AN INTEGRATION OF TWO COMPETING MODELS TO EXPLAIN PRACTICAL INTELLIGENCE

by

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A Dissertation Submitted to the Faculty of the

DEPARTMENT OF SPECIAL EDUCATION, REHABILITATION, AND SCHOOL PSYCHOLOGY

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

2006

THE UNIVERSITY OF ARIZONA

GRADUATE COLLEGE

As members of the Dissertation Committee, we certify that we have read the dissertation, prepared by Omar M. Muammar and entitled, An Integration of Two Competing Models to Explain Practical Intelligence and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of DOCTOR OF PHILOSOPHY.

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ACKNOWLEDGMENTS

A few moments in my life, I found myself unable to express my acknowledgement to those who have changed my life forever. The reason is that the kindness of those people is limitless and indeed the capacity of my language does not serve this purpose.

To my father who does not give up asking about me,

To my mother who was looking for this day,

To my wife and partner who supported me,

To my children who suffered by being away form me,

To my sisters who kept me a close friend,

To my advisor and friend, Dr. C. June Maker who has had the greatest impact on my success,

To my advisor and friend, Dr. Shirley Schiever who is a great instructor and a great person,

To Dr. Joel Levin who have reorganized my mind,

To my advisor and instructor, Dr. James Chalfant helped me,

To my advisor and instructor, Dr. John Taylor who supported my decisions,

To all of those who have helped me in this work,

To ALL of YOU,

I express my sincere gratefulness, appreciation, and thankfulness for all what you have done for me and for being a part of my life and accomplishments,

Omar

DEDICATION

To My

Parents, Wife, Children, and Sisters

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ABSTRACT

Practical intelligence that accounts for people's performance on real-life problem solving is not related to intelligence in the traditional theories. The primary purpose of this research was to investigate the role of two competing cognitive models in explaining practical intelligence. The author extracted from the literature four cognitive processes and two types of knowledge that significantly accounted for performance on real-life problem solving. The cognitive processes model included (a) metacognition, (b) defining a problem, (c) flexibility of thinking, and (d) selecting a solution strategy. The types of knowledge model included (a) structural knowledge, and (b) tacit knowledge. The secondary purpose of this research was to determine the contribution of some non-cognitive factors to practical intelligence. These factors included (a) self-efficacy, and (b) motivation. These processes and constructs were derived from contemporary theories of intelligence including the Triarchic Theory of Sternberg (1985a), the Bioecological Treatise of Ceci (1996), and theories of expertise.

The author developed a Practical Intelligence Instrument (PII) battery based on components of the cognitive processes model, the types of knowledge model, and non-cognitive factors. The PII battery consisted of several subscales to measure components mentioned above. The PII also included items to measure familiarity with problems. The PII was administered to 116 volunteer participants. The validity of the PII subscales was derived from three sources: content, face, and construct validity, including convergent and discriminant. The reliability of the subscales in the PII battery ranged from .63 to .93. The PII also included four scenarios that are real-life problems. Participants were asked

to provide solutions for these problems. Three experts from the social science field evaluated participants' strategies based on four criteria. Several statistical procedures were used to analyze the data including a hierarchal multiple regression model, ANOVA, and the Pearson Product-Moment correlation.

The results showed that around 54% of the variance in practical intelligence was explained by the cognitive processes model, the types of knowledge model, and self-efficacy and motivation. The cognitive model explained around 42%. The types of knowledge model explained around 15%. The non-cognitive factors explained around 20 % of the variance in practical intelligence.

CHAPTER I

INTRODUCTION

An individual's scores on conventional intelligence tests are not good predictors of success in life. The mismatch between IQ scores and performance when solving real-life problems has been articulated in many contemporary theories of intelligence and empirical research findings (Benner, 1984; Ceci, 1996; Ceci & Liker, 1986; Gardner, 1983, 1993, 1999; Sternberg, Forsythe, Hedlund, Horvath, Wagner, Williams, & Snook, 2000; Sternberg & Wagner, 1986). Ability to perform on real-life problem solving is associated with a complex interaction between cognitive factors, including cognitive processes and non-cognitive factors as well as familiarity and complexity of problems. Complexity of cognition, therefore, cannot be uncovered by traditional tests of intelligence because of these tests' lack of a theoretically and methodologically sound framework. This research is an attempt to pinpoint the cognitive competencies used in solving real-life problems.

