of thinking [intellectual] styles in their contribution to academic achievement" (p. 363). Thus, intellectual styles have a contextual dependency. Consequently, she determined that the relationship between intellectual style and course performance was contextually dependent.

However, context went beyond the subject of the course, as evidenced by the differences between Zhang's results from her 2001 and 2004 articles. For example, in her 2001 article, Zhang found that a local style (Type II) predicted lower student course scores in English ($\beta = -.22$, $p < .01$) among Hong Kong students ($N = 206$). Conversely, Zhang reported in her 2004 article that the hierarchical style (Type I) predicted higher student academic performance in English ($\beta = .19$, $p < .01$) with a different sample of students ($N = 250$) from Hong Kong. Thus, Zhang's findings reported in the 2001 and 2004 articles indicated that the predominant intellectual style of the sample related to performance, not an intellectual style relating to a specific course (e.g., English, Chinese language, etc.).

Although the preceding paragraphs provided empirical evidence of intellectual style related to academic performance, the different style constructs used by the various researchers (e.g., Ross et al., 2001) made comparing their results difficult. Table 2 lists the studies presented in this section and the style type the result matches to in the threefold model. By reviewing Table 2, it becomes apparent that a predominant style or style type does not exist.

Table 2

Intellectual Style Research Findings and Threefold Model of Intellectual Styles Types

Author/ Date	Intellectual style	Sample	IV/DV	Findings		
				Type I	Type II	Type III
Bernardo et al. (2002)	Theory of mental self-government (Sternberg, 1988)	University students (N = 429)	IV: intellectual style DV: GPA	Judicial (r = .12, p < .05) Hierarchical (r = .11, p < .05)	Executive (r = .17, p < .01) Conservative (r = .10, p < .05)	Anarchic (r = .12, p < .05) Internal (r = .11, p < .05)
Ross et al. (2001)	Mind style (Gregorc, 1979, 1982)	Introduction to computers students (N = 805)	IV: intellectual style DV: GPA	Concrete random (M_{GPA} = 2.5, SD = .92)	Concrete sequential (M_{GPA} = 2.95, SD = .91)	Abstract sequential (M_{GPA} = 2.71, SD = .98) Abstract random (M_{GPA} = 2.15, SD = .98)
		Computer applications in education students (N = 169)	IV: intellectual style DV: GPA	Concrete random (M_{GPA} = 3.56, SD = .57)	Concrete sequential (M_{GPA} = 3.67, SD = .39)	Abstract sequential (M_{GPA} = 3.72, SD = .36) Abstract random (M_{GPA} = 3.42, SD = .69)
Kordjazi & Ghonsooly (2015)	Mode of thinking (Torrance, 1988; Torrance et al., 1988)	Iranian English students (N = 53)	IV: intellectual style DV: Preliminary English Test (PET): Synonym Test		Analytic (M = 4.42, SE = .37, p < .05)	
			DV: PET: Antonym Test		Analytic (M = 3.93, SE = .40, p < .05)	
			DV: PET Translation Test		Analytic (M = 4.08, SE = .39, p < .05)	
			DV: PET: Image Test	Holistic (M = 4.53, SE = .37, p < .05)		

Table 2 Cont'd

Author/ Date	Intellectual style	Sample	IV/DV	Findings		
				Type I	Type II	Type III
Zhang (2001)	Theory of mental self-government (Sternberg, 1988)	Mainland China university students ($N = 215$)	IV: intellectual style DV: Entrance Exam score		Executive ($\beta = -.13$, $p < .05$)	
		Hong Kong university students ($N = 209$)	DV: physics GPA			External ($\beta = -.36$, $p < .01$)
			DV: Use of English GPA		Local ($\beta = -.22$, $p < .01$)	Internal ($\beta = .24$, $p < .01$)
			DV: Chinese Literature GPA	Judicial ($\beta = -.43$, $p < .01$) Hierarchical ($\beta = .30$, $p < .05$) Legislative ($\beta = -.28$, $p < .05$)		
			DV: Geography GPA	Liberal ($\beta = -.26$, $P < .05$)		
		Hong Kong secondary school students ($N = 250$)	IV: intellectual style DV: Biology GPA	Hierarchical ($\beta = .26$, $p < .05$)		
			DV: Chinese History GPA	Hierarchical ($\beta = .18$, $p < .01$)		
			DV: Chinese Language GPA	Hierarchical ($\beta = .16$, $p < .01$)		
			DV: Chemistry GPA	Judicial ($\beta = .26$, $p < .05$)		
			DV: Computer Literacy GPA	Hierarchical ($\beta = .27$, $p < .001$)		

Table 2 Cont'd

Author/ Date	Intellectual style	Sample	IV/DV	Findings		
				Type I	Type II	Type III
			DV: Design and Technology GPA		Monarchic ($\beta = .28$, $p < .01$)	
			DV: Economics and Public Affairs GPA	Hierarchical ($\beta = .25$, $p < .001$)		
			DV: English GPA	Hierarchical ($\beta = .19$, $p < .01$)		
			DV: Geography GPA	Hierarchical ($\beta = .22$, $p < .001$)		
			DV: Integrated Science GPA	Hierarchical ($\beta = .22$, $p < .01$)		
			DV: History GPA	Hierarchical ($\beta = .27$, $p < .001$)		
			DV: Mathematics GPA	Judicial ($\beta = .16$, $p < .05$)		
			DV: Physics GPA	Judicial ($\beta = .23$, $p < .05$)		
			DV: Religious Studies GPA	Hierarchical ($\beta = .21$, $p < .01$)		

Model Style Research

Kolb's (1976) construct of learning style consists of four style constructs: converging, diverging, assimilating, and accommodating. Kolb noted that individuals who prefer to rely on abstract conceptualization, coupled with active experimentation, have a converging style and are good at the practical application of concepts. Individuals who prefer a combination of concrete experiences and reflective observations have a diverging style and often are interested in people and feeling orientated (Coffield et al., 2004; Kolb, 1976). Individuals with an assimilating style prefer abstract conceptualizations and reflective observations, and they often prefer dealing with abstract concepts than with people (Coffield et al., 2004; Kolb, 1976). Finally, individuals with an accommodating style prefer concrete experiences and active experimentation, and they enjoy learning through trial and error.

Contessa, Ciardiello, and Perlman (2005); Fox and Bartholomae (1999); Lynch, Woelfl, Steele, and Hanssen (1998); Okay (2012); and Orhun (2012) primarily focused their research on the relationship between intellectual style and performance. Mammen et al. (2007) focused on describing the intellectual styles of general surgery residents, but they also included performance as a factor of the study. Of the six studies based on the construct of learning style, Fox and Bartholomae, Mammen et al., and Okay did not report a statistically significant relationship between intellectual style and performance. On the other hand, Contessa et al. and Orhun reported the existence of a relationship between performance and intellectual style.

Contessa et al. (2005), Lynch et al. (2005), and Orhun (2012) reported similar findings. They all found that students with a converging style outperformed students with accommodating or diverging styles. In Orhun's study of engineering students (*N* = 87) in a calculus class, he found that students with an assimilating style (*t* [30.56] = 29.12) or a converging style (*t* [32.45] = 24.43) performed better than those with an accommodating (*t* [34.92] = 22.7) or a diverging (*t* [22.7] = 14.98) style did. Contessa et al. reported findings similar to Orhun. Contessa et al. studied medical students (*N* = 16) in a surgery residency to determine whether students with a specific intellectual style performed better on the American Medical Exam than those with other styles. They found that students with a converging style had an average exam score of 62.6; those with an accommodating style had an average score of 42.

Lynch et al.'s (1998) study of third-year medical students (*N* = 227) was the final study reviewed that featured the use of Kolb's (1976) construct of learning style. Lynch et al. sought to determine whether intellectual style correlated with performance on the (a) U.S. Medical Licensing Examination Step 1, (b) the National Board of Medical Examiners multiple-choice surgical subject examination, and (c) the National Board of Medical Examiners computer-based case simulations. They found that individuals with a converger style and an assimilator style performed better on the U.S. Medical Licensing Examination step 1 and the National Board of Medical Examiners multiple-choice surgical subject examination than individuals with an accommodator or a diverger style. They also found that all styles exhibited similar performance on the National Board of Medical Examiners computer-based case simulations.

With the exception of Mammen et al. (2007) and Okay (2012), all of the other researchers who used Kolb's (1976) construct of learning style in their studies found a relationship between intellectual style and academic performance. In addition, Contessea et al. (2005), Lynch et al. (1998), and Orhun (2012) found that students with a converging style performed better than those students with an accommodating or a diverging style did. Lynch et al. and Orhun reported that students with an assimilating style, outperformed students with accommodating or diverging styles. Consequently, these researchers determined that students with an assimilating or a converging style were more likely to succeed. However, because Fox and Bartholomae (1999), Mammen et al., and Okay did not find any statistically significant relationship between intellectual style and academic performance, the existence of a relationship requires further research.

Table 3 presents the results from Contessa et al. (2005), Lynch et al. (1998), and Orhun (2012) for ease of comparing the results of the studies. Unlike Table 2, Table 3 does not include style types (e.g., Type I) because Kolb's (1976) construct of learning does not fall within the threefold model. Consequently, the results from Table 2 and Table 3 are not comparable, with the exception of noting that Contessa et al., Lynch et al., and Orhun found a relationship between intellectual style and academic performance like Zhang (2001, 2004) and the other researchers identified in Table 2.

Table 3

Construct of Learning Style and Academic Performance

Author/ Date	Intellectual style	Sample	IV/DV	Findings			
				Diverger	Accommodator	Converger	Assimilator
Orhun (2012)	Construct of learning style (Kolb, 1976)	Anadolu University students ($N = 87$)	IV: intellectual style DV: Calculus GPA	t (22.7) = 14.98	t (34.92) = 22.7	t (32.45) = 24.43	t (30.56) = 29.12
Contessa et al. (2005)	Construct of learning style (Kolb, 1976)	Medical students ($N = 16$)	IV: intellectual style DV: American Medical Exam score		$M = 42$	$M = 62.6$	
Lynch et al. (1998)	Construct of learning style (Kolb, 1976)	Third-year medical students ($N = 227$)	IV: intellectual style DV: U.S. Medical Licensing Exam Step 1 score	$M = 190$	$M = 193$	$M = 201$	$M = 200$
			DV: National Board of Medical Examiners (NBME) surgical subject examination score	$M = 443$	$M = 434$	$M = 467$	$M = 461$
			DV: NBME computer-based case simulations score	$M = 5.60$	$M = 5.55$	$M = 5.63$	$M = 5.47$

Summary: Intellectual Style and Academic Performance

Researchers such as Zhang (2001, 2004) have provided empirical evidence of a link between academic performance and intellectual style. Lynch et al. (1998), Ross et al. (2001), and Zhang (2001), among others, have repeatedly found that at least one style had validity as a predictor of academic performance. In addition, researchers such as Ross et al. (2001) and Zhang (2001, 2004) have provided indications that factors such as group could influence the predominant intellectual style. For example, external style was a valid predictor of performance in physics ($\beta = -.36$, $p < .01$) for Hong Kong university students ($N = 209$; Zhang, 2001), but judicial style was a valid predictor of performance in physics ($\beta = .23$, $p < .05$) for Hong Kong secondary school students ($N = 250$; Zhang, 2004). Consequently, Zhang's (2001, 2004) results indicate that a best style or styles do not exist. Accordingly, researchers should not assume that a predominant style exists for a given population or that a specific style has validity as a predictor; rather, researchers should measure the population for predominant style.

Although researchers such as Lynch et al. (1998) and Orhun (2012) have provided evidence that styles have validity as predictors of academic performance, other researchers (e.g., Okay, 2012) have not found similar evidence. Conflicting results have indicated that the status of intellectual style as a predictor of performance is far from settled. Such results also have indicated the need for more research to build the case for or against the use of intellectual style as a predictor of performance. Hence, this study adds to the evidence to build the case for or against the concept that intellectual style has validity as a predictor of performance.

General Cognitive Ability, Intellectual Style, and Performance

Previous studies on intellectual style and job or academic performance have not evaluated general cognitive ability, which this study did. Consequently, exploring general cognitive ability and intellectual style related to performance would appear as wholly unexplored territory. However, few researchers (e.g., Kokis, Macpherson, Toplak, West, & Stanovich, 2002; Stanovich & West, 1998, 2008) have explored general cognitive ability and intellectual style, along with their relation to performance, specifically rational thinking performance.

The work of researchers such as Stanovich and West (1998) has provided insight into the relation of general cognitive ability, intellectual styles, and differences in performance, albeit narrowly constrained to critical-thinking assessments. For example, Stanovich and West studied the relationship among general cognitive ability, thinking disposition (intellectual style), and rational thinking performance of 546 undergraduate students. They found that general cognitive ability and intellectual style accounted for approximately 39% of an individual's performance on the rational thinking measure. In addition, they determined that general cognitive ability explained .198, $F(1, 526) = 171.88$, $p < .001$) of the variance and that intellectual style explained .094, $F(1, 526) = 81.51$, $p < .001$ of the variance.

In a study similar to Stanovich and West (1998), Kokis et al. (2002) studied the relationship among the general cognitive ability, intellectual style (cognitive style), and analytic reasoning performance of 108 children in Grades 5, 6, and 8. Kokis et al. found that intellectual style and general cognitive ability explained the unique variance in performance for some of the criterion variables on the analytic reasoning measure. They found that intellectual style explained .048 ($p < .01$) of the variance on the inductive reasoning criterion, with general cognitive ability controlled for. They also found that intellectual style explained .050 ($p < .05$) of the unique variance on the deductive reasoning criterion and that general cognitive ability explained .080 ($p < .01$) of the unique variance. Kokis et al. assessed that their findings and found support for the notion that intellectual style uniquely predicts performance when controlling for general cognitive ability.

The results of investigations by researchers such as Stanovich (1999, 2009) have provided valuable information for this study. Specifically, rationality researchers have studied both general cognitive ability and intellectual style as predictors of performance, which job and academic researchers have not. In addition, rationality researchers have provided information indicating that intellectual styles do predict unique variances in performance while controlling for general cognitive ability. Consequently, results of studies by researchers such as Kokis et al. (2002) have shown that thinking perspective profile, coupled with general cognitive ability, could have better validity as a predictor of analytic performance than general cognitive ability alone.

Intellectual Style and Job Performance

Researchers such as Chan (2010) have commented on the potential value of using intellectual style as a predictor of job performance. However, as noted in the Literature Search Strategy section, few articles have explored the possible relationship between intellectual style and job performance. I was able to identify only three empirical articles.

Of the authors of the three articles, Chan (1996) and Gallivan (2003) reported that a statistically significant relationship between intellectual style and job performance did not exist. The authors of the remaining article, Chilton et al. (2005), reported a statistically significant relationship between at least one intellectual style and job performance.

Chilton et al. (2005) wrote one of the three articles identified in the literature search. One of the key purposes of their study was to determine how intellectual style fit affected the job performance of software developers using Kirton's (1976) decision-making style. To determine the predominant intellectual style of the software developers, Chilton et al. measured perceived and actual predominant intellectual styles. They identified that the software developers ($N = 123$) perceived adaptor (Type II, $M = 92.1$, $SD = 14.6$) as the predominant intellectual style in their work environment. Chilton et al. reported that the measured, predominant intellectual style among the software developers was adaptor (Type II, $M = 94.5$, $SD = 14.3$). They also found that performance varied with intellectual style fit ($\beta = 2.35$, $SE = .64$, $p < .001$), with the individuals with the best fit having the best performance. Hence, they determined that the closer a software developer's intellectual style score came to the predominant intellectual style, the better the job performance of the software developer was.

Although Chilton et al. (2005) were the only researchers to find a statistically significant relationship between intellectual style and job performance, evidence from educational researchers provided additional support of a relation between intellectual style and performance. For example, Zhang's (2001, 2004) results that intellectual style positively varied with academic performance ($\beta = .16 - .28$) were similar to Chilton et al.'s findings (β = 2.35). Thus, although Chilton et al.'s findings were alone among other studies in finding a relationship between intellectual style and job performance, their study is supported by the findings of education researchers (e.g., Kordjazi & Ghonsooly, 2015; Zhang, 2001, 2004) and rationality researchers (e.g., Kokis et al., 2002) that intellectual styles hold potential as a predictor for job performance.

Insofar as Chilton et al.'s (2005) results stand in contrast to the results reported by Chan (1996) and Gallivan (2003), Chilton et al. noted that their method was different in important ways from Chan's and Gallivan's methods. Chan assumed that the predominant intellectual style for specific positions was either adaptor or innovator (Chilton et al., 2005). Similarly, Gallivan arbitrarily assumed that the predominant intellectual style in the participants' workplace was innovator (Chilton et al., 2005). Conversely, Chilton et al. empirically determined the predominant intellectual style present in the workplace for the employees whom they studied. According to Chilton et al., the differences in methods likely contributed to Chan's and Gallivan's findings. Accordingly, Chilton et al.'s results provided a better indicator of the potential of intellectual style, but a single study is simply insufficient to make any conclusions about the validity of intellectual style as a predictor of job performance.

Few researchers (Chan, 1996; Chilton et al., 2005; Gallivan, 2003) have explored the relationship between intellectual style and job performance. Of the three empirical articles identified, Chan (1996) and Gallivan (2003) reported that the relationship between employee intellectual style and job performance was not statistically significant (see Table 4). Conversely, Chilton et al. (2005) found a statistically significant relationship. Although the authors of two of the three articles did not find a statistically significant relationship between intellectual style and job performance, it is spurious to conclude that no relationships exist. The evidence is simply insufficient.

Aside from published research about intellectual style and job performance, to date, no published research has compared intellectual style to general cognitive ability as a predictor of job performance. However, rationality researchers such as Stanovich and West (1998) have found that intellectual style compares favorably with general cognitive ability as a predictor of performance. However, Stanovich and West's findings were in relation to rational thinking performance, not job performance. Consequently, comparing the validity of intellectual style and general cognitive ability as predictors of job performance is a natural step.

Table 4

Intellectual Style and Job Performance

Author/Date	Intellectual style	RQs/Hypotheses	Sample	Key assumptions	IV/DV	Analysis & results	Conclusions
Chan (1996).	Decision-making style (Kirton, 1976)	An increase in the degree of cognitive misfit between the individuals' cognitive style and the predominant style relates to job turnover and performance	Entry level Singaporean Civil Service engineers (N = 253)	Staff engineers predominantly have the adaptor style. Research and development engineers predominantly have the innovator style.	IV: decision-making style score DV: job performance	No significant relationship between intellectual style and job performance.	Cognitive style fit was uncorrelated with job performance.
Chilton, Hardgrave, & Armstrong (2005).	Decision-making style (Kirton, 1976)	The cognitive style fit of the employee's style and the style of the job environment relates positively to job performance	Software developers (N = 123) from eight different companies.		IV: decision-making style score DV: job performance	The employee's style and the style of the job environment positively related to job performance (β = 2.35, SE = .64, p < .001), supporting the hypothesis.	The person-job cognitive style fit related to job performance with improved fit relating to higher performance.

Table 4 Cont'd

Author/Date	Intellectual style	RQs/Hypotheses	Sample	Key assumptions	IV/DV	Analysis & results	Conclusions
Gallivan (2003)	Decision-making style (Kirton, 1976)	Employees who are innovators will have higher levels of job performance compared to adaptors based on supervisor and customer ratings.	Software developers (N = 220)	The innovator style is the predominant style of the environment and those with the innovator style would exhibit higher job performance.	IV: decision-making style score DV: job performance	Results were not statistically significant (r = .16, p = .09) and did not support the hypothesis.	Intellectual style did not relate to job performance or aspects of job performance.

Theoretical Foundation

According to D'Argembeau et al. (2010), the human ability to engage in mental travel through time provides a means for the simulation of "virtually infinite future possibilities" (p. 1701). Triberti and Riva (2016) hypothesized that mental time travel allows individuals to adjust their representational views of the opportunities and limitations of their emerging environments and develop future potentialities. Consequently, the mechanisms that allow individuals to develop future potentialities could give them the ability to create the optimum representation of future potentialities a performance advantage (Suddendorf & Corballis, 2007). Furey and Fortunato's (2014) MindTime theory provided an empirically based theoretical lens for assessing how humans develop potentialities.

Furey and Fortunato's (2014) MindTime theory, which integrates mental time travel (Suddendorf & Corballis, 1997; Tulving, 1985) and construal-level theory (Trope, Liberman, & Wakslak, 2007), provided a key theoretical lens for this study. Accordingly, this section starts with descriptions of mental time travel (Suddendorf & Corballis, 1997; Tulving, 1985) and construal-level theory (Trope et al., 2007) to provide information on foundational concepts. Building on the foundational concepts, this section includes (a) an overview of the MindTime theory, including the four theoretical propositions; (b) descriptions of Future, Present, and Past thinking perspectives; (c) descriptions of thinking perspective profiles; and (d) a summary of the MindTime theory.

Mental Time Travel

Tulving (1985) wrote that three forms of consciousness exist that relate to the three memory systems: autonoetic, or self-knowing, consciousness; noetic, or knowing, consciousness; and anoetic, or unknowing, consciousness (Gardiner, 2001; Tulving, 1985). According to Tulving, autonoetic consciousness relates to the episodic memory system, noetic consciousness relates to the semantic memory system, and anoetic consciousness relates to the procedural memory system. Hence, autonoetic consciousness provides individuals with rich details of lived events using the episodic memory system (Gardiner, 2001; Tulving, 1985). Furthermore, autonoetic consciousness allows individuals to link details of past and present experiences with future potentialities (Gardiner, 2001; Tulving, 1985). Consequently, normal, healthy persons with autonoetic consciousness can roam at will over past events and future potentialities through mental time travel (Tulving, 1985).

Suddendorf and Corballis (1997) expanded on Tulving's (1997) definition by hypothesizing that mental time travel involves the mental reconstruction of past events using episodic memory. They also hypothesized that mental time travel includes the construction of possible future events. They further hypothesized that construction of the representations occurs through different cognitive capacities, including meta-representations and disassociating potentialities from current realities.

Polyn and Sederberg (2014) wrote that mental time travel involves the activation of different neural circuits that produces rhythmic oscillatory signals. Following the retrieved context theory, memory formation involves an interaction between executive and associate processes to form neural-based item representations (Polyn & Kahana, 2008). Morton et al. (2013), in their study of category-specific neural oscillations and memory recall using scalp electroencephalography, found evidence that the participants ($N = 29$) conducted memory recall searches by category. Items clustered by category "were identified more reliably than the items that would be forgotten (t([28] = 3.26, $p < .005$)" (p. 2415). Hence, individuals forget or have difficulty recalling incidental details (i.e., uncategorized details) over time. The ability to retrieve information, along with the categorization of the information, affects mental time travel partly through an interaction between existing neural representations and executive and associate processes (Morton et al., 2013; Polyn & Sederberg, 2014).

In the context of the MindTime theory, neural representations develop in relation to natural stimuli, with representations based on avoiding negative stimuli and seeking positive stimuli (Furey & Fortunato, 2014). Consequently, context development of a situation occurs through the integration of current stimuli, which influence perceptual representations, and preexisting neural representations (Polyn & Sederberg, 2014). The ability to engage in mental time travel involves perceptions of relevant stimuli and the relative strength of the stimuli (Morton et al., 2013; Polyn & Sederberg, 2014).

Construal-Level Theory

According to Trope and Liberman (2010), the theories of categorization (Rosch, 1975); concept formation (Medin & Smith, 1984); and action identification (Vallacher & Wegner, 1987) formed the foundation of the construal-level theory. Based on these theories, Trope and Liberman developed the framework for construal-level theory, which links the concept of psychological distance to perceptions of events or objects. Two of the important concepts introduced with the construal-level theory are *psychological distance* and *level of construal* (Trope et al., 2007).

The first concept, psychological distance, consists of four dimensions of distance: temporal, spatial, hypothetical, and social (Trope et al., 2007). Bar-Anan, Liberman, Trope, and Algom (2007) wrote that the different dimensions of construal-level theory provide similar contextual information for psychological processes. As temporal, spatial, hypothetical, or social distance increases, cognitive representations of the event transition from concrete to increasingly abstract (Trope & Liberman, 2010). For example, using a cell phone to call a friend transitions from the immediate (temporal) concrete cognitive representation that includes specific details, such as the type of phone, to a distant (temporal) abstract cognitive representation of “made a call to a friend” (Trope & Liberman, 2010). Consequently, as new stimuli supplant stimuli from the event, individuals omit or assimilate “details that are inconsistent with the chosen abstract representation” of the event (Trope & Liberman, 2010, p. 441). Furthermore, as psychological distance increases, representations of the event become simpler and schematic (Trope & Liberman, 2010).

Based on the conceptualization of psychological distance, Trope and Liberman (2010) developed the second concept of the construal-level theory, that is, level of construal. The construal-level theory has two levels of construal, namely, low and high (Trope et al., 2007). Low-level construals typically consist of unstructured contextualizations of events that include incidental details, whereas high-level construals are structured sets of decontextualized information (Trope et al., 2007). Consequently, representations of near-term events (low-level construals) include a high level of details, including superfluous details. Conversely, representations of distant future events often are abstract and largely include only linked, vital information (Trope et al., 2007). Hence, the level of construal affects what options individuals have for reacting to or interacting with events.

Several researchers (e.g., Braga, Ferreira, & Sherman, 2015; Chen & He, 2016) have conducted empirical studies supporting the construal-level theory. Of the numerous studies, those conducted by Bar-Anan et al. (2007); Gilead, Liberman, and Maril (2013); and Stephan, Liberman, and Trope (2011) have provided a good cross-section of studies and research methods that support the construal-level theory. Bar-Anan et al. sought to determine whether a Stroop effect (Stroop, 1935) occurred among a group of students ($N = 16$) when the temporal distance of the words used in the study was manipulated. The Stroop effect is a measure in psychology to assess cognitive focus, where conflicting stimuli exist, such as when the word "blue" is written in red (Bar-Anan et al., 2007; Carr & Dweck, 2011). Bar-Anan et al. found that a word and temporal distance interaction existed, $F(1, 15) = 5.21$, $p < .05$, with faster responses to "congruent ($M = 655$ ms [milliseconds]) than to incongruent ($M = 671$ ms) combinations" (p. 618). Consequently, Bar-Anan et al. determined that the Stroop effect was present because the participants reacted to congruent stimuli more quickly.

In another study, Stephan et al. (2011) sought to determine whether temporal distance affected the perceptions of students ($N = 22$) regarding their familiarity with social targets (i.e., participants were shown pictures provided by the researchers of individuals in social scenarios). They used two temporal distances, proximal future and distal future, coupled with a familiarity instrument. The first temporal distance (proximal future) consisted of telling the participants that they would meet an individual in a picture during the current session of the study; the second temporal distance (distal future) involved the participants meeting the individual in the picture at the next session of the study (Stephan et al., 2011). Stephan et al. found that temporal distance affected scores on the familiarity instrument, with participants achieving higher scores for objects with a closer temporal distance ($M = 3.9$, $SD = .9$) than objects at a more distant temporal distance ($M = 3.0$, $SD = 1.0$). Consequently, temporal distance affected construal level. The researchers determined that closer temporal distances resulted in low-level construals (higher familiarity indicating more detail); distant temporal distances had high-level construals.

Gilead et al. (2013) used functional magnetic resonance imaging (fMRI) images and reaction measurements in their study of the effect of temporal distance of sentences on the neural markers of students' ($N = 21$) brains. Using fMRI images, they found that the processing of future sentences involved three areas of the brain: medial prefrontal cortex, posterior cingulate cortex, and left temporoparietal junction. In contrast, they found that fMRI images indicated that the processing of present and past sentences involved the insular cortex and the cerebellum. Gilead et al.'s results supported their prediction that construal-level theory predictions were accurate concerning the processing of proximal and distal temporal mental representations of objects and events. Gilead et al.

also found that proximal temporal mental representations exhibited higher reliance on concrete mental images than distal temporal representations.

Gilead et al. (2013) wrote that the level of abstraction and the temporal distance of the sentence affected response time. Response times for abstract (*M* = 1311 ms, *SD* = 473) and present tense (*M* = 1296 ms, *SD* = 477) were slower than concrete (*M* = 1251 ms, *SD* = 448) and future tense (*M* = 1263, *SD* = 441) sentences, respectively (Gilead et al., 2013). Consequently, Gilead et al.'s results supported construal levels, as outlined by Trope et al. (2007) in the construal-level theory, where low-level construals include more information than high-level construals do. Gilead et al. found that temporal distance affected the activation of the brain and processing time, with time increasing as construal level moved from a high to a low level.

The aforementioned studies are examples of empirical studies supporting the construal-level theory. Other examples include Liberman, Sagristano, and Trope's (2002) study, in which they found that the participants were more likely to think of objects abstractly if they were in the future versus the present. Similarly, Liberman, Trope, McCrea, and Sherman (2007) found that perspective of temporal placement affects construal level and construal level affects temporal perspective. Ample empirical support exists for the construal-level theory, including support from fMRI images, making construal-level theory a solid foundation upon which to build other theories.

MindTime Theory

Furey and Fortunato (2014), building on mental time travel (Suddendorf & Corballis, 1997; Tulving, 1985) and the construal-level theory (Trope et al., 2007), developed four theoretical propositions for the MindTime theory. For their first theoretical proposition, Furey and Fortunato proposed that three patterns of perceptual and cognitive mental activity exist, namely, Past thinking, Present thinking, and Future thinking perspectives, based on symbolic representations of the Past, Present, and Future as distinct temporal realities.

For their second proposition, Furey and Fortunato (2014) proposed that individual differences exist in the ways people use their Past, Present, and Future thinking perspectives, which then influence how they perceive and process information and interact with the world and others. Hence, variations in utilization influence individuals' (a) perceptual and social judgments, (b) goal-setting activities, (c) intentions and preferences, and (d) communication and interaction with others (Furey & Fortunato, 2014). Furey and Fortunato further proposed that employment of Past, Present, and Future thinking perspectives provides the foundation of an individual's identity and subjective awareness of time (Fortunato & Furey, 2012; Furey & Fortunato, 2014). Thus, individuals exhibit a habitual use of Past, Present, and Future thinking perspectives that forms their thinking perspective profiles, a key element of what differentiates one person from another.

In their third theoretical proposition, Furey and Fortunato (2014) proposed that Past, Present, and Future thinking perspectives operate at the collective and individual levels. They further proposed that collective patterns of Past, Present, and Future thinking perspectives form the foundation of culture, including the establishment of cultural norms. Furey and Fortunato asserted that the collective pattern of Past, Present, and

Future thinking perspectives influences how groups of people navigate change and address collective goals in the perceived support of the collective.

For their fourth theoretical proposition, Furey and Fortunato (2014) proposed the following:

> The theory of MindTime provides a basis for understanding the quality and nature of the interaction between any two individuals or groups of individuals as well as the quality and nature of the interactions among the members of any collective. (pp. 9-10)

Furey and Fortunato (2014) asserted that the MindTime theory was a way to identify and describe work team effectiveness. They also asserted that the MindTime theory could provide organizations with insight into candidate selection and career development. The MindTime theory provided a framework for identifying and describing the habitual ways in which individuals and organizations approach different components, which could relate to individual and organizational effectiveness and performance, which supported the purpose of this study.

Future thinking perspective. Future thinking perspective refers to the ways that individuals creatively imagine hypothetical future scenarios (Furey & Fortunato, 2014). Furey and Fortunato (2014) proposed that the ability of human beings to engage in Future thinking has given them a survival advantage by providing a way to create novel solutions to problems. Future thinking perspective includes the development of abstract representations of objects and events in the generation of alternate futures and novel solutions (Fortunato & Furey, 2012; Furey & Fortunato, 2014). Furey and Fortunato wrote that Future thinking perspective manifests in several ways. For example, the Future thinking perspective can manifest as creative problem solving and the identification of potential opportunities in an environment. The Future thinking perspective also can manifest as flexibility and adaptability, and can relate to the openness and extraversion personality traits (Furey & Fortunato, 2014).

Given the manifestations of Future thinking perspective, Furey and Fortunato (2014) noted that individuals who use a Future thinking perspective tend to possess a sensitivity to perceived opportunities, imagine alternative realities, and envision novel and innovative solutions to challenges. The Future thinking perspective also includes lateral thinking ability, or the ability to employ unorthodox methods to solve intractable problems (Furey & Fortunato, 2014). Individuals using the Future thinking perspective often express optimism and courage. Future thinking perspective provides human beings with a way to address potential obstacles and adapt their environment to enhance their potential for success by envisioning alternative realities.

Past thinking perspective. Like Future thinking perspective, Past thinking perspective refers to a habitual pattern of thinking (Fortunato & Furey, 2010, 2012). However, whereas Future thinking perspective involves imagining future possibilities, Past thinking perspective involves accessing the knowledge and experiences stored in memory (Fortunato & Furey, 2010; Furey & Fortunato, 2014). In addition, Past thinking perspective, which facilitates access to and the evaluation of experiences, allows individuals to develop a foundation and a framework for the generation of novel ideas and solutions with Future thinking (Furey & Fortunato, 2014). Consequently, Past thinking perspective allows individuals to “engage in introspection, reflection, contemplation, analysis and information gathering” (Fortunato & Furey, 2010, p. 437).

Past thinking perspective manifests in several ways (Fortunato & Furey, 2010, 2012; Furey & Fortunato, 2014). For example, individuals high in Past thinking perspective have a tendency to engage in reflective and contemplative activities (Furey & Fortunato, 2014). In addition, these individuals (a) engage in deliberate thinking, (b) tend to reconsider decisions, (c) show a preference for studious environments, and (d) seek careers that focus on analytic inquiry involving information and knowledge (Furey & Fortunato, 2014). Hence, individuals who exhibit Past thinking perspective have a tendency for cautiousness, skepticism, and cynicism while exhibiting slower decision making (Fortunato & Furey, 2010).

Present thinking perspective. The Present thinking perspective is a pattern that corresponds with innate, conceptual representations of the present as a distinct reality (Furey & Fortunato, 2014). Individuals who use a Present thinking perspective have the “ability to organize, plan, and structure one’s environment and activities” to ensure stability and harmony (Fortunato & Furey, 2010, p. 437). Like Past and Future thinking perspectives, Present thinking perspective manifests in several ways, such as individuals tending to (a) develop concrete classifications of objects and events; (b) exhibit good performance on detailed-orientated tasks; (c) engage in the organization, planning, and structuring of environment and activities; (d) subscribe to and maintain predefined schemas, including cultural and personal schemas; (e) engage in pragmatic decision making; (f) develop stable and harmonious relationships; and (g) approach life situations in pragmatic, resilient, and positive ways (Fortunato & Furey, 2010, 2012; Furey & Fortunato, 2014). Individuals who use Present thinking perspective have a tendency to adopt and adhere to "pre-defined social and personal schemas (e.g. rules, laws, procedures)" to ensure stability and harmony in their environment (Fortunato & Furey, 2010, p. 437). Individuals who use a Present thinking perspective gravitate toward groups and activities that support order and social norms (Furey & Fortunato, 2014).

Thinking perspective profiles. Because individuals use thinking perspectives to various degrees, Fortunato and Furey (2012) asserted that individuals or groups have unique profiles of Past, Present, and Future thinking perspectives. In addition, thinking perspective profiles exist as a stable pattern of perspectives with dominant and subordinate thinking perspectives, or a balance of thinking perspectives (Fortunato & Furey, 2012). Furey and Fortunato (2014) hypothesized that the degree of match between thinking perspective profile and the environment (e.g., the curricula and methodology of an academic course) could influence performance. For example, Past thinking perspective eases the reconstruction and reevaluation of semantic and episodic memories in the development of a framework that supports the generation of (a) novel solutions to problems by Future thinking perspective, (b) frameworks for Present thinking perspective for the structuring of the current environment, and (c) schemas for Present thinking perspective in the maximization of control of the environment or event to produce the desired outcomes (Fortunato & Furey, 2010). However, if individuals underuse Past thinking perspective in their problem-solving activities, their solutions could underperform because of the lack of substantiation against similar past activities (Furey

& Fortunato, 2014). Consequently, thinking perspective profile could affect performance, and the MindTime theory provided a framework for assessing whether thinking perspective profile and intellectual style are related to job performance. However, to date, researchers have not explored whether a relationship between Past, Present, or Future thinking perspective, or any other thinking perspective profile, and job performance exists.

Although current research regarding performance and thinking perspectives does not exist or was not found during the literature search, a study by Fortunato and Furey (2012) indicated that a relationship between the pattern of the task environment and the thinking perspective profile of an individual exists. Despite providing possible indicators that could relate to performance, their study did not specifically relate to the question at hand. However, their study did indicate that individual differences in thinking perspective could affect task enjoyment, which could factor into performance. Their study provided some important clues, but did not provide empirical evidence for this study.

Summary: MindTime Theory

Zhang et al. (2012) commented that the field of intellectual styles has struggled to find an identity. Coffield et al. (2004), in their review of intellectual styles, identified 71 models. Some of the models identified by Coffield et al. had similar constructs; others did not. Some styles also had different labels for preexisting constructs from other styles (Coffield, et al., 2004). In addition, many constructs either lacked a sufficient theoretical basis or the claimed theoretical basis for the construct did not match the application of the construct (Coffield et al., 2004). For example, Joniak and Isaksen (1988) were not able to support claims by Gregorc (1982) relating to his theoretical model. Consequently, two of the preeminent problems associated with intellectual styles are overlapping constructs, or similar constructs with different labels, and an insufficient theoretical basis.

The MindTime theory (Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014) does not suffer from either of the aforementioned problems because it was built methodically on a strong theoretical and conceptual foundation. In using the construal-level theory and the concept of mental time travel, Fortunato and Furey (2009, 2010, 2012) established the MindTime theory on a body of empirical research. In addition, empirical research supporting the construal-level theory and mental time travel has been supported by several empirical studies of the human brain (e.g., Bar-Anan et al., 2007; Morton et al., 2013). The MindTime theory has a strong theoretical foundation as well as constructs linked to neurological functions such as semantic and episodic memory. Thus, the MindTime theory offers two advantages over other intellectual styles, namely, a sound theoretical foundation and a link to actual neurological functions, much like the CHC theory of intelligence.

Current Literature Limitations

As with most topics, value exists in the development of new knowledge and expanded scientific knowledge to promote positive social change in regard to predicting job performance. The gaps in the current literature, as previously stated, are the lack of research involving the examination of different intellectual styles and job performance, and comparisons of intellectual style and general cognitive ability as predictors of job performance. Conceptually, addressing the limitations in the current literature is easy:

Researchers simply need to conduct more research. Hence, a researcher merely needs to select an intellectual style, find a target population, and conduct the research. However, the number of different intellectual styles complicates research in part because of the way that the developer of the style conceptualized the style. For example, although Chan (1996), Chilton et al. (2005), and Gallivan (2003) used Kirton's (1976) decision-making style, Kirton (1976, 2003) conceptualized his style not relating to performance. Even though how a developer conceptualized a style does not prevent a researcher from using it, such use might be inappropriate. Hence, as Coffield et al. (2004) wrote, competing intellectual style theories and measures, coupled with the validity and reliability of the measures, can complicate the decision about which style to use. Reliability and validity issues with the measures and the research that supports a style often are contested, as well, making their use difficult to substantiate (Coffield et al., 2004).

The lack of a solid theoretical foundation is another issue with many intellectual styles (Coffield et al., 2004; Rayner et al., 2012). For example, Fitzgerald and Hattie (1983) criticized Gregorc's (1982) inventory and intellectual style for its weak theoretical foundation. Moreover, according to Coffield et al. (2004), some researchers have claimed theoretical foundations for their styles, but they have applied those theories in ways inconsistent with the precepts of the theories. Subsequently, the different factors within the field of intellectual styles complicate researchers' decisions about which styles to use in their studies.

To overcome issues with constructs, theoretical foundations, and the reliability and validity of the instrument, I used the MindTime theory and the MindTime Profile

Inventory™ (Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014) in the study. The MindTime theory (Furey & Fortunato, 2014) melds theoretical perspectives from the construal-level theory (Trope et al., 2007) and mental time travel (Tulving, 1985) with findings from empirical research to form a comprehensive theory of intellectual style. Fortunato and Furey (2009, 2010, 2012) also have used their MindTime Profile Inventory™ with large samples. Thus, the MindTime Profile Inventory™ does not suffer from the validation and reliability statistics based on small sample sizes that some instruments mentioned by Coffield et al. (2004) do. By using the MindTime theory and the MindTime Profile Inventory™, I overcame the shortcomings of some other styles.