Human intelligence has been puzzling scholars for more than a century. Recently, reliable evidence that has emerged from different schools of thought (e.g., cognitive psychology, sociology, and neurophysiology) has shown that intelligence is manifested in different forms and conventional measurements of intelligence reveal limited aspects of a human's true ability. Contradicting the psychometric and cognitive psychological views of intelligence as a unilateral construct; intelligence, as a concept today, has multiple forms, is a complex construct, and is sensitive to the environment where it flourishes (Benner, 1984; Ceci, 1996; Gardner, 1983, 1999; Sternberg, 1985a; Sternberg et al., 2000). This evidence persists and research findings continue to provide support for this perspective.

Humans' ability to solve problems develops through an effective interaction between their cognitive competencies and tasks presented in the environment in which they live. People develop, through their nurturing, certain cognitive competencies that are related to the tasks they encounter. The environment contains a wide range of activities. The more systematic and organized the activities, the higher the gain individuals make from these activities. I believe that the environment plays a crucial role in cognitive development. The types of tasks in a particular environment and the degree of complexity in these tasks help individuals to develop and facilitate different abilities. For example, certain abilities and competencies develop in certain schools because types of tasks vary in these contexts. People who are exposed to certain kinds of problems develop competencies to solve these problems effectively and intelligently. That is why novel tasks for some people may not be solved as effectively as familiar ones.

More specifically, when people encounter a problem frequently, they develop problem solving strategies to deal with such a problem. These strategies are evaluated constantly to determine their effectiveness in solving particular problems. Thus, efficient strategies are kept and poor ones are eliminated; for example, a salesman encounters on a daily basis customers with different needs and motives. Presumably, a successful salesman would try out and develop different persuasive strategies to sell products. Through this process, the salesman uses different cognitive competencies, including flexible thinking, to produce as many persuasive strategies as possible and brings into play critical thinking to judge the effectiveness of these strategies. Additionally, types of problems that are activated in any environment are important constraints for developing successful cognitive competencies. For example, a factory worker develops a very sensitive intellect for differentiating between dangerous and normal sounds. That skill is developed through constant exposure to problems in a particular context. Consider similar examples for individuals in different environments.

Cognitive processes do not operate in a vacuum, as implied above (Newell & Simon, 1972). The domain of knowledge is the space in which these processes unfold. A domain of knowledge consists of facts, concepts, ideas, generalizations, and theories. These elements are basic units for cognitive operation. Problem solving also does not occur in isolation from these elements. For instance, products, consumers, and services are basic concepts for a salesman to sell effectively. A salesman should have proper knowledge about the product s/he sells, communication skills, and goals. Scholars believe that proficiency in a domain of knowledge is fundamental in problem solving (Chi & Ceci, 1987; Shin, Jonassen, & McGee, 2003; Sternberg & Horvath, 1999).

Every domain has different levels of knowledge and unique structures. At the lower level, a domain of knowledge includes facts and concepts. This type of knowledge is called declarative knowledge. A higher level of knowledge includes generalizations and theories. This type of knowledge is structural knowledge (Jonassen, Beissner, & Yacci, 1993). Another type of knowledge that perhaps is more related to practical application is what Polanyi (1958) called tacit knowledge. This type of knowledge is implicit knowledge that people develop through their personal experiences. Structural knowledge and tacit knowledge were found to be important predictors of performance on real-life problem solving. These types of knowledge are integrated in one model. I intended in this research to investigate the role of these types of knowledge as they relate to practical intelligence.