Aside from overcoming the shortcomings of other intellectual styles, such as the lack of a theoretical foundation in Gregorc's (1976) mind styles model (as cited in Coffield et al., 2004), the MindTime theory provided a solid theoretical foundation to address the specific gaps and limitations in the current literature. The previously identified limitations were as follows: (a) Only three empirical studies currently published involved intellectual styles and job performance, (b) researchers have studied one intellectual style taxonomy, and (c) the researchers of two of the three articles assumed that a predetermined intellectual style related to better job performance. Accordingly, the intent of this study was to address the gaps and limitations in the literature.

Summary and Conclusion

Research involving general cognitive ability has a rich history spanning more than 100 years (Ghiselli, 1973; Hulsheger et al., 2007; Hunter & Hunter, 1984; Ree & Earles, 1992; Ree et al., 1994). The depth and breadth of available research have supported the assertion by researchers (e.g., Cucina et al., 2015); however, little is known about the relationship between intellectual style and job performance, with few researchers (Chan, 1996; Chilton et al., 2005; Gallivan, 2003) having explored this relationship. Only Chilton et al. (2005) found a relationship between job performance and intellectual style, noting that it was a predictor of job performance. Hence, the evidence available would appear to run against a relationship between intellectual style and job performance, but where the sparse research in the job realm would indicate that a relationship likely does not exist, evidence from the realm of education has indicated otherwise.

Zhang (2001, 2004), along with other educational researchers, provided empirical evidence of the validity of intellectual style as a predictor of performance, albeit academic performance. For example, Zhang (2004) found that several different styles predicted performance in a variety of academic settings (e.g., Chinese literature). Consequently, academic researchers have provided empirical evidence showing that intellectual style has potential value as a predictor of performance.

Aside from educational researchers, rationality researchers (e.g., Stanovich, 1999) have provided evidence of the validity of intellectual style as a predictor of performance. Furthermore, rationality researchers (e.g., Kokis et al., 2002), unlike educational researchers, have controlled for general cognitive ability when studying the validity of intellectual style as a predictor of performance, which provided important evidence for this study that performance is not predominantly about general cognitive ability. The shortcoming of the evidence provided by rationality researchers was that they were exploring only intellectual style as a predictor of a single facet of performance, namely, critical-thinking performance.

Evidence from academic researchers such as Zhang (2001) and educational researchers (e.g., Kokis et al., 2002) has provided some tantalizing indicators, albeit not directly relatable to job performance, indicating that conclusions about the validity of intellectual style as a predictor of job performance require further job-related research. However, challenges come not only from indicators not directly applicable to job performance but also from the field of intellectual styles itself.

Although many challenges exist, as indicated throughout this chapter, none of the challenges is insurmountable. For example, this study included the MindTime theory (Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014), which does not suffer from a lack of a theoretical basis. Consequently, evidence does exist from different disciplines that intellectual style has validity as a predictor of performance, but studying the subject required a thoughtful and methodical process to avoid problems overwhelming the research. In addition, even with a thoughtful and methodical approach, intellectual style was not likely to surpass general cognitive ability as a predictor of performance. However, the possibility existed that intellectual style, or more specifically, thinking perspective profiles, could add incremental validity to general cognitive ability as a predictor of job performance.

Chapter 3 includes descriptions of the research methods used, including the sampling method, the method of instrument use, and data analysis. Chapter 3 also presents a discussion of the use of regression analysis as a valid method to identify relationships among general cognitive ability, intellectual styles, combinations of intellectual styles, and job performance. I also describe the target population, sample, and instruments; explain the ethical considerations; and provides detail about the data security protocol.

Chapter 4 includes descriptive statistics for the demographics of the sample, along with statistical analyses of the data from the ICAR16, the MindTime Profile Inventory™, and the SAJPA. In addition, Chapter 4 includes statistical analyses of thinking perspective profiles to answer the two RQs. First, Chapter 4 includes statistical analyses of the validity of thinking perspective profiles as predictors of analytic job performance; second, Chapter 4 contains statistical analyses of the incremental validity of thinking perspective profiles beyond general cognitive ability as predictors of analytic performance.

Chapter 5 has five sections. The first section is the interpretation of the findings; the second section presents the limitations of the study. The third section offers recommendations for future studies. The fourth section describes implications from the study findings. The final section is the conclusion.

Chapter 3: Research Method

The five sections in Chapter 3 address different aspects of the research method. The first section includes the overall research design and approach. The second section includes the setting of the study and sampling, including the target population, sampling method, and sample size. The third section includes a description of the four instruments. The fourth section provides a description of ethical considerations, and the final section provides an overview of the study process, including the order of the study.

Research Design and Rationale

A quantitative, nonexperimental design was used in the study. Two conditions influenced the selection of a nonexperimental design. First, because I had limited access to the target population consisting of analysts (i.e., risk and intelligence analysts), brief contact was possible, but long-term contact was not possible because of security and confidentiality concerns. Limited access without guarantees of continued access prevented consideration of experimental designs. Second, because I was not able to isolate the target population, the use of an experimental design was not practical. As Garson (2013d) noted, quantitative, nonexperimental designs are appropriate for studies in which control groups, randomized subjects, or manipulation of IVs is not possible or is prohibitively difficult.

In addition to the preceding conditions, my limited access to the target population narrowed the possible sampling methods. I used convenience sampling in the solicitation of volunteers in analytic positions from government agencies and professional groups who agreed to participate, making the nonexperimental design the most appropriate design for this study.

I collected data using four instruments, the first of which was a demographic survey. The second instrument was the ICAR16, developed by Condon and Revelle (2014). The third instrument was the MindTime Profile Inventory™ (Fortunato & Furey, 2009, 2010, 2012; Furey & Fortunato, 2014). The fourth instrument was the SAJPA, a self-assessed, behaviorally anchored response scale job performance survey that I developed.

Methodology

Population

The target population comprised incumbents who conducted intelligence or risk analysis for the U.S. government within the National Protection and Programs Directorate (NPPD) of the Department of Homeland Security (DHS) at the time of the study. According to O*NET (2016), approximately 117,000 people were working as intelligence analysts as of 2015, along with an unknown number of individuals working as risk analysts. A target population in excess of 100,000 was very large; however, attaining even a small sample presented two challenges. First, the individuals in the target population mainly worked for entities within the government (e.g., National Security Agency) that had high levels of security and often prohibited or severely limited access to their personnel. Attaining permission and access to the target population limited the number of potential volunteers. Second, of the agencies that agreed to participate, only a few individuals working as analysts for the agencies volunteered to join the study.

According to Frankfort-Nachmias and Nachmias (2008), researchers use convenience sampling when they cannot estimate the size of their target populations. Because of limited availability of or access to the target population, a researcher might choose to use convenience sampling (Garson, 2016a). One limitation of convenience samples and other forms of nonprobability samples is that they are not representative of the target populations (Frankfort-Nachmias & Nachmias, 2008).

Although convenience sampling limited the generalizability of the results to the participants, it was the most appropriate sampling method for this study for two reasons. First, accessing the target population was a challenge that limited the possibility of identifying the actual size of the target population. Second, this study was exploratory, so the goal was to examine possible evidence of the validity of thinking perspective profile as a predictor of job performance.

The target population comprised individuals who were conducting intelligence or risk analysis for NPPD within DHS at the time of the study. Members of target populations are often educated individuals who do not fall into any vulnerable categories such as minors (O*NET, 2016). However, because sampling was anonymous, I could not ensure that the participants did not belong to a vulnerable category. The informed consent process and the ability to withdraw from the study at any time protected any participants who might have fallen into one or more vulnerable categories.

Sampling and Sampling Procedures

Sample size. When conducting empirical research, researchers must consider sample size (Frankfort-Nachmias & Nachmias, 2008). Three factors that researchers often take into account when determining sample size are significance, confidence intervals (CIs), and explanatory power (Garson, 2016a). For probability sampling methods, such as simple random samples, all three factors must be considered (Garson, 2016a). However, for nonprobability sampling, such as the convenience sampling method used for this study, only explanatory power was necessary (Garson, 2016a). A sample large enough to meet a power of .80, which researchers have accepted as a sufficient explanatory power for empirical studies (Cooper & Garson, 2016; Garson, 2016a), was determined as the minimum sample size needed.

G*Power v.3.1.9.2 was used for the a priori power analysis to determine the sample size needed to attain a power of .80. Results indicated that a sample of 68 participants was needed for a linear multiple regression model testing the two predictors of general cognitive ability and thinking style profile, with a total of eight predictors for a power of .80, $\alpha = .05$, and $f^2 = .15$. For a power of .95, the required sample size increased to 107.

Because fewer than 68 volunteers from the DHS volunteered to join the study, I sent requests for volunteers to agencies outside of the DHS, such as the U.S. Department of Defense. My solicitations for agencies to agree to participate were largely unsuccessful. Consequently, solicitation for volunteers eventually included professional groups on LinkedIn, as approved by Walden University’s institutional review board (IRB).

Procedures for recruitment, participation, and data collection. Sampling took place in three phases. In the first phase, I identified and contacted U.S. government agencies such as the Office of Cyber and Infrastructure Analysis that employed individuals who were conducting intelligence or risk analysis at the time of the study. Agencies that indicated an interest in the study received an invitation to participate in a presentation about the different facets of the study. The presentation included an overview of the underpinning theories, a description of the instruments, and an explanation of the security procedures used for data collection.

In the second phase of sampling, I solicited volunteers from the agencies that agreed to participate by sending a standard solicitation message to incumbents who conducted intelligence or risk analysis. The message included a description of the study, risks and benefits associated with participation, confidentiality information, data security information, my contact information, contact information for Walden University, and a link unique to that agency to the website with the consent information and instrument.

The final phase of collection involved giving the volunteer participants access to the consent information (see Appendix A) and the data collection instruments. The consent information included a description of the study, risks and benefits associated with participation, confidentiality information, data security information, my contact information, and contact information for Walden University. After reading the consent information, potential participants who agreed to join the study indicated that they understood the potential risks and benefits by completing the biographical survey (see Appendix A), SAJPA (see Appendix B), the ICAR 16 (see Appendices C & D), and the MindTime Profile Inventory™ (see Appendices E & F) on SurveyMonkey through a link provided to them in the solicitation letter. After completing the instruments, participants had the option to include an e-mail to receive their results.

Because fewer than 68 individuals from U.S. government agencies volunteered, solicitation for volunteers was expanded to include professional organizations. Sampling mirrored the third sampling phase outlined previously. The only difference between the third sampling phase and the sampling of volunteers from professional organizations was the solicitation letter, which was tailored for professional groups.

Instrumentation

Demographic survey. Collecting demographic information on age, gender, education, and ethnicity is common in research. However, because the focus of this study was whether thinking perspective profiles have validity as predictors of analytic inventory, I collected demographic information on gender, ethnicity, analytic experience, and education only. This information provided was appropriate for this exploratory study.

International Cognitive Ability Resource. Condon and Revelle (2014) developed the ICAR in response to a perceived need for a measure of general cognitive ability for primary researchers. Primary researchers often need to use several commercial instruments to meet their research needs because of a general inability to choose between specific items (Condon & Revelle, 2014). The ICAR became a flexible platform allowing researchers to develop custom combinations of items to meet their needs.

Most measures of general cognitive ability are commercial instruments, so the costs associated with using multiple measures or even a single measure can vary widely (Condon & Revelle, 2014). Because the ICAR is freely available in the public domain, the ICAR has provided researchers with a flexible and cost-effective instrument (Condon & Revelle, 2014). However, as Condon and Revelle (2014) noted, many critics of instruments in the public domain have argued that the lack of control over the instrument could affect the validity of the instrument. Condon and Revelle asserted that instruments not in the public domain are not immune from disclosure. Field (2012) questioned the efficacy of intellectual property right laws maintaining the confidentiality of the tests because the laws do not stop copyright violations. Even copyrighted tests with controlled distributions are not immune from people studying for them by reviewing pirated copies.

Because the ICAR is an instrument in the public domain, one of its limitations, especially when it is administered online, is the possibility that respondents could affect its validity if they do searches for test items or study the test prior to taking it. To mitigate the possibility of studying for the ICAR or conducting Internet searches for test items, I did not mention that I would be asking participants to complete the ICAR16, the 16-item version of the full 60-item ICAR (see Condon & Revelle, 2014). Not advertising the ICAR16 made studying for the assessment less likely.

Condon and Revelle (2014) administered the ICAR16 to a subset (n = 4,574) of the volunteers for the ICAR project (N = 96,958). They found that the ICAR16 had an adequate (α = .81, ω_{total} = .83) internal consistency and exhibited a moderate general cognitive ability saturation (ω_h = .66) through all the items, with saturation high (ω = .8) in the verbal reasoning as well as the letter and number series items (Condon & Revelle, 2014). Condon and Revelle found that the ICAR16's reliability had moderate correlations with combined SAT ($r = .59$) and ACT composite ($r = .52$) scores. Condon and Revelle also found that the ICAR16 had strong correlations with the Shipley-2 composite A ($r = .81$) and B ($r = .82$). The ICAR16 even exhibited good psychometric qualities when compared to well-known measures of general cognitive abilities.

MindTime Profile Inventory™. I used the MindTime Profile Inventory™, formerly known as the TimeStyle Inventory™, to measure differences in individuals' thinking perspective profiles, which consist of different combinations of Past, Present, and Future thinking (Fortunato & Furey, 2009, 2010; Furey & Fortunato, 2015). Two versions of the instrument exist: a 34-item form and a 45-item form (Fortunato & Furey, 2009, 2010; Furey & Fortunato, 2015). I used the 45-item form because it was the most current form available at the time of the study.

The MindTime Profile Inventory™ includes three Likert-type scales, one for each thinking perspective: Past, Present, and Future (Fortunato & Furey, 2009, 2010; Furey & Fortunato, 2015). The Past, Present, and Future thinking scales each have 15 items (Furey & Fortunato, 2015). For each of the items on the scales, respondents are asked to assess how well each item describes them from 1 (*not at all well*) to 7 (*extremely well*; Furey & Fortunato, 2015, p. 2). For example, on the Past thinking scale, respondents assess whether they "like to generate ideas" (Furey & Fortunato, 2015, p. 2). Consequently, based on how a participant responds to the MindTime Profile Inventory™, the individual falls into one of eight thinking perspective profiles: (a) Past (high Past, low Present, and Future thinking perspectives); (b) Present (high Present, low Past and Future thinking perspectives); (c) Future (high Future, low Past and Present thinking perspectives);

(d) Past/Present (high Past and Present, low Future thinking perspectives); (e) Past/Future (high Past and Future, low Present thinking perspectives); (f) Present/Future (high present and Future, low Past thinking perspectives); (g) high integrated (high Past, Present, and Future thinking perspectives); and (h) low integrated (low Past, Present, and Future thinking perspectives; Fortunato & Furey, 2012).

The MindTime Profile Inventory™ has proven to have good reliability. For example, Fortunato and Furey (2010) reported that reliability estimates using coefficient alpha were .80, .91, and .84 for the Past, Present, and Future thinking Perspective scales, respectively. Overall, reliability, estimated with coefficient alpha, has ranged from .80 to .87 for the Past thinking Perspective scale, .91 to .92 for the Present thinking Perspective scale, and .80 to .91 for the Future thinking Perspective scale (Fortunato & Furey, 2009, 2010, 2012).

To date, no peer-reviewed sources exist in which job performance has been assessed using the MindTime Profile Inventory™. Fortunato and Furey (2010) recommended that future researchers explore “the extent to which Past, Present, and Future thinking [perspectives] predict such behavior as” job performance (p. 440). This study was the first attempt at determining whether Past, Present, and Future thinking perspectives had validity as predictors of job performance.

Self-Rated Analytic Job Performance Assessment. The O*NET (2016) job analysis report for intelligence analysts formed the basis for the SAJPA. I included 10 factors from the 308 factors (e.g., analyzing data or information) from 11 categories (e.g., skills) in the O*NET job analysis in the instrument. The 10 factors formed the basis for the 20-question SAJPA, with two items per factor. Following are the item numbers and factors assessed by the items:

- 1 and 11: Core task: validate known intelligence.
- 2 and 12: Core task: gather, analyze, correlate, or evaluate information from a variety of resources.
- 3 and 13: Core task: prepare written reports and presentations based on research and analysis of intelligence data.
- 4 and 14: Skills: reading comprehension.
- 5 and 15: Skills: active listening.
- 6 and 16: Skills: critical thinking.
- 7 and 17 Abilities: inductive reasoning.
- 8 and 18: Abilities: problem sensitivity.
- 9 and 19: Abilities: deductive reasoning.
- 10 and 20: Work styles: analytical thinking (O*NET OnLine, 2016).

I split the 20 items are split into two sections, with Section 1 containing Items 1 to 10 and Section 2 containing Items 11 to 20. The intent behind the two sections, each of which included the same factors and number of items, was to facilitate the calculation of an average for each factor to limit score inflation.

The SAJPA had two limitations. First, the assessment might not have included factors that were not representative of the knowledge, skills, abilities, or tasks of the target population, or it might have omitted relevant factors. Consequently, the assessment might not accurately have captured important aspects of analytic job performance, which limited the instrument.

Second, the self-rated aspect of the assessment could have affected the accuracy of the assessment of job performance. According to Demerouti, Verbeke, and Bakker (2005), self-rated assessments risk inflated scores based on participants' biases. Accordingly, the biased scores might not have converged with the scores from other sources, such as supervisor or peer ratings (Demerouti et al., 2005). However, Churchill, Ford, Hartley, and Walker (1985) noted that their self-reported performance measure exhibited less range restriction and error than other forms of performance measures, such as supervisor rated performance measures. Consequently, the SAJPA might have given inflated job performance scores, but exploring whether the scores were inflated was beyond the scope of this study.

Data Analysis

To address the two RQs and test the hypotheses, the following respective analyses were incorporated.

RQ1: Does thinking perspective profile (i.e., Past, Present, and Future thinking) predict intelligence analysts' job performance?

H_{01}: Thinking perspective profile does not predict intelligence analysts' job performance.

H_{a1}: Thinking perspective profile predicts intelligence analysts' job performance.

Data analysis for Hypothesis 1 involved the use of a general linear model. According to Garson (2013d), general linear models are appropriate for the analysis of normally distributed variables. One of the initial assumptions for this study was that the IV, thinking perspective profile, and the DV, analytic job performance, were normally distributed. Hence, a general linear model was appropriate for the analysis.

RQ2: Does thinking perspective profile (i.e., Past, Present, and Future thinking) add incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance?

H_{02}: Thinking perspective profile does not add incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance.

H_{a2}: Thinking perspective profile adds incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance.

The initial method to test if thinking perspective profiles added to the incremental validity of general cognitive ability as a predictor of analytical job performance was an ANOVA. However, because of the lack of volunteers from identifiable groups, a comparison between group means, a key requirement for conducting ANOVAs, was not possible (Garson, 2013b). Consequently, data analysis to test Hypothesis 2 involved a hierarchical linear model, which Hunsley and Meyer (2003) recommended to test for incremental validity. According to Hunsley and Meyer, the concept of incremental validity is simple and straightforward, but the analysis of incremental validity is complex. Although a stepwise linear regression also can test for incremental validity, Thompson (1995) recommend against it. Thompson (1995) wrote that hierarchical linear regression is preferable to stepwise regression because of the emphasis of stepwise regression analysis's emphasis on sampling error, resulting in outputs that lack replicability and generalizability.

Threats to Validity

The very nature of applied science rests on the interpretation of data or information often collected using instruments. According to Parker (1993), all research includes flaws that often are categorized by the type of validity that they can affect. However, it is important to note that the American Educational Research Association (AERA), the APA, and the National Council on Measurement in Education (2014) stopped using specific types of validity (e.g., construct validity, internal validity) in 1999 and now categorize validity evidence. This short section includes subsections relating to categories of validity evidence to explain possible threats to validity for this study.

External Validity

Parker (1993) noted that external validity evidence relates to the generalizability of the findings to other groups. According to Garson (2016b), two major issues exist with external validity related to sampling, specifically if the sample was random. The first issue is called statistical external validity evidence, which refers to the sample data as representative of the population being studied (Garson, 2016b). The second issue is called contextual external validity of evidence and relates to the measurement of constructs, which have use in contexts other than that within the study it was used, such as intellectual style (Garson, 2016b). For evidence of external statistical validity, studies that use convenience sampling or other nonrandom sampling methods are deemed as having low external validity evidence (Garson, 2016b). Because this study involved convenience sampling, the sampling method was a threat to validity. Low statistical external validity evidence means that the results are not generalizable to other populations (AERA et al., 2014). To mitigate evidence of low statistical external validity, the nongeneralizability of the results was emphasized, along with the presentation of the results.

Garson (2016b) wrote that contextual external validity relates to concerns about the applicability of indicators to measure constructs outside of the context in which they were originally used. Of the four instruments, I used the ICAR16 and the MindTime Profile Inventory™ to measure general cognitive ability and thinking perspective profiles, respectively. The other two instruments were a demographic survey and the SAJPA, with the demographic survey asking standard demographic questions (e.g., ethnicity, gender), and the SAJPA based on the KSAs for intelligence analysts from O*NET (2016). The threat to contextual external validity evidence was minimized by using two instruments that were used for studies involving diverse populations and the other two instruments following widely used questions and KSAs specific to the population assessed.

Internal Validity

According to Parker (1993), threats to internal validity evidence arise from the failure to identify and control sources of error variance (e.g., assuming that a nonlinear variable is linear). Parker mentioned several different types of threats, including maturation, which affects longitudinal studies, and testing, wherein pretesting sensitizes the participants in such a manner as to affect posttest outcomes. Garson (2016b) also mentioned specification bias, in which the omission or inclusion of variables can affect the outcomes. Because of the nature of this study, the only threat to internal validity mentioned by Garson and Parker was selection bias.

Garson (2016b) noted that selection bias relates to sampling procedures and whether they were random. Selection bias can result in the estimated coefficients being different from a random sample (Garson, 2016b). Because I used a convenience sampling method rather than a random sampling method, the coefficients presented as predictors of performance were unlikely to match a random sample of intelligence analysts. To minimize the potential for misconstrual of the results, it was emphasized that the results were not generalizable to other populations.

Statistical Conclusion Validity

Threats to statistical validity evidence stem from basing conclusions on the inappropriate use of statistics (Garson, 2016b; Parker, 1993). Of the threats to statistical conclusion validity evidence listed by Parker (1993), three were potential threats to the validity of this study: random heterogeneity of the respondents, low reliability of the instruments, and low statistical power. The threat from low statistical power was addressed by conducting an a priori power analysis to determine adequate sample sizes for powers of .80 and .95. The threat from low reliability of the measures was addressed by conducting internal reliability analysis of the instruments (see Chapter 4). The threat from random heterogeneity of the respondents stems from a possible inflation of error variance (Parker, 1993). The threat from heterogeneity of the respondents was mitigated by acknowledging the nongeneralizability of results.

Ethical Procedures

The APA's (2010) ethical principles and code of conduct served as the foundational material for this study relating to ethics. The specific principles that underpinned this study were Principle A: Beneficence and Nonmaleficence, Principle B: Fidelity and Responsibility, and Principle E: Respect for People's Rights and Dignity (APA, 2010). The standards specifically relevant to this study were (a) 2.04: bases for scientific and professional judgment; (b) 3.09: cooperation with other professionals; (c) 3.10: informed consent; (d) 4.01: maintaining confidentiality; (e) 4.02: discussing the limits of confidentiality; (f) 4.05 disclosures; (g) 4.07: use of confidential information for didactic or other purposes; (h) 6.01: documentation of professional and scientific work and maintenance of records; (i) 6.02: maintenance, dissemination, and disposal of confidential records of professional and scientific work; (j) 8.01: institutional approval; (k) 8.02: informed consent to research; (l) 8.05: dispensing with informed consent for research; (m) 8.07: deception in research; (n) 8.08: debriefing; (o) 8.10: reporting research results; (p) 8.14: sharing research data for verification; (q) 9.02: use of assessments; (r) 9.03: informed consent in assessments; (s) 9.04: release of test data; (t) 9.06: interpreting assessment results; (u) 9.10: explaining assessment results; and (v) 9.11: maintaining test security (APA, 2010).

In addition to adhering to the APA's (2010) ethics and principles, this study underwent Walden University's IRB approval process (IRB approval #10-03-17-0409978). According to Walden University, the IRB ensures that research conducted under the auspices of the university by members and students meets U.S. federal regulations and Walden University's ethical standards. This study also underwent IRB processes, as required by the participating organizations (e.g., DHS), to ensure that it met those organizational requirements.

Researchers face many challenges while conducting their studies, including maintaining the confidentiality of the participants and ensuring the security of data. This study was an anonymous study, meaning that the participants did not have to provide any contact information unless they desired wanted to receive their results from the different instruments. Participants who did provide their contact information had this information stripped from the data prior to inclusion in the overall data sets to ensure their privacy. In addition, individuals who did provide contact information had the information stored in an encrypted database that was separate from the anonymized data. Only I and the proper authorities, such as Walden University's IRB, have access to the contact information that the participants provided.

To ensure the security of the data, they will reside in encrypted Microsoft Access databases on my computer with 128-bit encryption, and backup images of the database will remain on a separate hard drive for the amount of time required by the university. The first database contained the contact information of participants who requested their results, and the second database contained the data collected from the demographic survey, the ICAR16, the MindTime Profile Inventory™, and the SAJPA.

As previously mentioned, this study had two separate databases. All databases were in the form of Microsoft Access databases with 128-bit encryption. The first database contained contact information for participants who requested their results; the second database contained the data collected from the four instruments. The databases primarily resided on my computer, with backup images of the database on a separate hard drive.

For this study, data disclosure fell under two categories, namely, personally identifiable information and research data. Releases of personally identifiable data occurred in accordance with APA (2010) ethical principles, specifically APA Standard 4.05, which states:

> (a) Psychologists may disclose confidential information with the appropriate consent of the organizational client, the individual client/patient or another legally authorized person on behalf of the client/patient unless prohibited by law.
>
> (b) Psychologists disclose confidential information without the consent of the individual only as mandated by law, or where permitted by law for a valid purpose such as to (1) provide needed professional services; (2) obtain appropriate professional consultations; (3) protect the client/patient, psychologist, or others from harm; or (4) obtain payment for services from a client/patient, in which instance disclosure is limited to the minimum that is necessary to achieve the purpose.

The release of research data required a formal request that included the purpose of the request and the contact information of the requestor. In addition, any release of research data did not include the alphanumeric identifiers used during data collection to help to mitigate the potential risk of identifying any of the participants.

Summary

Chapter 3 explained the RQs and provided a detailed description of the quantitative, nonexperimental design of the study. Also included in the chapter was information about the population, which comprised volunteers working as federal government analysts (e.g., risk and intelligence analysts) to answer the RQs.

This chapter included an explanation of the three-phase convenience sampling schema used to collect the data. The first phase involved identifying and contacting U.S. government agencies that were employing individuals to conduct intelligence or risk analysis at the time of the study. The second phase involved the solicitation of volunteers. The final phase involved a four-step process to collect the data.

This chapter also had an explanation of the data collection process, which included that during the final phase of the sampling schema, volunteers completed a demographic survey, the ICAR16, the MindTime Profile Inventory™, and the SAJPA. After completing the final phase of sampling, the analyses of data involved the use of multivariate linear regression. Statistical regression analysis involved two types of regression models, based on assumptions and applicability to the data and RQs. The first regression model used was a general linear model to test the first hypothesis, which assumed that the variables were normally distributed. The second model was a hierarchical linear regression to test the second hypothesis for incremental validity.

Also included in this chapter is detailed information on ethical considerations, confidentiality, and data security. The APA (2010) ethics standards were the foundation of the ethical considerations for this study and included such considerations as Section

3.10 informed consent and Section 4.01 maintaining confidentiality. Accordingly, the APA ethics standards informed the confidentiality and data security approach, a process that minimized the use of any participants' names in the study to provide the best possible protection against the release of confidential information. This chapter also included a detailed description of the methods used to answer the RQs. The methods described in this chapter provided empirical evidence about the validity of thinking perspective profiles as a predictor of job performance, which added to scientific knowledge to the field of I/O psychology.

Chapter 4 includes descriptive statistics for the demographics of the sample, along with statistical analyses of the data from the ICAR16, the MindTime Profile Inventory™, and the SAJPA. Chapter 4 also includes statistical analyses of thinking perspective profiles to answer the two RQs. First, Chapter 4 includes statistical analyses of the validity of thinking perspective profiles as predictors of analytic job performance. Second, Chapter 4 contains and statistical analyses of the incremental validity of thinking perspective profiles beyond general cognitive ability as predictors of analytic performance.

Chapter 5 has six sections. The first two sections present an interpretation of the findings and the implications of the findings. The third section focuses on the limitations of the study. The fourth and fifth sections offer recommendations for future studies and a discussion of the implications for positive social change, respectively. The final section is the conclusion.

Chapter 4: Results

Chapter 4 starts with a brief synopsis of the study and its purpose, along with the RQs and hypotheses. Also included in Chapter 4 is information on sampling and descriptive statistics of the sample, as well as reliability and validity statistics of the ICAR16, the MindTime Profile Inventory^{TM}, and the SAJPA. Chapter 4 concludes with statistical analyses of the collected data and the results of the analyses.

Study Purpose

The intent of this quantitative, nonexperimental study was to determine if the thinking perspective profile was a valid predictor of analytic job performance. It also sought to determine whether thinking perspective profiles added incremental validity to general cognitive ability as a predictor of analytic job performance.

Data Collection

I used convenience sampling with a target population of analysts who conduct risk or intelligence analysis as a major part of their job. Data collection, which initially focused on intelligence analysts working for the U.S. government, was expanded to include two online professional groups of intelligence analysts. Recruitment of volunteers occurred from November 2017 through March 2018 and included six agencies within the U.S. government and two online professional groups.

Data collection resulted in 87 responses; 10 were incomplete and were removed based on the assumption that consent was not given due to noncompletion, leaving 77 responses from 59 men and 18 women. The initial sample size estimation was 68 using the G*Power calculator v.3.1.9.2 with $f^2 = .15$ and $\alpha = .05$ for a power of .80. Using

G*Power calculator v.3.1.9.2, I conducted a post hoc power calculation for eight predictors and a single regression coefficient for a two-tailed, linear multiple regression with $f^2 = .15$, and $\alpha = .05$. The sample size of 77 resulted in a power of .92. The calculation was different from the initial calculation for sample size in Chapter 3 because I determined that using a hierarchical linear regression with eight predictors and a single regression coefficient was more appropriate for analyzing the data.

Although the sample size provided good power of .92, with approximately 117,000 people employed as intelligence analysts (O*NET, 2016), the sample was not representative of the discipline of intelligence analysis. In addition, because volunteers came from different organizations, the sample was not representative of any single organization. Consequently, the results were generalizable only to the sample itself, which was one of the limitations noted in Chapter 3.

Analysis of participants' demographic data indicated that the analytic experience ranged from less than 1 year ($n = 7$) to 26 or more years ($n = 1$), with most respondents having 6 to 10 years of experience ($n = 20$). Education for the volunteers ranged from completion of high school ($n = 18$) to postgraduate degree ($n = 7$), with most volunteers having some college or a college degree ($n = 59$). For ethnicity, nine volunteers chose not to respond. Of the volunteers who responded to the question about ethnicity ($n = 68$), 45 self-identified as White, followed by eight as Black or African American, eight as Asian American or Pacific Islander, six as Hispanic American or Latino American, and one as American Indian or Alaskan (see Table 5).

Table 5

Participants' Demographic Information: Experience and Education

Experience	*N*	< 1 yr	1-5 yrs	6-10 yrs	11-15 yrs	16-20 yrs	21-25 yrs	26 + yrs	
Total	77	6	17	12	8	3	1		
Gender	*n*								
Male	59	4	19	18	10	4	3	1	
Female	18	3	6	2	3	3	1		
Ethnicity									
White	45	2	14	12	9	4	3	1	
Black or African American	8		5	1	1	1			
Hispanic or Latino	6	1		4	1				
Asian or Pacific Islander	8	1	1	2	2	1	1		
American Indian or Alaskan	1			1					
Prefer not to say	9	3	5			1			
Education		High school	1 yr of college	2 yrs of college	3 yrs of college	Bachelor's degree	Some graduate	Master's degree	Some postgraduate
Total	77	18	2	15	2	7	9	16	1
Gender	*n*								
Male	59	15	2	11	1	7	7	10	1
Female	18	3		4	1		2	6	
Ethnicity									
White	45	7		10		5	7	11	1
Black or African American	8	2	1	1	2			1	
Hispanic or Latino	8			2		1	1		
Asian or Pacific Islander	8	2	1	1			1	3	
American Indian or Alaskan	1			1					
Prefer not to say	9	7				1		1	

Instrument Score Reliability

The volunteers accessed and answered questions from the biographical survey, the MindTime Profile Inventory^{TM}, the ICAR16, and the SAJPA through the SurveyMonkey website. The instruments required the volunteers to provide answers to all questions prior to proceeding to the next instrument to complete the assessment. Completion of all instruments indicated consent, as stated earlier. Failure to answer all of the questions resulted in all data associated with the individual being discarded because it was assumed consent was not given. Reliability was calculated for each of the instruments on the samples obtained, and the method used was tailored to the nature of the instrument and its psychometric characteristics.

MindTime Profile Inventory^{TM} Reliability

The MindTime Profile Inventory^{TM} has three components: Future, Present, and Past thinking perspectives. Each is measured using a Likert-type scale that ranges from 1 (*not at all well*) to 7 (*extremely well*), which made Cronbach's alpha an appropriate test of reliability (Garson, 2016b). Cronbach's alpha for the MindTime Profile Inventory^{TM} indicated that the Future, Present, and Past Thinking Perspective scales had high reliabilities of .94, .89, and .90, respectively. The MindTime Profile Inventory^{TM} also had a high reliability of .84 (see Table 6). The reliability findings compared well with previous findings for the MindTime Profile Inventory^{TM} Thinking Perspective Scales, which ranged from .80 to .88 for the Future Scale, .91 to .92 for the Present Scale, and .80 to .91 for the Past Scale (Fortunato & Furey, 2009, 2010, 2012).

Table 6

MindTime Profile Inventory^{TM} Reliability Statistics

Construct	Cronbach's alpha	Cronbach's alpha based on standardized items	No. of items
Future	.94	.94	15
Present	.88	.89	15
Past	.91	.90	15
Instrument			
MindTime Profile Inventory	.84	.84	45

ICAR16 Reliability

The ICAR16 has four scales: Letter/Number, Matrix Reasoning, 3D Rotation, and Verbal Reasoning. Each scale has four dichotomous items scored as either correct or incorrect. According to Wombacher (2017), Kuder and Richardson's Formula 21 (Kuder & Richardson, 1937), commonly known as KR-21, is an appropriate test of reliability for measures with dichotomous variables. I used Excel to calculate KR-21 to determine the reliability of the ICAR16. Because I used the ICAR16 only to measure general cognitive ability, I did not assess the individual scales for reliability. The ICAR16 exhibited adequate reliability (P_{KR21} = .72, M = 8.00, SD = 3.47).

SAJPA Reliability

The SAJPA is a single measure. Each item is scored on a Likert-type scale with a range of 1 to 9, which made Cronbach's alpha an appropriate test of reliability (Garson, 2016b). Using Cronbach's alpha to check for reliability of the SAJPA, I determined that it had good reliability (α = .99). Although a high alpha represents high internal reliability, Streiner (2003) noted that alphas over .90 could indicate the duplication of items, leading to redundancy. However, because the SAJPA measures only analytic job performance, a single construct, I decided to keep all items.

Descriptive Statistics

All of the participants provided responses to biographical survey, the MindTime Profile Inventory^{TM}, the ICAR16, and the SAJPA instruments, which included 4 items, 45 items, 16 items, and 20 items, respectively. To compute the MindTime Profile Inventory^{TM} scores, which included the Future, Present, and Past thinking perspectives, along with Future/Present, Future/Past, Present/Past, and Future/Present/Past interactions, I followed the procedure provided by Fortunato (personal communication, December 21, 2017). Calculating scores for the Past, Present, and Future thinking perspective scores involved calculating the unweighted means for the items associated with each thinking perspective.

For the MindTime Profile Inventory^{TM}, the mean ranged from 3.77 (SD = .99) for Future thinking perspective to 5.27 (SD = .73) for Past thinking perspective. The means for the composites, Future/Present, Future/Past, Present/Past, and Future/Present/Past, were 18.01 (SD = 4.79), 19.65 (SD = 5.24), 25.79 (SD = 6.22), and 95.02 (SD = 28.64), respectively. The results indicated that Past thinking perspective was the leading individual thinking perspective among the total sample. For gender groups, Past thinking perspective was the predominant thinking perspective (male participants, n = 59, M = 5.25, SD = .67; female participants, n = 18, M = 5.30, SD = .92).

Scoring of the ICAR16 followed Kirkegaard and Nordbjerg's (2015) method of scoring correct answers with a 1 and incorrect answers with a 0, with the unweighted sum providing the overall score. The mean score for all volunteers in this study was 8.00 (*SD* = 3.49). Male participants (*n* = 59) had a marginally higher mean of 8.02 (*SD* = 3.31) for the ICAR16 than the female participants did (*n* = 18, *M* = 7.94, *SD* = 4.12). The medians for ethnicities ranged from 5.00 for American Indian or Alaskan Native (*n* = 1) to 8.88 (*SD* = 2.30) for Asian American or Pacific Islander (*n* = 8). All group medians fell within one SD of the median for the total sample.

The mean of all the answers provided the overall SAJPA score. The mean score for the SAJPA was 5.50 (*SD* = .52). Male participants had a marginally lower mean of 5.47 (*SD* = .47) on the SAJPA than the female participants did (*M* = 5.61, *SD* = .67). The median for the different ethnicities ranged from 5.00 for American Indian or Alaskan Native (*n* = 1) to 5.56 for Hispanic American or Latino American (*n* = 6, *SD* = 2.95). Like the results of the ICAR16, all groups fell within one SD of the median for the total sample.

Table 7

Participants' Demographic Information From the ICAR16, SAJPA, and MindTime Profile Inventory™

		ICAR16	SAJPA	Future	Present	Past	Future/ Present	Future/ Past	Present/ Past	Future/Present/ Past
Gender										
Female	*M*	7.94	5.61	3.36	4.94	5.30	16.31	17.40	26.48	85.85
	n	18								
	SD	4.12	.67	1.04	.85	.92	4.93	4.71	6.98	29.34
Male	*M*	8.02	5.47	3.89	4.83	5.25	18.53	20.34	25.58	97.82
	n	59								
	SD	3.31	.47	.94	.86	.67	4.67	5.23	6.02	28.09
Ethnicity										
White	*M*	8.22	5.54	3.83	4.82	5.18	18.22	19.52	25.30	94.56
	n	45								
	SD	3.83	.58	1.00	.91	.83	5.30	4.93	6.86	31.13
Black or African American	*M*	8.50	5.55	3.95	4.94	5.34	18.87	21.28	26.46	101.89
	n	8								
	SD	3.34	.53	1.13	.85	.61	4.19	7.36	5.74	30.73
Hispanic American or Latino American	*M*	7.50	5.56	3.81	5.03	5.73	18.40	21.83	28.87	105.56
	n	6								
	SD	2.95	.55	1.41	.78	.25	3.78	7.89	4.66	22.61
Asian or Pacific Islander	*M*	8.88	5.46	3.78	5.00	5.35	18.75	20.05	26.89	99.90
	n	8								
	SD	2.30	.48	1.00	.56	.69	4.57	5.06	5.49	26.80
American Indian or Alaskan Native	*M*	5.00	5.21	2.87	5.47	5.40	15.67	15.48	29.52	84.62
	n	1								
	SD	.	.	.	.	.	.	.	.	.

Table 7 Cont'd

		ICAR16	SAJPA	Future	Present	Past	Future/ Present	Future/ Past	Present/ Past	Future/Present/ Past
Prefer not to answer	*M*	6.33	5.27	3.36	4.64	5.23	15.58	17.52	24.22	80.99
	n	9								
	SD	3.08	.20	.42	.95	.48	3.48	2.12	5.03	17.36
Total	*M*	8.00	5.50	3.77	4.85	5.27	18.01	19.65	25.79	95.02
	N	77								
	SD	3.49	.52	.99	.85	.73	4.79	5.24	6.22	28.65

Regression Analysis

The regression analysis was performed with SPSS v.24. The analysis consisted of hierarchical, multiple linear regression of the DV and IVs for the testing of the hypotheses. For the analysis, the DV was the SAJPA score, representing self-reported analytic job performance. The seven IVs were general cognitive ability, Future thinking perspective; Present thinking perspective; Past thinking perspective; and the four thinking perspective interactions of Future/Present, Future/Past, Present/Past, and Future/Present/Past, respectively. The first analysis, which was completed for RQ1, involved conducting a standard linear regression with the DV of SAJPA score and the seven IVs. The second analysis, which was completed for RQ2, involved conducting a hierarchical linear regression with the SAJPA score (DV) and eight IVs (i.e., the three thinking perspectives, the four interactions, and the addition of general cognitive ability).