Practical intelligence is defined in this study as “an individual’s ability to perform on real-life problem solving effectively.” I believe practical intelligence is influenced by constant exposure to types of problems that are triggered in a particular context, as well as by the cognitive competencies people use to solve these problems. Many scholars have formed theories to explain how people solve their real-life problems or what Sternberg et al. (2000) called practical intelligence. For example, Sternberg (1985a) took into consideration both the internal and the external factors that influence individual performance when solving problems. Ceci (1996), in the bioecological treatise of intelligence, took into account the role of multiple cognitive competencies; contextual factors, including motivation and catalysts; and the fundamental role of domain of knowledge as a space for the cognition to function. In theories of expertise, scholars also focused on knowledge and cognitive processes as primary factors that distinguish experts from novice problem solvers. These theorists contended that both internal and external factors of individuals are vital for problem solving ability. These theories provide a conceptual and theoretical framework for the current research.

The author believes that practical intelligence cannot be measured by simple problems as in the traditional tests of intelligence. These tests have many limitations, as I discuss in the next chapter. Empirical research findings also showed that the low of relationship between IQ tests and the ability to perform on real-life problem solving might be due to the problems as they are structured in these tests. Practical intelligence should be measured by solving ecologically valid problems. In this research, I addressed this concern by using real-life problems to assess people's practical intelligence.

In this study, the author synthesized and integrated scattered cognitive processes and types of knowledge from the contemporary theories and empirical research findings in two models called the *cognitive processes model and types of knowledge model*. In the following, I discuss the significance of the current study from theoretical and methodological points of view. At the end of this chapter, I present the research questions that are to be answered in this study.

Significance of the Study

Contemporary scholars developed theories of intelligence to fill the gaps created by traditional theorists (Benner, 1984; Berg, 1992; Berg, Strough, Calderone, Sansone, & Weir, 1998; Ceci, 1996; Gardner, 1983, 1993, 1999; Sternberg, 1985a; Sternberg et al., 2000; Wagner & Sternberg, 1985). A critical gap was the lack of a convincing argument about how people solve problems. Scholars argue that intelligence, as recognized by cognitive, psychometric, and contextual theorists, provides a limited explanation of a human's ability (Ceci, 1996; Sternberg, 1985a, 1997a). From different schools of thought, many scholars endeavor to provide insightful explanations of how humans solve daily dilemmas. Empirical findings account for a great variance in how people solve their real-life problems. The effect sizes of promising cognitive factors that contribute to practical intelligence range from .10 to .52. These factors include higher and lower order cognitive processes and two types of knowledge.

The author believes that the limited explanation of practical intelligence is a result of shortcomings in methods and also of traditional theories of intelligence and their methodologies. At the theoretical level, traditional theorists of intelligence did not agree on an acceptable definition of intelligence, nor did they agree upon which particular cognitive constructs are associated with the ways people solve problems. At the methodological level, tests of intelligence have been developed using backward reasoning and they lack a theoretical basis. Furthermore, tests of intelligence measure problem solving ability by items that are not valid ecologically. In the following section, I address these concerns in more detail.

Theoretical Concerns

What is intelligence? Intelligence, as a psychological construct, is a controversial concept between scholars. Presently, scholars still do not agree on what intelligence is. Sternberg and Kaufman (1998) stated that the definition of intelligence depends on who you ask, and definitions differ widely across different disciplines, time, and place. This dilemma has not been resolved for more than a century. The lack of agreement on an acceptable definition of intelligence has led to the development of many approaches to study this concept from different fields of science. I will illustrate shortly some of the theories that in part, revealed important factors that account to a reasonable degree for people's performance on problem solving.

Many scholars have attempted to rethink the concept of intelligence and develop new theories that explain this phenomenon in a broader sense. For example, Gardner proposed in his Multiple Intelligence (MI) theory that no single construct of intelligence exists but rather it has multiple forms (Gardner, 1983). The MI theory was developed based on evidence and criteria from different fields of science, including psychology, developmental psychology, and neurophysiology. Sternberg (1985a), in his triarchic theory of intelligence, suggested that intelligence is a function of one's particular inner state environment interacting with the environment. Sternberg (1985a, 1997b), in his triarchic theory of intelligence, also termed as the theory of successful intelligence, seeks to explain the relationship between the internal and external factors of individuals, and the interactions among all these factors. The internal world of individuals includes all mental mechanisms that underlie intelligence. The external world refers to the application of the mental mechanisms to a real-life problem. The interaction between the two realms is what he referred to as the experiential factor. Ceci (1996) proposed his bioecological theory of intelligence in which multiple cognitive potentials, contexts, and knowledge factors are essential components of intelligence. Ceci and his colleagues studied the role of intelligence in a more natural context.