Research Question 1

RQ1: Does thinking perspective profile (i.e., Past, Present, and Future thinking) predict intelligence analysts' job performance?

H_{01}: Thinking perspective profile does not predict intelligence analysts' job performance.

H_{a1}: Thinking perspective profile predicts intelligence s' job performance.

Standard multiple linear regression models have five assumptions: homoscedasticity, multivariate normality, no perfect or near-perfect collinearity, no auto-correlation, and the linear relationship of variables (Garson, 2014). The assumption of homoscedasticity was determined using a P-P (see Figure 1). With tolerances ranging from .000 to .001 and variance inflation factors (VIFs) over 10, the model exhibited collinearity, but none of the IVs had perfect or near perfect collinearity, thus meeting the assumption (see Table 8). According to O'Brien (2007), the VIF itself should not cause the discounting of a statistically significant finding. However, O'Brien also wrote that a statistically significant finding must note that it is significant with collinearity.

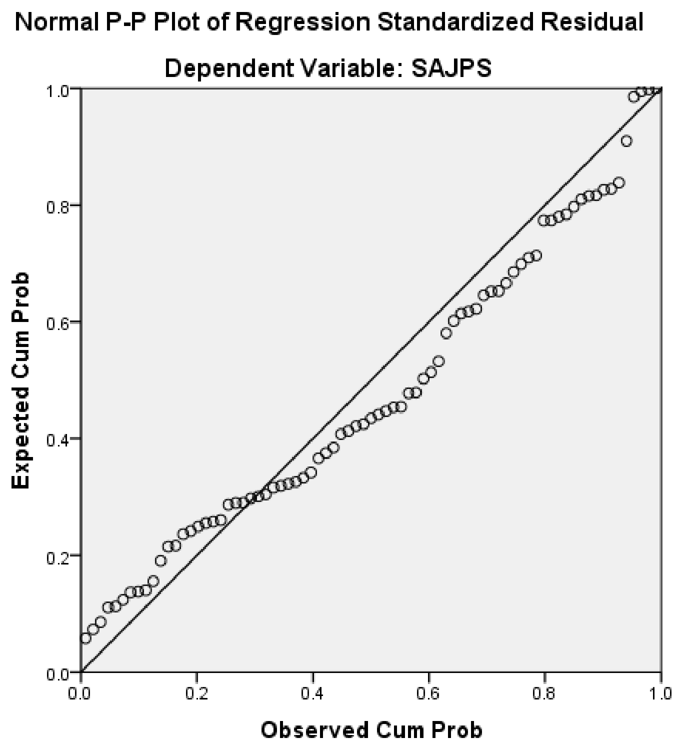

Figure 1. Normal P-P plot of residuals for DV.

Table 8

Coefficients for Thinking Perspective and Interactions

Model		Unstandardized coefficients		Standardized coefficients	*t*	Sig.	95% CI for B		Correlations			Collinearity statistics	
		B	SE	β			Lower bound	Upper bound	Zero order	Partial	Part	Tolerance	VIF
1	(Constant)	-15.89	8.19		-1.94	.056	-32.23	.45					
	Future	6.86	1.99	**12.90**	3.46	**.001**	2.90	10.82	.42	.38	.28	.000	2199.32
	Present	3.73	1.74	**6.05**	2.14	**.036**	.26	7.20	-.43	.25	.17	.001	1257.86
	Past	3.80	1.57	**5.28**	2.43	**.018**	.68	6.93	-.40	.28	.19	.001	747.73
	Future/ Present	-1.23	.43	**-11.22**	-2.87	**.006**	-2.08	-.37	.08	-.33	-.23	.000	2417.18
	Future/ Past	-1.24	.38	**-12.38**	-3.26	**.002**	-2.00	-.48	.16	-.37	-.26	.000	2278.32
	Present/ Past	-.68	.33	**-8.08**	-2.04	**.045**	-1.35	-.02	-.45	-.24	-.16	.000	2478.87
	Future/ Present/ Past	.23	.08	**12.33**	2.75	**.008**	.06	.39	-.08	.31	.22	.000	3173.84

To determine if the model met the assumption of no autocorrelation, I used the Durbin-Watson statistic. I found $d = .83$, which indicated a positive autocorrelation (see Table 8). The model did not meet the assumption of no autocorrelation. Garson (2013a) wrote that the presence of positive autocorrelation indicates underestimation of standard errors, biased significance tests, and codependence among variables, but does not affect beta coefficients. Fortunato and Furey (2009, 2010, 2012; Furey & Fortunato, 2014) noted that individuals use all thinking perspectives, which indicates that thinking perspectives and interactions have a level of codependence. The presence of autocorrelation was not surprising, but still likely affected the results of the analysis.

The determination of whether the model met or did not meet the assumption of linear relationship of variables involved partial regression plots for the IVs. Appendix G contains Figures G1 to G7, which depict the homoscedastic nature of IVs: (a) Future thinking perspective, (b) Present thinking perspective, (c) Past thinking perspective, (d) Future/Present interaction, (e) Future/Past interaction, (f) Present/Past interaction, and (g) Future/Present/Past interaction. Hence, the model met the assumption of homoscedasticity. Overall, with one of the five assumptions violated, the results of the linear regression are suspect and could prove misleading.

Although O'Brien (2007) argued against discarding significant findings based on the presence of collinearity, Garson (2014) asserted that for research focused on prediction, not causal analysis, it is appropriate to note that collinearity does not affect regression estimates. Garson further wrote that in the case of independent construct components such as thinking perspectives, it often is desirable to keep all variables.

However, Garson also noted that the assessment of IVs is problematic because of the inability to determine the role of the IV. Although the analysis included all of the IVs, the high collinearity meant that the results for the IVs likely did not accurately describe individual effects.

Null Hypothesis 1 (i.e., thinking perspective profile) does not predict intelligence analysts' job performance, was rejected. All thinking perspectives and interactions had statistically significant validity as predictors of analytic job performance. Future ($\beta = 12.91$, $p = .001$); Present ($\beta = 6.05$, $p < .05$); and Past ($\beta = 5.28$, $p < .05$) thinking perspectives, as well as the Future/Present/Past ($\beta = 12.33$, $p < .05$) interaction, had positive variance with performance (refer back to Table 8). Future/Present ($\beta = -11.22$, $p < .05$); Future/Past ($\beta = -3.26$, $p < .05$); and Present/Past ($\beta = -2.04$, $p < .05$) interactions had negative variance with performance. Overall, the model explained 56% of the variance in analytic performance (see Table 9).

Table 9

RQ1 Model Summary

Model	*R*	R^2	Adj. R^2	SE of estimate	Durbin-Watson
1	.75[a]	.56	.52	.36	.83

Note. [a]Predictors: (constant), Past, Present, Future, Future/Present, Future/Past, Present/Past, Future/Present /Past.

Because of the presence of high collinearity between the IVs, I conducted a primary components analysis (PCA) to determine the presence of latent components, which indicate that different IVs measure something similar that had not been identified previously (Garson, 2013a). PCA allows researchers to identify latent components among a group of variables (Garson, 2013a). Because of the high collinearity among the thinking perspectives and thinking perspective interactions, PCA allowed me to determine how many latent components existed among the IVs.

To determine if PCA was appropriate, I conducted a Kaiser-Meier-Olkin (KMO) statistic and Bartlett's test of sphericity to ensure that there was at least one intercorrelation among the IVs (Garson, 2013a). Bartlett's test was significant (x^2[21] = 1480.51, $p < .001$), showing that there was at least one intercorrelation among the IVs, indicating that PCA was appropriate. The KMO statistic was .24, indicating collinearity and the potential for issues factoring the IVs (see Table 10). However, Garson (2013a) wrote that with modern computing capabilities, sample adequacy should not be a concern because computationally intensive efforts such as PCA are not a concern, which was not the case when the KMO statistic was developed, which required hand calculations that could take days or weeks.

Table 10

KMO and Bartlett's Test

KMO measure of sampling adequacy.		.244
Bartlett's test of sphericity	Approx. chi-square	1480.511
	df	21
	Sig.	.000

For the PCA, a varimax rotation was chosen because the varimax rotation, as compared to no rotation or oblique rotation, provides results that are easily interpretable (Garson, 2013a). After using PCA with varimax rotation, the thinking perspectives, and interactions, had seven distinct latent components. However, two latent components explained 87.69% of the variance, with the first component explaining 51.11% and the second explaining 36.58% (see Table 11). Using Hair, Anderson, Tatham, and Black's

(1998) recommendations that component loading of high (i.e., at or above .6) and low (i.e., at or below .4), I determined that Future/Past interaction (α = .949), Future/Present interaction (α = .910), Future thinking perspective (α = .907), and Future/Present/Past interaction (α = .843) all had a high loading on the first component. Similarly, Present/Past interaction (α = .995), Present thinking perspective (α= .876), and Past thinking perspective (α = .773) had a high loading on the second component. The Future/Present/Past interaction's high loading on the first component and moderate loading on the second component (α= .529) indicated that the interaction had little distinctive explanatory value. Finally, following recommendations made by Gorsuch (1983), zero loadings included any component loadings that fell between -.10 and .10 (see Table 12).

Table 11

Total Variance Explained

	Initial eigenvalues			Rotation sums of squared loadings		
Component	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	3.578	51.110	51.110	3.274	46.768	46.768
2	2.560	36.577	87.687	2.864	40.919	87.687
3	.817	11.674	99.361			
4	.021	.301	99.661			
5	.014	.199	99.860			
6	.010	.139	99.999			
7	6.979E-5	.001	100.000			

Note. Extraction method: PCA

Table 12

Rotated Component Matrix[a]

Construct	Component	
	1.00	2.00
Future	.907	-.413
Present	.035	.876
Past	.070	.773
Future/Present	.910	.242
Future/Past	.949	.027
Present/Past	.063	.995
Future/Present /Past	.843	.529

Note. Extraction method: PCA
Rotation method: Varimax with Kaiser normalization[a]
[a.]Rotation converged in three iterations

Based on the results of the PCA, the null hypothesis that thinking perspectives do not have validity as predictors of intelligence analysts' job performance was still rejected. Only Future/Past, Future/Present, and Present/Past interactions, and Present and Past thinking perspectives were accepted as predictors of performance. The Future/Present/Past interaction was discarded because of heavy loading with Components 1 and 2, which indicated that it was not measuring anything unique.

Research Question 2

RQ2: Does thinking perspective profile (i.e., Past, Present, and Future thinking) add incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance?

H_{02}: Thinking perspective profile does not add incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance.

H_{a2}: Thinking perspective profile adds incremental validity to general cognitive ability as a predictor of intelligence analysts' job performance.

Addressing RQ2 required assessing whether thinking perspectives added incremental validity to general cognitive ability as a predictor of analytic performance. Hunsley and Meyer (2003) described the concept of incremental validity as simple and straightforward but the analysis of incremental validity being complex. One method that Hunsley and Meyer recommended for testing incremental validity is hierarchical linear regression. Thompson (1995) wrote that hierarchical linear regression is preferable to stepwise regression of stepwise regression analysis's emphasis on sampling error, resulting in outputs that lack replicability and generalizability. Hunsely and Meyer noted that the ordering of variables. However, Hunsely and Meyer, as well as Garson (2013a), wrote that other than the order that the researcher justifies, a method or methods for ordering variables do not exist. The results of the PCA gave me a way to order the variables. Introduction of the variables started with general cognitive ability, followed by the thinking perspectives and interactions in order of highest correlation with the components (see Table 12).

Similar to the analysis for RQ1, the analysis for RQ2 involved a linear regression model, which should meet five assumptions. The assumptions for a multiple linear model are homoscedasticity, multivariate normality, no perfect or near-perfect collinearity, no autocorrelation, and the linear relationship of variables (Garson, 2014). The assumption of homoscedasticity was determined using a P-P, which showed that linearity met the first assumption (see Figure 2). Models 2, 3, and 4 had tolerances from .351 to .805 and VIFs from 1.242 to 2.847; the models did not exhibit collinearity; and none of the IVs had perfect or near-perfect collinearity, thus meeting the assumption. Conversely, Models

5, 6, and 7 had tolerances ranging from .014 to .642 and VIFs ranging from 1.557 to 107.276, the models exhibited collinearity, but none of the IVs had perfect or near-perfect collinearity, thus meeting the assumption (see Table 13). As previously noted, the presence of collinearity was not sufficient to discount statistically significant findings (O’Brien, 2007), but identifying the contribution of individual variables was difficult, so the results were suspect (Garson, 2013a).

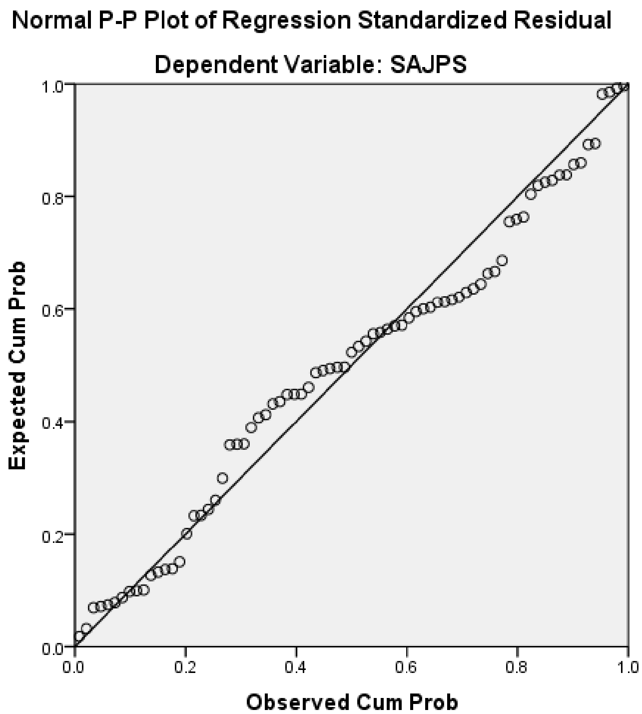

Figure 2. Normal P-P plot of residuals for DV.

Table 13

RQ2 Model Summary

						Change statistics					
	Model	*R*	R^2	Adj. R^2	SE of the estimate	ΔR^2	ΔF	*df*1	*df*2	Sig. ΔF	Durbin-Watson
1[a]	(Constant) *g*[a]	.74[a]	.54	.53	.36	.54	88.04	1	75	.000	
2[b]	*g* Present/Past	.75[b]	.56	.55	.35	.02	3.45	1	74	.067	
3[c]	*g* Present/Past Future/Past	.75[c]	.56	.54	.36	.00	.04	1	73	.843	
4[d]	*g* Present/Past Future/Past Future/Present	.75[d]	.56	.54	.36	.00	.02	1	72	.877	
5[e]	*g* Present/Past Future/Past Future/Present Future	.81[e]	.65	.62	.32	**.09**	17.75	1	71	**.000**	
6[f]	*g* Present/Past Future/Past Future/Present Future Present	.82[f]	.67	.64	.31	**.02**	4.43	1	70	**.039**	Table 13 cont'd

	Model	R	R^2	Adj. R^2	SE of the estimate	ΔR^2	ΔF	$df1$	$df2$	Sig. ΔF	Durbin-Watson
7[g]	*g* Present/Past Future/Past Future/Present Future Present Past	.83[g]	.69	.65	.31	.02	3.40	1	69	.070	.65

Note. [a.] General cognitive ability (*g*)

[b.]DV: SAJPA

To determine if the model met the assumption of no autocorrelation, I used the Durbin-Watson statistic. I found $d = .65$, which indicated a positive autocorrelation (see Table 9). Consequently, the model did not meet the assumption of no autocorrelation. The presence of positive autocorrelation indicates underestimation of standard errors and biased significance tests (Garson, 2013a).

The determination of whether the model met or did not meet the assumption of linear relationship of variables involved partial regression plots for the IVs. Appendix H contains Figures H1 to H7, which illustrate the linearity of the IVs: (a) of general cognitive ability, (b) Present/Past interaction, (c) Past thinking perspective, (d) Future/Present interaction, (e) Future thinking perspective, (f) Present thinking perspective, and (g) Past thinking perspective, respectively. Hence, the model met the assumption of linearity. Overall, all models met four of the five assumptions, which indicates results could prove misleading.

For RQ2, the null hypothesis that thinking perspectives do not add incremental validity to general cognitive ability was rejected. Adding each predictor to the linear regression, as previously described, resulted in an improvement in an adjusted R^2 ranging from .01 to .12, and an ΔR^2 from .02 to .88 over general cognitive ability alone (see Table 16 late in the chapter). However, the only models with statistically significant ΔR^2 were Model 5 ($\Delta R^2 = .09$, $\Delta F(1,71) = 17.75$, $p < .001$) and Model 6 ($\Delta R^2 = .02$, $\Delta F(1,70) = 4.43$, $p < .05$; see Table 13). Following Schmidt and Hunter's (1998) argument, the ΔR^2 of .09 of Model 5 would translate into an 18% increase in validity, and the ΔR^2 of .02 of

Model 6 would translate into a 4% increase in validity. Consequently, Model 5 showed a modest improvement and Model 6 a minimal improvement.

For Model 5, which exhibited the better ΔR^2, all of the assessed IVs had validity as predictors of analytic performance. Of the IVs, general cognitive ability (β = .54, $p < .001$); Present/Past interaction (β = 1.10, $p = .001$); and Future thinking perspective (β = 1.64, $p < .001$) varied positively with analytic performance (see Table 14). Conversely, Future/Past interaction (β = -1.32, $p < .001$) and Future/Present interaction (β = -1.13, $p < .001$) varied negatively with performance (see Table 14). Although several IVs had validity as predictors, the presence of a positive autocorrelation could have indicated that some or all of the validity of the IVs was biased and was not significant.

Table 14

Coefficients for General Cognitive Ability, Thinking Perspectives, and Interactions

Model		Unstandardized coefficients		Standardized coefficients	*t*	Sig.	95% CI for B		Correlations			Collinearity statistics	
		B	*SE*	*ß*			Lower bound	Upper bound	Zero order	Partial	Part	Tolerance	VIF
1	(Constant)	4.62	.103		45.01	.000	4.41	4.82					
	g	.11	.012	**.74**	9.38	**.000**	.09	.13	.74	.74	.74	1.00	1.00
2	(Constant)	5.05	.253		19.94	.000	4.54	5.55					
	g	.10	.013	**.67**	7.74	**.000**	.07	.13	.74	.67	.60	.81	1.24
	Present/ Past	-.01	.007	-.16	-1.86	.067	-.03	.00	-.45	-.21	-.14	.81	1.24
3	(Constant)	5.03	.269		18.73	.000	4.50	5.57					
	g	.10	.014	**.66**	7.26	**.000**	.07	.13	.74	.65	.56	.73	1.37
	Present/ Past	-.01	.007	-.16	-1.84	.069	-.03	.00	-.45	-.21	-.14	.77	1.31
	Future/Past	.00	.01	.02	.20	.84	-.02	.02	.16	.02	.02	.90	1.11
4	(Constant)	5.04	.272		18.54	.000	4.50	5.58					
	g	.10	.014	**.66**	7.08	**.000**	.071	.13	.74	.64	.55	.71	1.41
	Present/ Past	-.01	.008	-.17	-1.75	.084	-.03	.00	-.45	-.20	-.14	.65	1.53
	Future/ Past	.00	.013	.00	.01	.989	-.03	.03	.16	.00	.00	.39	2.57
	Future/ Present	.00	.014	.02	.16	.877	-.03	.03	.08	.02	.01	.35	2.85
5	(Constant)	2.28	.70		3.25	.002	.88	3.67					
	g	.08	.01	**.54**	6.19	**.000**	.06	.11	.74	.59	.44	.64	1.56
	Present / Past	.09	.03	**1.10**	3.51	**.001**	.04	.15	-.45	.39	.25	.05	20.00

Table 14 Cont'd

Model		Unstandardized coefficients		Standardized coefficients	*t*	Sig.	95%CI for B		Correlations			Collinearity statistics	
		B	*SE*	*β*			Lower bound	Upper bound	Zero order	Partial	Part	Tolerance	VIF
	Future / Past	-.13	.03	**-1.32**	-3.96	**.000**	-.20	-.07	.16	-.43	-.28	.04	22.53
	Future / Present	-.12	.03	**-1.13**	-3.79	**.000**	-.19	-.06	.08	-.41	-.27	.06	17.78
	Future	1.32	.31	**2.49**	4.21	**.000**	.70	1.95	.43	.45	.30	.01	70.64
6	(Constant)	3.56	.92		3.89	.000	1.73	5.39					
	g	.08	.01	**.51**	5.86	**.000**	.05	.10	.74	.57	.40	.62	1.61
	Present / Past	.14	.03	**1.61**	4.13	**.000**	.07	.20	-.45	.44	.28	.03	31.97
	Future / Past	-.18	.04	**-1.82**	-4.52	**.000**	-.26	-.10	.16	-.48	-.31	.03	34.40
	Future / Present	-.05	.05	-.49	-1.17	.244	-.15	.04	.080	-.14	-.08	.03	36.99
	Future	1.27	.31	**2.39**	4.12	**.000**	.65	1.88	.42	.44	.28	.01	71.17
	Present	-.49	.23	-.80	-2.11	.039	-.96	-.03	-.43	-.24	-.15	.03	30.49
7	(Constant)	6.52	1.85		3.54	.001	2.85	10.21					
	g	.08	.01	**.53**	6.11	**.000**	.05	.11	.74	.59	.41	.62	1.62
	Present / Past	.20	.05	**2.36**	4.21	**.000**	.11	.29	-.45	.45	.29	.02	68.65
	Future / Past	-.11	.06	**-1.08**	-1.92	**.059**	-.22	.00	.16	-.23	-.13	.01	69.50
	Future / Present	-.05	.05	-.49	-1.18	.241	-.14	.04	.08	-.14	-.08	.03	36.99
	Future	.87	.37	**1.64**	2.34	**.022**	.13	1.61	.42	.27	.16	.01	107.28
	Present	-.82	.29	**-1.33**	-2.82	**.006**	-1.40	-.24	-.43	-.32	-.19	.02	48.54
	Past	-.57	.31	-.79	-1.84	.070	-1.19	.05	-.40	-.22	-.12	.03	40.64

Note. DV: SAJPA

Summary and Transition

Chapter 4 began with a brief synopsis of the study, the purpose of the study, the RQs, and the hypotheses. Chapter 4 also included information on sampling, descriptive statistics of the sample, and reliability statistics of the ICAR16, the MindTime Profile Inventory^{TM}, and the SAJPA. Chapter 4 concluded with statistical analyses of the data and a discussion of the findings.