These theorists and others broaden the traditional concept of intelligence. They share in common the idea that intelligence is manifested in multiple forms and environments, which play an essential role in its development. Distinctively, all abovementioned theorists believe that intelligence as a concept is the ability to solve problems. This concept is also employed in this study. Gardner's (1983) theory is focused on the several forms of intelligence that function in different domains. Sternberg's (1985a) triarchic theory of intelligence emphasizes the role of cognitive and metacognitive processes. Ceci (1996) did not specify mental processes in his theory; however, his emphasis was on the role of the domain of knowledge and catalysts from environments to foster intelligence. Notably, contemporary theorists of intelligence break the unilateral notion of intelligence into more multifaceted constructs. These theorists provided partial evidence to explain people's performance on real-life problem solving according to the two models developed in this study.

A second concern of this author is that psychometric theorists of intelligence tended to focus on one or a few constructs as means to explain functions of intelligence. For example, many scholars consider intelligence as a unilateral construct that is explained by the *"g"* factor. However, for such complex phenomena, I believe this argument is hard to accept because the *"g"* factor, as many scholars revealed, did not account for how people solve real-life problems (Ceci, 1996; Goleman, 1995; Sinnott, 1989; Sternberg, 1985a; Sternberg et al., 2000). By contrast, contemporary theorists of intelligence consider several aspects of intelligence and reveal several factors associated with ways people solve problems. For example, Sternberg et al. (2000) explained practical intelligence as a construct that was derived from contextual knowledge people learned through their lifespan. This knowledge is not measured in traditional tests of intelligence. Sternberg (1985a) asserted that metacognition has a prominent role in problem solving. Gardner (1983, 1993, 1999) viewed human ability as blooming in different domains. Ceci (1996) postulated that intelligence is a result of contextual experiences and interactions. These theorists together discussed the vital role of both internal characteristics and the context in shaping the individual's ability to solve problems. In comparison, traditional theorists of intelligence desperately want to completely eliminate the influence of the contextual factors from their tests.

The third concern addressed by this researcher is that traditional tests of intelligence, based on psychometric and cognitive psychology, measure superficial processes, such as the speed of cognitive processing. Performance on speed tests was used to make generalizations about individual reasoning and ability to solve complex problems. When doing so, the quality of solutions and how individuals reach these solutions were ignored. The psychometric approach lacks theoretical bases. In addition, tasks of intelligence tests are often very simple and do not mimic any real-life complex problems.

The researcher of this study capitalized on the knowledge gained from contemporary theories and empirical research findings and integrated, in a broad sense, different schools of thoughts to investigate practical intelligence using two models to address the abovementioned concerns. The author identified the co-factors with people's performance on real-life problem solving. These factors were categorized into two major dimensions: cognitive theories and knowledge theories. Cognitive psychologists emphasized the role of cognitive processes in problem solving. Contextual and expertise theorists verified the role of knowledge in solving problems. The researcher's goal was to investigate the contribution of the two models. In the following section, I illustrate the constructs in each model.

The Cognitive Processes Model

In the literature I reviewed, scholars specified certain cognitive processes that operate when people solve problems. These processes include higher and lower order cognitive processes. The higher order processes include metacognition, which refers to an individual's ability to monitor his/her own thinking and the awareness and control of it. Sternberg (1985a) and Shin et al. (2003) postulated that metacognitive processes have control over lower order cognitive processes and memory. In Figure 1.1, I illustrate the theoretical role of this construct and how it controls the lower order processes and knowledge acquisition. Furthermore, I believe that an effective metacognition construct also controls the non-cognitive factors and knowledge acquisition.

As revealed by the literature, the contribution of metacognition to the variance in practical intelligence ranged from .10 to .28 (Heng, 2000; Jaušovec, 1997; Jaušovec & Jaušovec, 2000; Shin et al., 2003; Swanson, 1992). The lower order cognitive processes that are associated with people's performance on real-life problem solving include defining a problem, flexibility of thinking, and selecting a solution strategy. Defining a problem is a subjective process and has not been quantified. This factor was found to be a predictor of the ability to select solution strategy (Berg et al., 1998). I included this factor as an important construct that leads to specific paths in problem solving. Flexibility of thinking was the second component in lower order processes that contributes an important effect size (r^2 = .22 to .30) to practical intelligence (Crawford & Channon, 2002; Patrick & Strough, 2004). In solving real-life problems, as opposed to problems in traditional tests of intelligence, individuals have to generate a variety of solutions. Selecting a solution strategy process is another cognitive process that contributes to people's practical intelligence (Berg, 1989; Blanchard-Fields et al., 1997; Klaczynski, 1994).

These factors showed greater contribution to performance on solving problems than other cognitive and non-cognitive factors (e.g., speed of processing, attitude). I integrated these cognitive processes in the cognitive processes model in this research to investigate the role of each process in practical intelligence (see Figure 1.1). Even though these processes were included in the cognitive processes model, their effect sizes were relatively high for a psychological construct such as practical intelligence. Further precautions are discussed in the Method Section. The assumption derived from these models is that if these processes contribute separately to practical intelligence, they should contribute more as a group.

The Types of Knowledge Model

Other researchers showed that two types of knowledge were essential to practical intelligence. Sternberg et al. (2000) argued that tacit knowledge is among the best predictors for practical intelligence. This type of knowledge is gained though experience and from a particular context. Tacit knowledge contributes to practical intelligence with a moderate effect size, $r^2 = .36$, (Sternberg, Nokes, Geissler, Prince, Okatcha, Bundy, & Grigorenko, 2001). Shin et al. (2003) and Day, Arther, and Gerrman (2001) agreed that structural knowledge is an important contributor to problem solving abilities, especially in a specific domain. This type of knowledge is defined in this study as knowledge about how a domain is structured through theories that are validated empirically. This type of knowledge was one of the important contributors to people's performance on real-life problem solving ($r^2 = .19$). These two types of knowledge were included in this research in the knowledge model (see Figure 1.1). The aim was to reveal the role of the knowledge model in practical intelligence.

The contribution of the cognitive processes and types of knowledge models in this research and the interaction between the two models are significant and unique goals of this research. In my review of literature, as stated in the next chapter, several of these factors were investigated in this study. However, they have been derived from many theories and empirical research findings. As previously stated, if these variables explain separately a great deal of practical intelligence, then these factors together should explain more or at least the same amount of variance in problem-solving ability.

Methodological Concerns

The first methodological concern is related to tasks used in intelligence tests. One criticism of traditional tests of intelligence is that developers rely on artificial tasks that by no means replicate real-life problems. Tasks in any intelligence assessment should be ecologically valid. Performance on artificial and simple tasks does not reveal cognitive complexity in solving problems. Traditional tests of intelligence consisted of an abundant number of well-defined problems with one correct answer. Real-life problems, in contrast, are complex and ill-defined. These types can be solved by more than one correct answer. The inference that was made from traditional tests of intelligence is that simple cognitive processes that are measured by simple tasks can be generalized to complex problems. Yet, empirical researchers provided evidence contradicting this inference (Benner, 1984; Ceci, 1996; Heng, 2000; Sternberg & Frensch, 1991; Sternberg & Horvath, 1999).