All statistical analysis involved SPSS v.24, with the exception of the reliability statistics for the ICAR16. Reliability statistics for the MindTime Profile Inventory^{TM} and the SAJPA were straightforward using Cohen's alpha; the reliability statistics for the ICAR16 were not as straightforward. Because the ICAR16 uses dichotomous variables, I sought an alternative to Cohen's alpha and chose KR21. Because SPSS cannot calculate KR21, I used Excel to calculate KR21 statistics for the ICAR16. All instruments exhibited satisfactory reliability.

Chapter 3 discussed the use of regression analysis to answer RQ1, but simple regression analysis was not possible because of the presence of collinearity, which necessitated additional techniques to address the collinearity. The analyses included multiple linear regression, coupled with PCA, to address RQ1. Results of the analyses supported the rejection of the null hypothesis for RQ1.Null Hypothesis 1. However, results of the PCA indicated that the Future/Present/Past interaction was heavily loaded on Components 1 and 2, so I dropped it as a predictor.

An important consideration, along with the presence of collinearity, was the presence of autocorrelation in the linear regression model used to address RQ1. The autocorrelation among the variables indicated a lack of independence of the predictor variables. Garson (2013a) wrote that autocorrelation biases significance tests, but not beta coefficients. Fortunato and Furey (2009, 2010, 2012; Furey & Fortunato, 2014) noted that individuals use all thinking perspectives, which indicated that the thinking perspectives and interactions had a level of codependence. Consequently, the presence of autocorrelation was not surprising; it still likely affected the results of the analysis.

Addressing RQ2 required a different form of analysis than suggested in Chapter 3. To analyze RQ2, I used a hierarchical linear regression model, as recommended by Hunsley and Meyer (2003). The hierarchical linear regression model, like the linear regression model used for RQ1, had high collinearity and autocorrelation. Thus, results from both models had some endemic issues, but, even with the issues, Null Hypothesis 2 was rejected. I accepted only two models, namely, Model 5 ($\Delta R^2 = .09$, $\Delta F(1,71) = 17.75$, $p < .001$) and Model 6 ($\Delta R^2 = .02$, $\Delta F(1,70) = 4.43$, $p < .05$) because of the seven models (see Table14), they were the only ones that had statistically significant ΔR^2.

Chapter 5 has six sections. The first two sections present my interpretation of the findings and their implication. The third section offers a discussion of the limitations of the study. The fourth and fifth sections offer recommendations for future studies and a discussion of the implications for positive social change, respectively. The final section is the conclusion.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of the study was to determine whether analytic job performance is different based on individuals' thinking perspective profiles. Previous researchers had not provided empirical evidence of the ways that analysts (e.g., intelligence analysts) view and use information, which Heuer (1999), Marsh (2013), and Moore (2007) asserted are critical to analytic job performance. This study provided empirical data to address the current lack of research about the relationship between intellectual style and job performance, with an emphasis on analytic job performance. Two RQs guided the study. The first RQ involved the validity of thinking perspective profiles as predictors of analytic job performance, and the second RQ focused on whether thinking perspective profiles added incremental validity to general cognitive ability as a predictor of analytic job performance. Chapter 5 has five sections. The first section includes an interpretation of the analyses presented in Chapter 4. The second section includes a discussion of the limitations of the study, and the third section includes recommendations for future studies. The fourth section provides a discussion of the implications for positive social change as well as theoretical implications. The final section is the conclusion.

Interpretation of the Findings

Seventy-seven individuals volunteered to participate in the study to explore the validity of thinking perspective profiles as predictors of analytic job performance and to determine whether thinking perspective profiles added incremental validity to general cognitive ability as a predictor of performance. Of the 59 male volunteers, 45 were White. Most European American respondents had at least a bachelor's degree (n = 40), and 19 had some college education. Responses to the demographic survey indicated that the sample comprised educated individuals who primarily were European American men. However, because of the sampling method, the demographic information was indicative of only those volunteering for the study, not all analysts in the field of intelligence analysis. O*NET OnLine (2012) indicated that 75% of those surveyed had at least a bachelor’s degree, but for this study, only 52% had at least a bachelor’s degree. The results of this study were exploratory and might require further studies to support the findings.

As indicated in Chapter 4, thinking perspective profiles were found to have validity as predictors of performance. I assessed seven of the eight thinking perspective profiles consisting of the following: (a) Past (high Past, low Present, and Future thinking perspectives); (b) Present (high Present, low Past, and Future thinking perspectives); (c) Future (high Future, low Past, and Present thinking perspectives); (d) Present/Past (high Present and Past, low Future thinking perspectives); (e) Future/Past (high Future and Past, low Present thinking perspectives); (f) Future/Present (high Future and Present, low Past thinking perspectives); (g) high integrated (high Past, Present, and Future thinking perspectives); and (h) low integrated (low Past, Present, and Future thinking perspectives. Assessing the low integrated thinking perspective profile was impractical because the nature of the analysis required maximal performance figures, so it was dropped from the analysis. The thinking perspective profiles that had validity as predictors were Past, Present, Future, Present/Past, Future/Past, Future/Present, and high integrated. Results of the analysis also indicated that individuals with Past, Present, Future, and high integrated thinking perspective profiles tended to perform better than those with Present/Past, Future/Past, or Future/Present profiles. Use of thinking perspective profiles might be an effective way to identify individuals with the best probability of exhibiting high analytic performance.

Although I found that most of the thinking perspective profiles had validity as predictors of performance, not all added incremental validity to general cognitive ability as a predictor of performance. Of the seven models, the best model exhibited an 18% improvement of validity over general cognitive ability alone as a predictor of performance. However, the model included only Future, Present/Past, Future/Past, and Future/Present thinking perspective profiles. The model indicated that Present/Past and Future thinking perspective profiles were associated with high performance, whereas the Future/Past and Future/Present thinking perspective profiles were associated with lower performance. Using the model may be one way to determine which candidates had a higher probability of exhibiting superior analytic job performance.

The current study was the fourth study to have addressed intellectual style as a predictor of job performance. Of the three previous studies, only Chilton et al. (2005) found that intellectual style had validity as a predictor of job performance. Following Chilton et al. (2005), I did not assume that one style was related to better performance. Chan (1996) and Gallivan (2003) assumed that a specific intellectual style was related to superior job performance, so their results did not support intellectual style as a predictor of job performance. Results of the current study and Chilton et al.'s (2005) study indicated that assuming the relevance of an intellectual style regarding job performance is a methodological error that should be avoided.

The current study results also supported findings by Kokis et al. (2002) and Stanovich and West (1998) regarding the relationship between thinking perspective profile and analytic reasoning performance. Kokis et al. as well as Stanovich and West focused on analytic reasoning, a key aspect of analytic job performance. Results of the current study also suggested a link between analytic thinking and thinking perspective profile, and provided support for research involving analytic thinking.

Most of the research concerning intellectual style and performance has been conducted in the education field. However, of the researchers studying intellectual styles, only Zhang (2001, 2004) assessed intellectual style for validity as a predictor of academic performance. The current study was one of the few studies that have addressed intellectual style for predictive validity for any form of performance. By adding to the limited literature, this study might provide the impetus for more studies.

An interesting finding from this study related to neuroscience and cognitive psychological research. Gilead et al. (2013), using fMRI images to determine which areas of the brain were activated based on temporal distance, found that thinking about the future involved the medial prefrontal cortex, posterior cingulate cortex, and left temporoparietal junction. Gilead et al. found that thinking about current and previous sentences involved the insular cortex and the cerebellum. The PCA conducted as a part of the statistical analysis indicated that Past and Present thinking loaded on the same component, whereas Future thinking loaded on a separate component. Although the results of the current study are not conclusive, findings similar to those described by Gilead et al. (2013) support some of the assertions made by Fortunato and Furey (2009, 2010, 2012; Furey & Fortunato, 2014) regarding the MindTime theory and its theoretical foundation.

Limitations of the Study

The study had six limitations, as discussed in Chapter 1, and one additional limitation that emerged during data analysis. The generalizability of the results was limited to the target population, who satisfied the established criteria to participate in the study. The second limitation involved generalizing the results to analytic tasks, not other job tasks. The third limitation was that the diversity of organizations represented by the participants precluded direct application of the results to any single organization. The fourth limitation involved convenience sampling, meaning that the participants might not have been representative of the target population. The fifth limitation was the use of a self-reported job performance instrument, which had the potential for biased reporting, such as self-presentation bias and response style bias. Because job performance data came from the study participants and were susceptible to biases, ensuring the accuracy of the data was a limitation of the study design. The sixth limitation involved the design of the study being incompatible with determining causality. Because the study followed a nonexperimental, cross-sectional design, the results did not show causality; instead, they identified the factors that related to analytic job performance within the limitations of the study design.

An additional limitation emerged from the collinearity between the IVs. The presence of collinearity indicated that IVs, especially those with high VIFs, measured a similar factor (O'Brien, 2007), which related to construct validity. The results for the IVs possibly provide inaccurate descriptions for discrete effects of individual IVs.

Recommendations

I offer three recommendations based on the findings. First, future studies should involve homogeneous samples. Based on Zhang's (2013) study of the malleability of intellectual styles, to understand intellectual styles such as thinking perspective profiles, researchers should seek homogeneous, not heterogeneous, samples. Heterogeneous samples could provide misleading results because they do not account for specific job requirements such as emphasizing writing ability over research ability.

Second, future researchers should consider conducting longitudinal studies to determine whether people with thinking perspective profiles related to reduced performance choose to leave organizations on their own or choose, instead, to change their initial styles so that they evolve to match the predominant profile. Mitchell and Cahill (2005) determined that students with styles that did not closely match those of their classmates self-selected out. The same effect observed by Mitchell and Cahill could happen in a work environment, so the validity of thinking perspective profiles as predictors could shift if incumbents self-select out of the work environment. In addition, longitudinal studies could indicate not only which candidates are likely to exhibit superior performance but also those who might leave.

The third recommendation is to increase the number of studies on intellectual styles as predictors of job performance. Future studies should focus only on intellectual styles that have a strong theoretical foundation, such as the MindTime theory. Two factors informed this recommendation. First, as Coffield et al. (2004) noted, the field of intellectual styles is rife with constructs that lack any theoretical foundation and often lack supporting research. Focusing on a narrow band of intellectual styles would strengthen the field. Second, one of the concerns in psychology involves the large number of unreplicated or nonreplicable studies used as foundational knowledge. I recommend repeating the current study to ensure that the results are not anomalous.

Shrout and Rodgers (2018) wrote that although incidents of outright fraud have been rare, overstating the magnitude of effects related to studies has been a prevalent issue. The strength of general cognitive ability as a predictor of performance rests in more than a century of research. Regardless of the results of this study, many more studies are required before intellectual styles in general and thinking perspective profiles in particular will be on par with general cognitive ability as predictors of performance.

Overall, this study was one of the few conducted to determine the value of intellectual styles as a predictor of job performance. The exploratory nature of this study means that more studies are necessary to either support or refute the findings. Hence, studies that meet the preceding recommendations are strongly encouraged, but more studies that fall even minimally within the recommendations are not only recommended but also are needed to broaden the knowledge of intellectual styles.

Implications

Although the research design and purpose of the study have theoretical and practical implications, the implications are far more relevant to the former than the latter, primarily because of the exploratory nature of the study. Following is a brief discussion of the positive social change, theoretical, and practical implications of the study.

Implications for Positive Social Change

This study has three implications for positive social change. The study adds to current understanding of the workings of the human mind as applied to job performance. Specifically, I determined that thinking perspective profiles had validity as predictors of job performance, illustrating that concerning intelligence analysis, it is not necessarily what employees' general cognitive abilities are, but how they apply them. Next, the results showed that thinking perspective profiles provided incremental validity to general cognitive ability as a predictor of job performance. Thus, thinking perspective profiles have the potential to be selection factors for candidates for knowledge work positions (e.g., intelligence analysts), but without the association with adverse impact that general cognitive ability has (Outtz & Newman, 2010). The results of this study further strengthened the link between I/O psychology research and cognitive psychology research.

Theoretical Implications

Furey and Fortunato (2014) asserted that the MindTime theory could provide organizations with insight into candidate selection and career development. Prior to this study, there was no empirical evidence to support their assertion. This study did provide evidence that the MindTime theory could have value for organizations as a factor in candidate selection and for individuals as a factor in career development. However, because of the exploratory nature of the study, neither candidate selection nor career development extended beyond theoretical application.

By providing evidence of the validity of thinking perspective profiles as predictors of performance, the study showed the relevancy of temporal thinking and analytic reasoning. As noted earlier, the emphasis on cognitive abilities, such as verbal ability, but not temporal thinking, to select employees is a common occurrence. As Kerbel (personal communication, June 23, 2017) stated, it is important for intelligence analysts to have the ability to think temporally, that is, the ability to forecast events. The current study supported Kerbel's statement by showing that Future thinking perspective is a valid predictor of intelligence analysts' performance. Moreover, the study provides a link between temporal thinking and analytic reasoning by supporting the findings of Kokis et al. (2002) as well as Stanovich and West (1998). Hence, this study supported theoretical concepts developed in the field of intelligence analysis, but also links temporal thinking by way of thinking perspective profiles with analytic reasoning ability and the concepts promoted by Stanovich and West (1998) and refined by Stanovich's (2016) research on rational thinking.

This study also presented evidence in the form of the PCA, which indicated that Future thinking ($\alpha = .907$) loaded on one component and that Past ($\alpha = .876$) and Present ($\alpha = .773$) thinking loaded on a second component, which paralleled the findings of Gilead et al. (2013). This finding provides support for the assertions made by Fortunato and Furey (2009, 2010, 2012; Furey & Fortunato, 2014) regarding their MindTime theory and its theoretic foundation. In addition, it provides a link, albeit a relatively weak link, among neuroscience, cognitive psychology, the theory of MindTime, and job performance research.

Beyond the implications of the MindTime theory, my study reinforced the results of and general methodological considerations in Chilton et al.'s (2005) study. Specifically, when studying intellectual style as a predictor of performance, researchers should not base their methods on the assumption that specific styles relate to higher or lower performance, something that Chan (1996) did. According to Garson (2016b), one of the threats to statistical validity is a Type II error, the assumption that a relationship does not exist.

In the cases of Chan (1996) and Gallivan (2003), neither researcher presented a post hoc power analysis. If the power of a post hoc power analysis equals or exceeds .80, the acceptance of the null hypothesis is considered valid (Garson, 2016b), barring any other issues. Consequently, researchers should assess for Type II errors, especially with small sample sizes, as determined by the statistical model used for the analysis.

This study also presented evidence of a methodological issue with research involving intellectual styles that researchers should be sensitive to, specifically latent variables. As described in Chapter 4, of the thinking perspectives and thinking perspective interactions assessed, only two latent variables were discovered after conducting a PCA. Although Fortunato and Furey's (2009, 2010, 2012; Furey & Fortunato, 2014) MindTime theory has three distinct constructs (Past, Present, and Future thinking), only two components (latent variables) were discovered, which Future thinking (α = .907) loaded on the first component, and Past (α = .876) and Present (α = .773) thinking loaded on the second component. As Peterson et al. (2009) noted, the study of intellectual styles presents many challenges, including the use of similar terms and the ways in which the creators of intellectual styles conceptualize different styles. Researchers should consider conducting some form of factor analysis to determine if the different constructs within a style are actually different or if they are measuring the same factor.

Practical Implications

The practical implications of this study are minimal at best, mainly because the study was exploratory and one of the few conducted over the past 2 decades on this topic. However, the results provided evidence of the possibility of adding to the incremental validity of general cognitive ability as a predictor of performance. Because this study relied on the use of the Internet, I demonstrated that it is possible to combine a measure of general cognitive ability with the MindTime Profile Inventory™ as a way to screen candidates remotely.

Conclusion

Results of this study added to the knowledge base about intellectual styles and job performance by providing evidence that thinking perspective profiles have validity as predictors of job performance and add incremental validity to general cognitive ability as a predictor of performance. Yet, even though the findings of this exploratory study support the notion of using thinking perspective profile as a factor in the selection of job candidates, they also identify some of the limitations, such as collinearity, involving intellectual style. Regardless, this study has been in the vanguard supporting research that focuses on the relationship between job performance and intellectual style.

I believe that this study has moved I/O psychology closer to filling the gap between personality (i.e., what people typically do) and general cognitive ability (i.e., maximal performance), as described by Chan (2010). Thus, as with many previous studies, this study has advanced the body of knowledge within the field of I/O psychology. However, further advances in knowledge depend on similar studies being conducted.

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Appendix A: Demographic Survey

Biographical Survey

What is your gender?

- ○ Female
- ○ Male
- ○ Prefer not to answer

What is your highest level of education?

- ○ Did not graduate from high school/GRE
- ○ Graduated from high school
- ○ 1 year of college
- ○ 2 years of college
- ○ 3 years of college
- ○ Graduated from college
- ○ Some graduate school
- ○ Completed graduate school
- ○ Some post graduate school
- ○ Completed post graduate school

How long have you worked as an analyst?

- ○ Less than 1 year
- ○ 1 – 5 years
- ○ 6 – 10 years
- ○ 11 – 15 years
- ○ 16 – 20 years
- ○ 21 – 25 years
- ○ 26 or more years

What is you ethnicity? (Please select all that apply.)

- ○ American Indian or Alaskan Native
- ○ Asian or Pacific Islander
- ○ Black or African American
- ○ Hispanic or Latino
- ○ White / Caucasian
- ○ Prefer not to answer
- ○ Other (please specify) ____________________________________

Appendix B: Self-Rated Analytic Job Performance Assessment

Description: This assessment allows you to assess your analytic job performance on factors such as your ability to prepare comprehensive reports. The factors used for this assessment were selected from the O*NET description of intelligence analyst.

Please rate your performance honestly and as accurately as possible. The results of this assessment are completely confidential and anonymous.

Instructions: This assessment has two sections, with section 1 containing items 1 – 10 and section 2 containing items 11 – 20. Please read each item carefully and respond by marking your performance on a scale of 1 – 9. Thank you for your participation.

Section 1:

Please read each item carefully and respond by marking your performance from 1 – 9, using Section 1 (below) as a guide.

Please respond honestly and candidly.