A second concern was related to the theoretical bases of these tasks. These bases are questioned because the tasks only show up in laboratory settings. For example, psychometric theories, instead of defining a construct, started with problems to include in tests of intelligence. This reversible method is not aligned with a scientific method for developing measurements. The scientific approach for devising a reliable measurement for an inner construct is usually started with a clear definition and characterization of the intended construct's parameters. Then, attempts are made to measure the construct's parameters by external indices that are manifestations of the inner construct. Unfortunately, this process has been worked backward in developing tests of intelligence. Using a psychometric approach, in the absence of a widely agreed-upon definition of intelligence, a researcher starts with an external index (e.g., tests of math and verbal problems) or a criterion, and then selects tasks that display population variance and covariance with the criterion. In other words, psychometricians select tasks that show individuals' differences in the population (Richardson, 2002). This psychometric approach has led many scholars to define intelligence as what intelligence tests test. Today, evidence against the psychometric notion of intelligence comes from the fact that what is measured by IQ tests does not predict an individual's ability to solve real-life or complex problems.

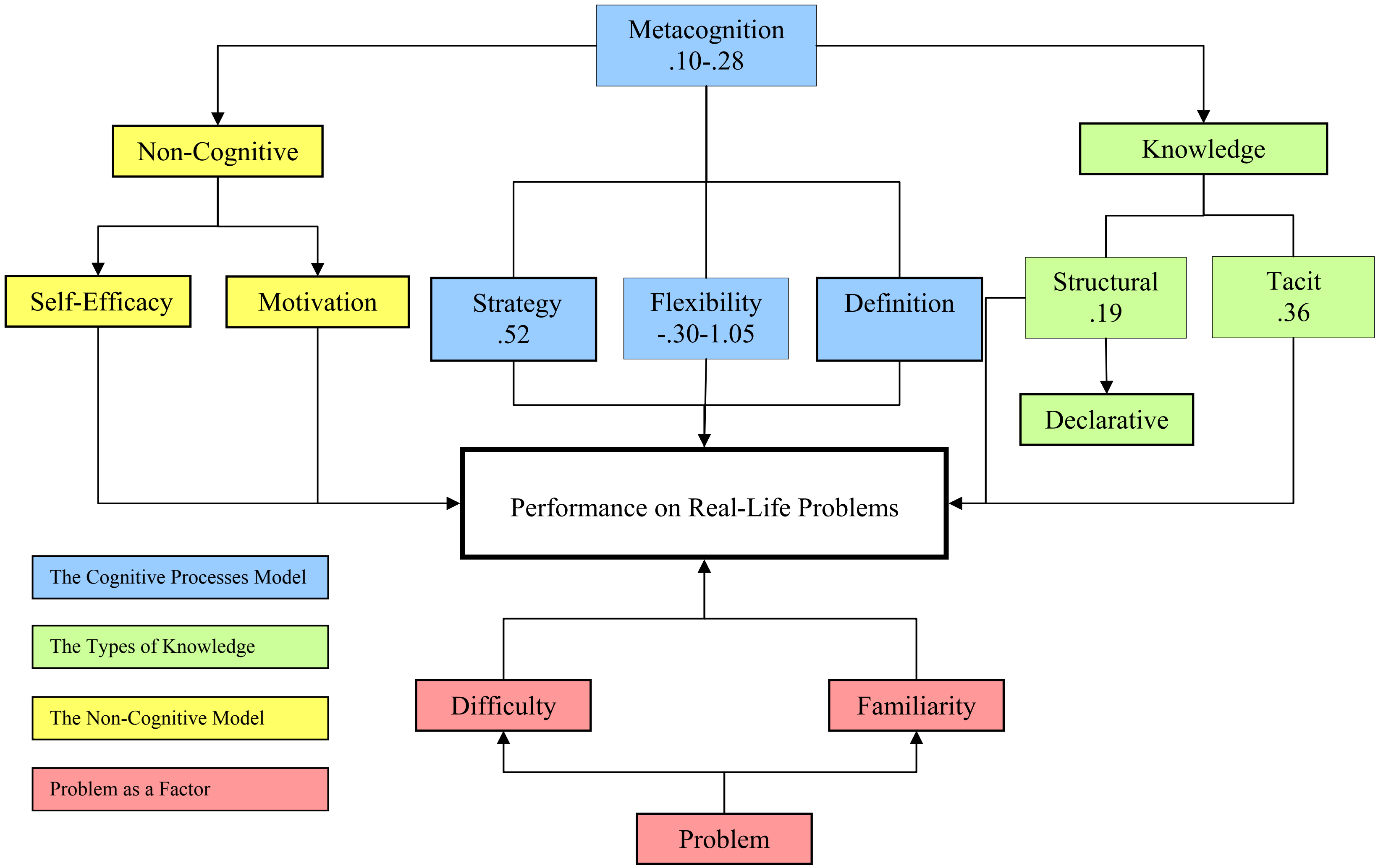


Figure 1.1: Illustration of Factors That Influence People's Performance on Real-Life Problem Solving and the Effect Sizes

The third concern is related to the structure of problems: their difficulty and familiarity. Scholars rarely took into consideration the structure of problems as variables in their research. Many scholars believe that the major source of variation between performance on traditional intelligence tests and real-life problems is the degree of the problems' structure (Berg, 1992; Jaušovec, 1997; Maker, 2005; Maker & Schiever, 2005; Neisser, 1976; Sternberg et al., 2000). For example, real-life problems differ from the laboratory-designed tasks in their level of structure and complexity. Also, familiarity with problems is another factor that might contribute to performance. This factor was rarely considered important in problem solving. These factors are related to problem structure as well as an individual's experience with certain types of problems. The goal was to use these factors as covariates, as well as to validate the assumption that people perform better on familiar problems as opposed to novel and complex problems.

In this research, to address the previous concerns, I used ecologically valid problems with different degrees of complexity. Problems used in this research were real-life problems that had occurred in different contexts in the past and still occur. I also used the degree of complexity and familiarity as covariates to control for when assessing an individual's performance in solving real-life problems. My assumption was that both difficulty and familiarity with the problems play an essential role in performance. Therefore, not only do the internal factors operate in solving real-life problems, but also the external factors.