Section 1								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
I do not have knowledge to complete this task	I can complete the task with direct guidance	I can complete the task with limited direct guidance	I can complete the task with periodic supervision	I can typically complete this task with little supervision	I can complete this complete this task without supervision	I can provide limited supervision and guidance to others	I provide supervision and guidance to others	I am considered an expert and I regularly provide guidance and training to others on this task

Item Number	Self-Rated Analytic Job Performance Assessment: Section 1								
1	Use multiple sources to verify known intelligence or information.								
	1	2	3	4	5	6	7	8	9
2	Analyze and evaluate intelligence or information from a variety of sources.								
	1	2	3	4	5	6	7	8	9
3	Write reports or develop presentation based on the analysis and evaluation of intelligence or information.								
	1	2	3	4	5	6	7	8	9
4	Read and comprehend intelligence or information from a variety of sources.								
	1	2	3	4	5	6	7	8	9
5	Comprehend ideas presented by others through oral presentation and describe those ideas accurately.								
	1	2	3	4	5	6	7	8	9
6	Engage in reflective thinking to identify my own biases and drivers that affect my perceptions about different subject and decision-making ability.								
	1	2	3	4	5	6	7	8	9
7	Combine different pieces of seemingly unrelated information to form general rules or conclusion.								
	1	2	3	4	5	6	7	8	9

8	Identify the existence or problems or if the potential for a problem exists.								
	1	2	3	4	5	6	7	8	9
9	Develop answers or conclusions that make sense through the application of general rules to defined problems.								
	1	2	3	4	5	6	7	8	9
10	Use logic to address issues or problems associated with intelligence or information.								
	1	2	3	4	5	6	7	8	9

Section 2:
Please read each item carefully and respond by marking your performance from 1 – 9, using Section 2 (below) as a guide. Please respond honestly and candidly.

Section 2								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
I do not have knowledge to complete this task	I can complete the task with direct guidance	I can complete the task with limited direct guidance	I can complete the task with periodic supervision	I can typically complete this task with little supervision	I can complete this complete this task without supervision	I can provide limited supervision and guidance to others	I provide supervision and guidance to others	I am considered an expert and I regularly provide guidance and training to others on this task

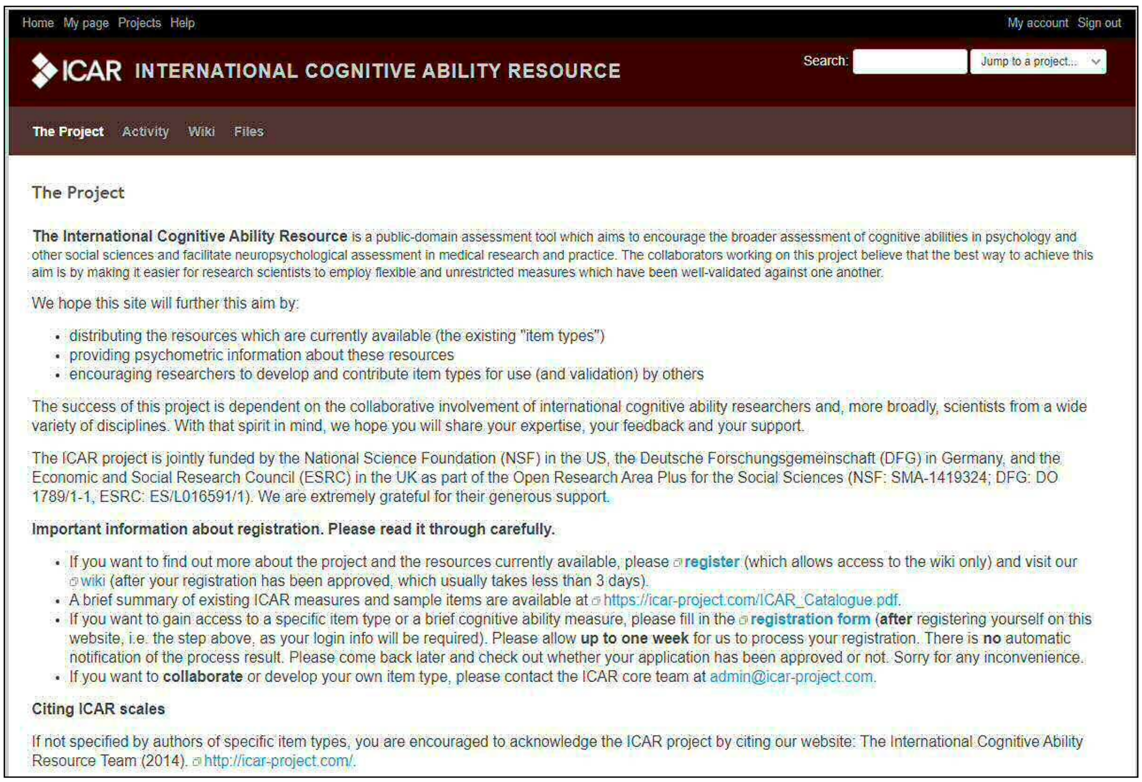
Item Number	**Self-Rated Analytic Job Performance Assessment: Section 2**								
11	Identify and use appropriate sources for the verification of information or intelligence.								
	1	2	3	4	5	6	7	8	9
12	Use a variety of source in the analysis and evaluation of intelligence or information from different sources.								
	1	2	3	4	5	6	7	8	9
13	Using intelligence or information, develop comprehensive written reports or presentations.								
	1	2	3	4	5	6	7	8	9
14	Understand written information from a variety of work related documents.								
	1	2	3	4	5	6	7	8	9
15	By asking appropriate questions and paying attention, understand ideas presented orally.								
	1	2	3	4	5	6	7	8	9
16	Identify indications of biased thought, weak or strong arguments, and alternative approaches using reflective thinking.								

	1	2	3	4	5	6	7	8	9
17	Form general rules or conclusions from the combination of information that does not have any obvious links.								
	1	2	3	4	5	6	7	8	9
18	Find or recognize when something is wrong or identify the potential for something to go wrong.								
	1	2	3	4	5	6	7	8	9
19	Apply general rules to defined problems to develop logical answers or conclusions.								
	1	2	3	4	5	6	7	8	9
20	Address intelligence or information related problems using logic.								
	1	2	3	4	5	6	7	8	9

Thank you for completing the Self-Rated Analytic Job Performance Assessment

Appendix C: ICAR16 Instrument Use Approval

The International Cognitive Ability Resource (ICAR), as indicated in Figure C1, is a public domain instrument, but requires registration to gain access to the instrument and instrument items. The approval for my account and for access to the instrument is in Figures C2 and C3, respectively.


Home My page Projects Help My account Sign out

ICAR INTERNATIONAL COGNITIVE ABILITY RESOURCE Search: Jump to a project...

The Project Activity Wiki Files

The Project

The International Cognitive Ability Resource is a public-domain assessment tool which aims to encourage the broader assessment of cognitive abilities in psychology and other social sciences and facilitate neuropsychological assessment in medical research and practice. The collaborators working on this project believe that the best way to achieve this aim is by making it easier for research scientists to employ flexible and unrestricted measures which have been well-validated against one another.

We hope this site will further this aim by:

- distributing the resources which are currently available (the existing "item types")
- providing psychometric information about these resources
- encouraging researchers to develop and contribute item types for use (and validation) by others

The success of this project is dependent on the collaborative involvement of international cognitive ability researchers and, more broadly, scientists from a wide variety of disciplines. With that spirit in mind, we hope you will share your expertise, your feedback and your support.

The ICAR project is jointly funded by the National Science Foundation (NSF) in the US, the Deutsche Forschungsgemeinschaft (DFG) in Germany, and the Economic and Social Research Council (ESRC) in the UK as part of the Open Research Area Plus for the Social Sciences (NSF: SMA-1419324; DFG: DO 1789/1-1, ESRC: ES/L016591/1). We are extremely grateful for their generous support.

Important information about registration. Please read it through carefully.

- If you want to find out more about the project and the resources currently available, please **register** (which allows access to the wiki only) and visit our wiki (after your registration has been approved, which usually takes less than 3 days).
- A brief summary of existing ICAR measures and sample items are available at https://icar-project.com/ICAR_Catalogue.pdf.
- If you want to gain access to a specific item type or a brief cognitive ability measure, please fill in the **registration form** (**after** registering yourself on this website, i.e. the step above, as your login info will be required). Please allow **up to one week** for us to process your registration. There is **no** automatic notification of the process result. Please come back later and check out whether your application has been approved or not. Sorry for any inconvenience.
- If you want to **collaborate** or develop your own item type, please contact the ICAR core team at admin@icar-project.com.

Citing ICAR scales

If not specified by authors of specific item types, you are encouraged to acknowledge the ICAR project by citing our website: The International Cognitive Ability Resource Team (2014). http://icar-project.com/.

Figure C1. ICAR home page screen capture

Figure C2. ICAR account approval screen capture

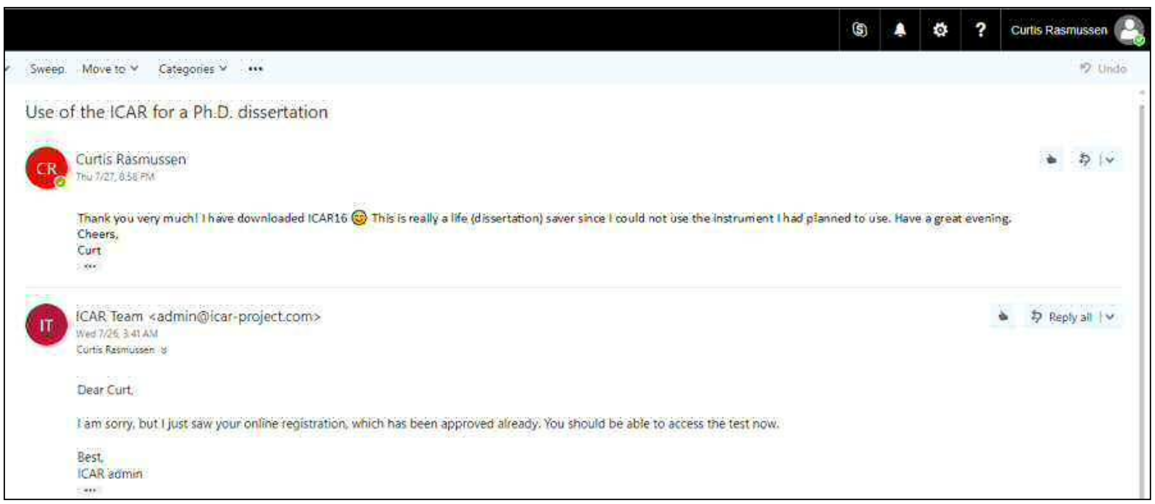


Figure C3. ICAR registration approval confirmation

Appendix D: ICAR16

Description: This is the International Cognitive Ability Resource (ICAR) developed by Condon and Revelle (2014). The ICAR measures general cognitive ability and compares favorably with other measures of general cognitive ability such as the ACT. For the purposes of this study, the ICAR is only used as a measure of general cognitive ability, and not for the diagnosis of cognitive conditions.

Instructions: Please ensure that you are in a place where you can concentrate on answering the questions without interruptions. The assessment consists of 16 questions, which will take approximately 30 to 60 minutes to complete, so please allow yourself ample time to complete the assessment. If you are unsure of a particular answer, please provide your best guess.

NOTE: When you complete a section of this survey, you will not be able to return to that section and change your responses.

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For access to the ICAR go to ICAR-Project.Com .

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Appendix E: MindTime Profile Inventory™ Basic Academic Research License

mindtime® foundation

Basic academic research license

The mindtime foundation provides accredited scientists with access to its intellectual property under certain conditions. The MindTime Profile Inventory™ (also known as the TimeStyle Inventory™, GPS for the Mind™, and the Thinking Perspective Inventory™) is provided for research purposes ONLY under the following conditions.

- Use of the MindTime Profile Inventory is for scientific, non-commercial, research purposes only. All other uses, including but not limited to those involving commercial, business, and personal, whether for-profit or not-for-profit is prohibited. To use the MindTime Profile Inventory for any purpose other than for the scientific research described in the application and Appendix A of this document, a license must be obtained from the mindtime foundation.
- At no time will any research be conducted whose purpose might be construed to be an attempt to reverse engineer the MindTime Profile Inventory™.
- The MindTime Profile Inventory is proprietary and is a registered intellectual property of the mindtime foundation. Dissemination of the MindTime Profile Inventory and all related materials to any person, entity, LLC, or corporation except the individual or entity indicated below is prohibited.
- When the MindTime Profile Inventory™ is used, a copyright notice attributing ownership of the inventory to the mindtime foundation must be clearly visible on each page or in a footnote.
- Whenever "MindTime®", "MindTime Profile Inventory™", or any of its other names are used they must appear with the proper ® or ™ (registered or trade mark) symbol.
- All research results (in aggregate form) derived through use of the MindTime Profile Inventory must be provided to the mindtime foundation within 30 days of the completion of data analysis. If no data were collected or the MindTime Profile Inventory was not finally used, it is the signatory researcher's responsibility to notify the mindtime foundation of this within 30 days of the end of your research.
- The mindtime foundation or its commercial partners have the right to cite your research results in any or all of our commercial activities, including but not limited to our website and any promotional materials.

MT Science T&C v 4.0 2017 1

Appendix A

Nature of research (please state clearly the purpose of your study and/or your research questions):

The purpose of my study is determine is to determine if thinking perspective profiles have validity as predictors of intelligence analyst job performance and if thinking perspective profiles add incremental validity to general cognitive ability as a predictor of intelligence analyst job performance.

Research Questions:

RQ1: Does thinking perspective profile (i.e., past, present, and future thinking) predict intelligence analyst job performance?

H_{01}: Thinking perspective profile does not predict intelligence analyst job performance.

H_{a1}: Thinking perspective profile predicts intelligence analyst job performance.

RQ2: Does thinking perspective profile (i.e., past, present, and future thinking) add incremental validity to general cognitive ability as a predictor of intelligence analyst job performance?

H_{02}: Thinking perspective profile does not add incremental validity to general cognitive ability as a predictor of intelligence analyst job performance.

H_{a2} : Thinking perspective profile adds incremental validity to general cognitive ability as a predictor of intelligence analyst job performance.

Estimated number of research or study participants: n = 200

Estimated date of start of data collection: September 2017

Estimated date of conclusion of data collection: December 2017 mindtime foundation

Institution. Name and full address

Walden University

100 S Washington Ave #900

Minneapolis, MN 55401

Department.

School of Psychology

Principal researcher assuming responsibility for the terms and conditions entered into in this agreement.

Curtis Rasmussen	PhD student, Walden University
Name	Title

I/we agree to the terms and conditions of this scientific license and specifically agree to be responsible for our institution's compliance.

Curtis Rasmussen	30 July 2017
Signature	Date
Signature	Date

Appendix F: MindTime Profile Inventory^{TM}

Copies of the MindTime Profile Inventory^{TM} are available by contacting Vincent J. Fortunato (vincentfortunato@mindtime.com) or John T. Furey (johnfurey@mindtime.com) at The MindTime Project, Inc.

Appendix G: Partial Regression Plots for RQ1

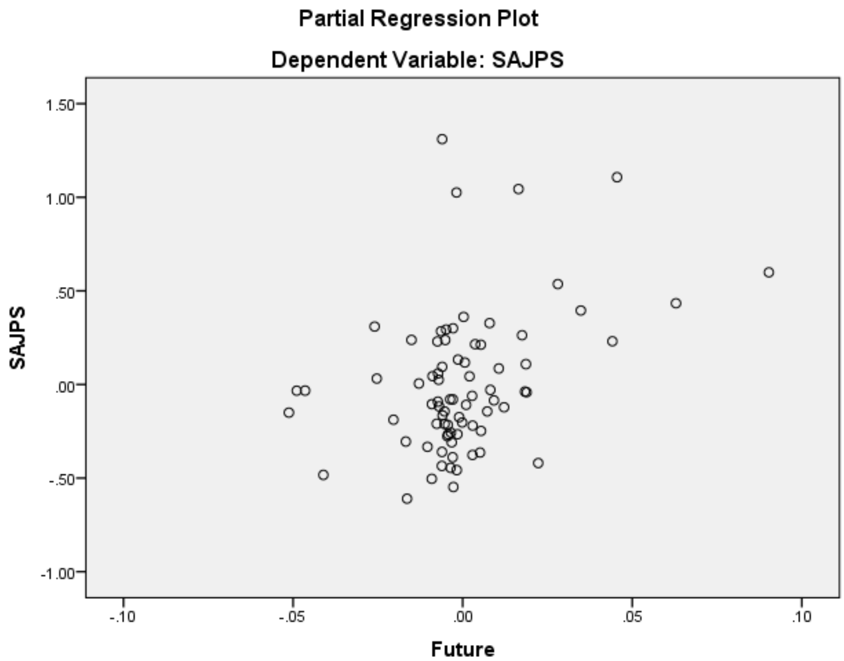

Figure G1. Partial regression plot for IV Future thinking perspective.

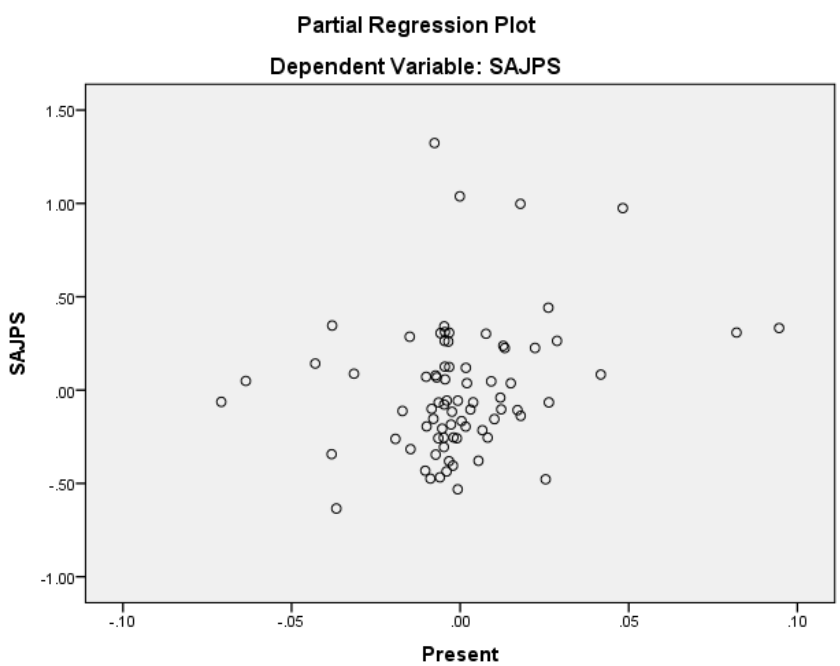

Figure G2. Partial regression plot for IV Present thinking perspective.

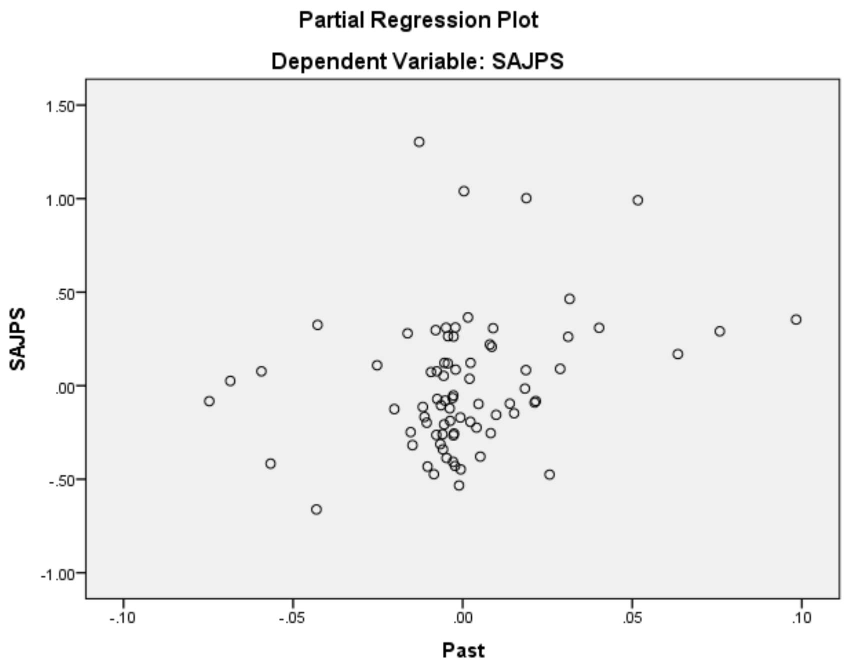

Figure G3. Partial regression plot for IV Past thinking perspective.

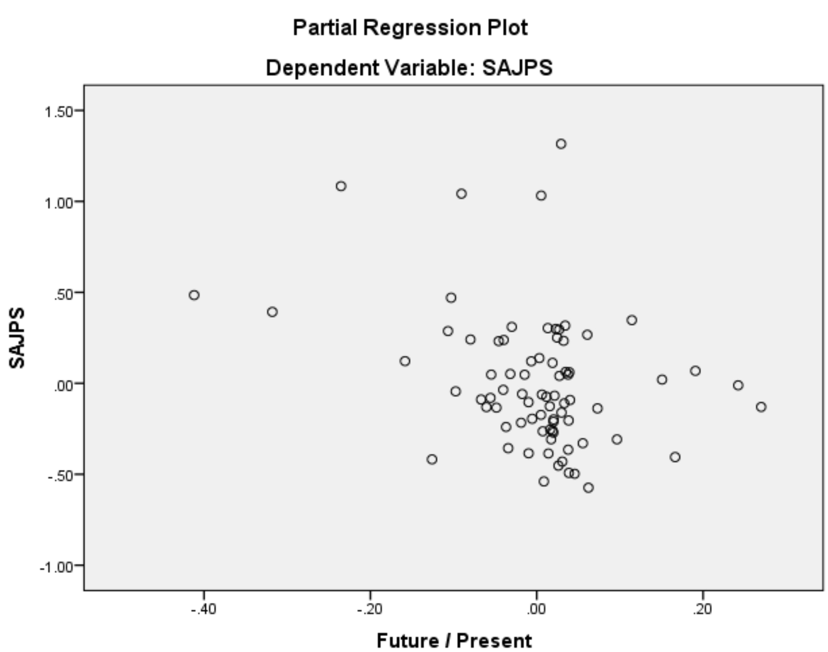

Figure G4. Partial regression plot for IV Future/Past interaction.

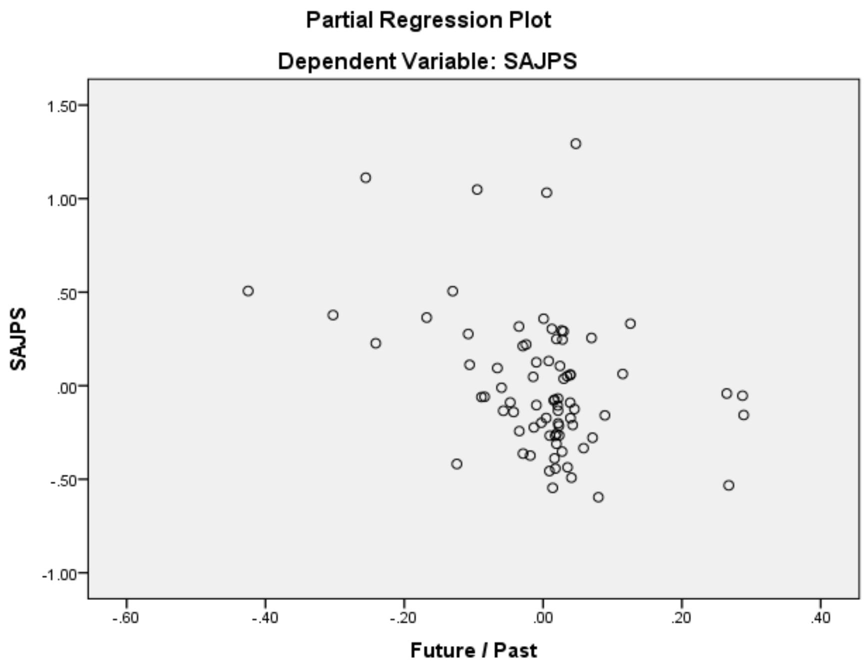

Figure G5. Partial regression plot for IV Future/Past interaction.

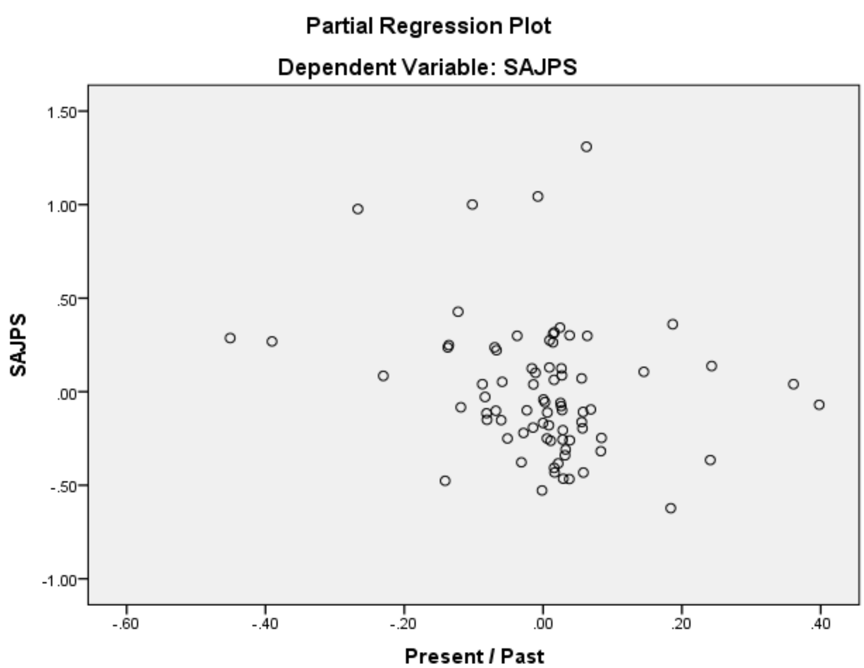

Figure G6. Partial regression plot for IV Present/Past interaction.

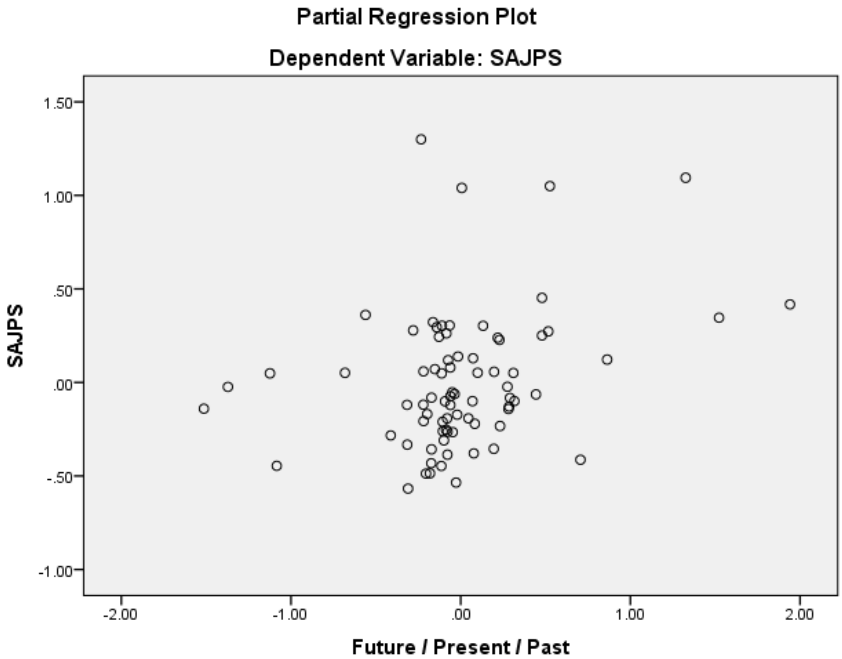

Figure G7. Partial regression plot for IV Future/Present/Past interaction.

Appendix H: Partial Regression Plots for RQ2

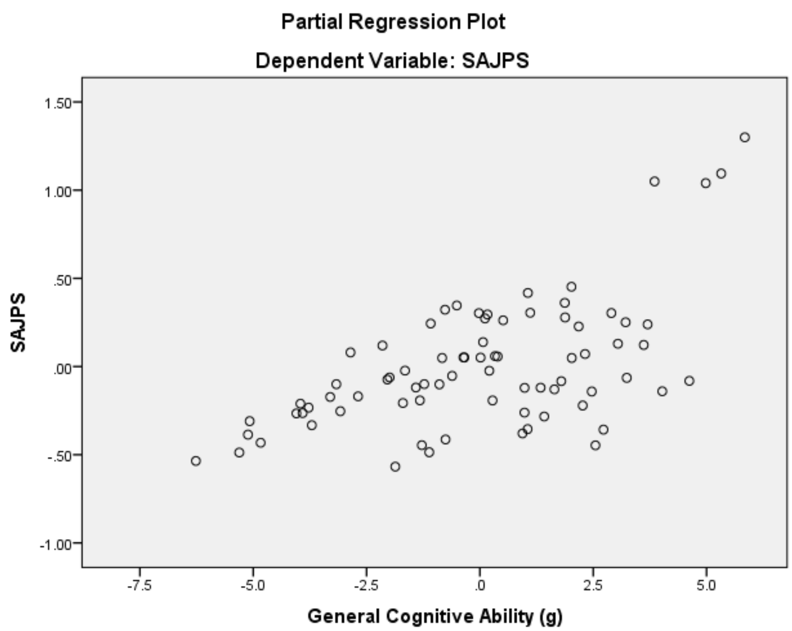

Figure H1. Partial regression plot for IV general cognitive ability (*g*).

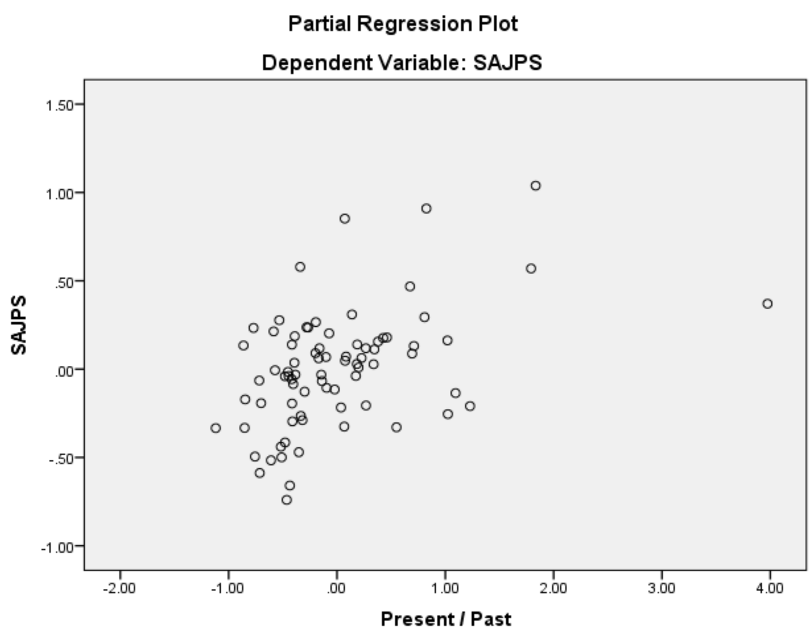

Figure H2. Partial regression plot for IV Present/Past interaction.

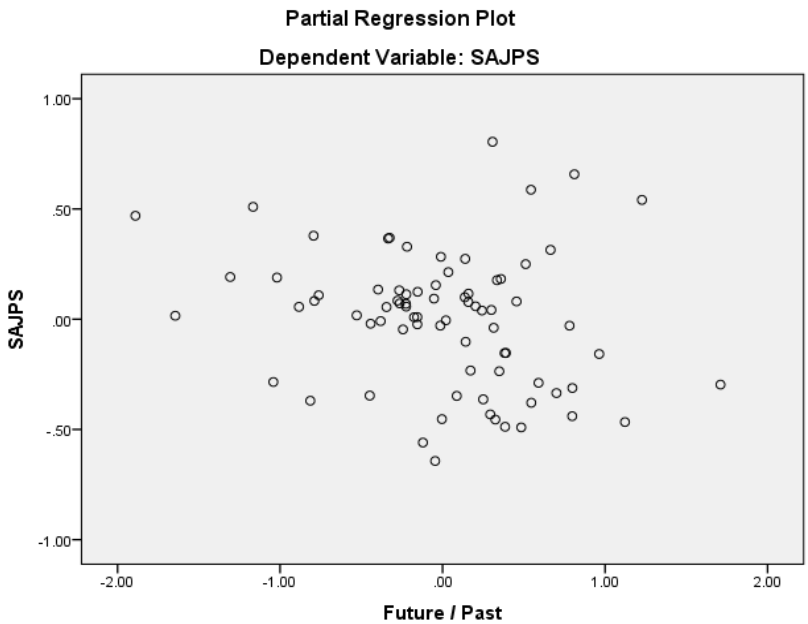

Figure H3. Partial regression plot for IV Future/Past interaction.

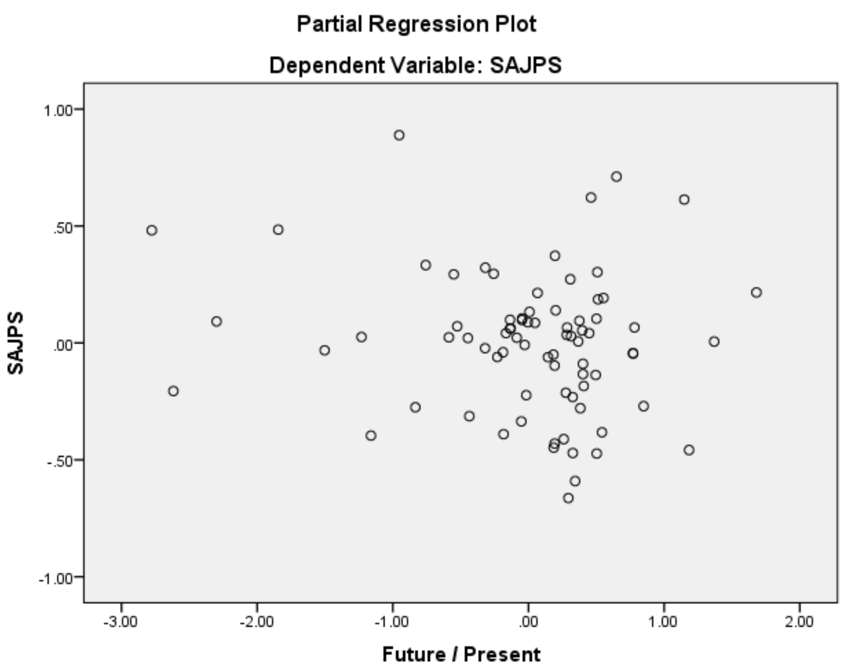

Figure H4. Partial regression plot for IV Future/Present interaction.

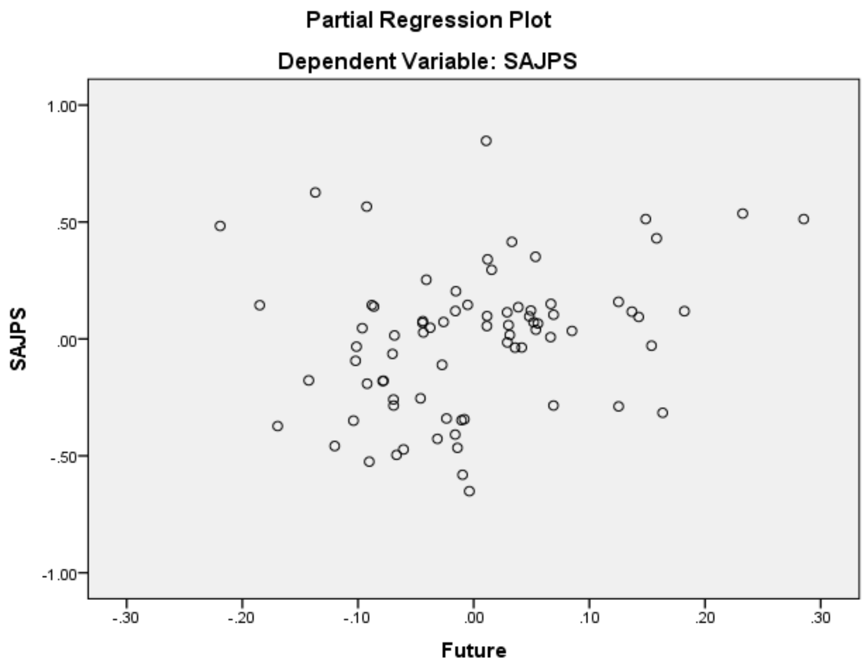

Figure H5. Partial regression plot for IV Future thinking perspective.

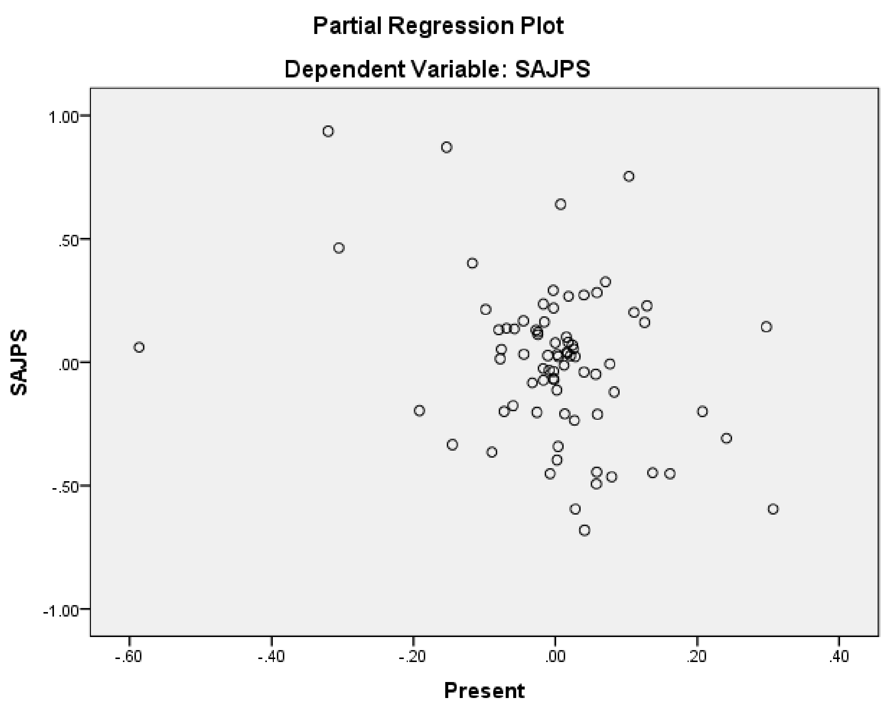

Figure H6. Partial regression plot for IV Present thinking perspective.

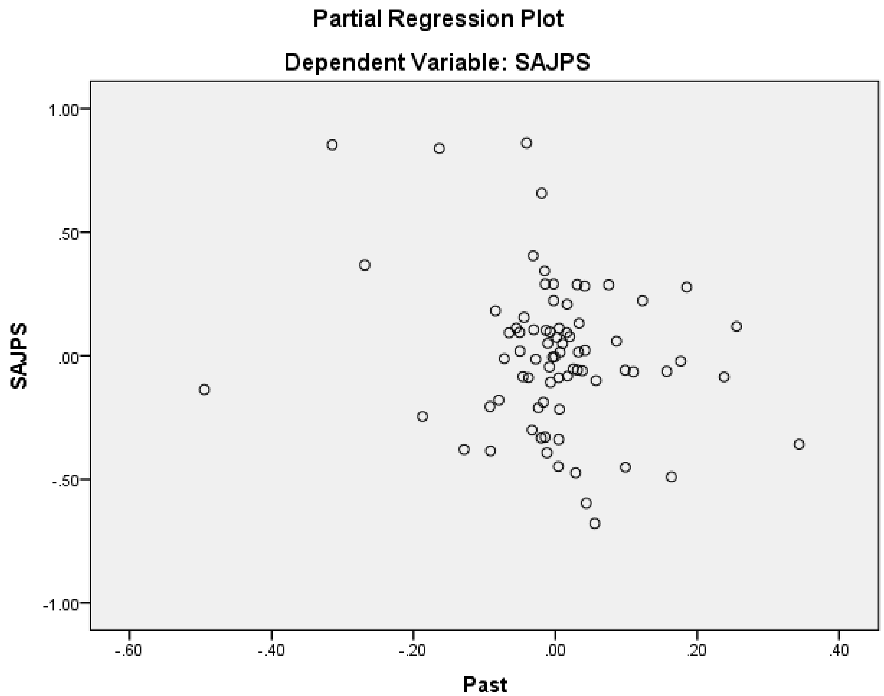

Figure H7. Partial regression plot for IV Past thinking perspective.