Purpose

The primary purpose of this research was to investigate the role of two competing cognitive models in explaining practical intelligence. I investigated the contribution of the cognitive processes model and types of knowledge model to practical intelligence and the interaction between them. The secondary purpose of this research was to determine the contribution of some of the non-cognitive factors to practical intelligence.

Research Questions

The research questions fall into five major categories: (a) cognitive processes in practical intelligence, (b) types of knowledge associated with practical intelligence, (c) the interaction between the two models, (d) the role of some of the non-cognitive factors, and (e) the role of difficulty and familiarity with problems in explaining practical intelligence.

First Category: The Cognitive Processes Model

(1) To what extent does the cognitive model contribute to people's performance on problem solving?

a) What is the role of metacognition in practical intelligence?

b) What is the role of defining a problem in practical intelligence?

c) What is the role of flexibility of thinking in practical intelligence?

d) What is the role of selecting a solution strategy in practical intelligence?

(2) To what extent is practical intelligence associated with general academic knowledge?

Second Category: The Types of Knowledge Model

(3) To what extent does the knowledge model contribute to people's performance on real-life problem solving?

a) What is the role of structural knowledge in practical intelligence?

b) What is the role of tacit knowledge in practical intelligence?

(4) To what extent is practical intelligence associated with domain specific knowledge?

Third Category: The Non-cognitive Factors

(5) To what extent do the non-cognitive constructs contribute to people's performance on real-life problem solving?

a) What is the role of self-efficacy in practical intelligence?

b) What is the role of motivation in practical intelligence?

Fourth Category: The Contribution of the Two Models and Non-cognitive Factors

(6) To what extent do the two models and non-cognitive factors together contribute to practical intelligence?

Fifth Category: Familiarity with Problems

(7) To what extent is familiarity with problems associated with performance on a measure of practical intelligence?

Sixth Category: Age as a Factor

(8) To what extent do older adults perform better than younger adults?

CHAPTER II

LITERATURE REVIEW

The primary purpose of this research is to investigate the role of two competing cognitive models in explaining practical intelligence: cognitive processes and types of knowledge. This section, in particular, focuses on the literature, including theoretical foundations and empirical research findings that are related to practical intelligence. This chapter is divided into four major sections: (a) theoretical foundations of practical intelligence, (b) internal factors that influence practical intelligence, (c) external factors associated with practical intelligence, and (d) the interaction between these internal and external factors.

When reviewing the literature, my objectives were as follow: (a) to determine the factors that influence the phenomenon under investigation, (b) to synthesize critical aspects of people's performance on real-life problem solving, (c) to critique and pinpoint the gaps in the literature related to the current problem, (d) to use the literature as a guide for this study, (e) to calculate the effect size and determine the practicality of the findings of the previous studies, and (f) to develop hypotheses aligned with the current research questions. My conceptualization for each section is to provide a theoretical background, support my arguments with empirical research findings, critique the literature, and make predications and develop hypotheses.

Practical Intelligence: Theoretical Foundations

Practical Intelligence in Traditional Theories of Intelligence

For more than a century, scholars from different intellectual domains have endeavored to explain how people solve problems effectively and succeed in life. Intelligence as a concept has been explained from diverse schools of thought; nevertheless, the complexity of intelligence as a psychological construct is hard to elucidate through a particular approach. Yet, different approaches may be partially successful in explaining limited aspects of intelligence as a competence in problem solving. In the following, the scope of my discussion is on practical intelligence as perceived by traditional theories of intelligence.

Practical intelligence, as a term used in this study, refers to how people deal with real-life problems effectively. Meegan and Berg (2002) defined real-life problem solving from the contextual point of view as "dealing with challenges, obstacles, and demands grounded in the day-to-day contexts, goals, activities and relationships of individuals" (p. 7). From a cognitive point of view, Klaczynski (1997) defined everyday problem solving as "the reasoning processes and strategies individuals use to solve problems that have more direct pertinence to their lives than problems traditionally used in problem solving research"(p. 193). The concept of real-life problem solving in both definitions primarily focuses on how people solve problems in natural contexts.

Berg et al. (1998) described practical intelligence as the ability to solve everyday problems that people frequently experience in daily life. These problems are complex in nature, multidimensional, and often ill-defined in that their goals, means, and solutions need to be determined. Sternberg et al. (2000), from a contextual point of view, refer to practical intelligence as "the ability that is directed toward one or more of three behavioral goals, adaptation to an environment, shape of an environment, or selection of an environment" (p. 96). Clearly, theorists of practical intelligence emphasize behavioral function or problem solving ability that takes place in a particular environment. Therefore, practical intelligence is not limited to a particular type of context; instead, any intelligent behavior in any situation can be considered to be practical intelligence.

Intelligence, as a concept in traditional views, is still a rather enigmatic construct. For example, scholars up until now do not have a clear definition of intelligence. Sternberg (1985a) articulated that many definitions exist and vary profoundly depending on when, where, and whom you ask. For instance, in 1921, scholars in psychology were asked what they considered intelligence to be, and the answer was simple: no single answer. The same question was repeated again in 1986, and evidently a consensus was not reached (Richardson, 2002). Furthermore, not only the psychologists differ in what they mean by intelligence, but also intelligence is a controversial issue across cultures. For example, Sternberg and his colleagues found that the concept and meaning of intelligence are embraced differently by Western and Eastern cultures (Sternberg et al., 2000). For instance, Western cultures, particularly in the United States, take into account the speed of mental processing as a factor that contributes to one's intelligence, whereas in Eastern cultures like China, taking the speed as indicator of performance that may raise a question about the quality of one's work.

For many, intelligence and problem solving are different sides of a coin (Gardner, 1983; Maker, 1996; Sternberg, 1985a). For example, Gardner defined intelligence as "the ability to solve problems or fashion products that are valued in one or more cultural settings" (p. x). Sternberg et al. (2000) defined successful intelligence as "the ability to achieve success in life…within one's sociocultural context" (p. 92). In both definitions, problem solving is the basic function of intelligence. Hence, problem solving abilities of individuals are perceived as important competencies that presumably determine one's performance in dealing with problems despite the context. Wallace, Maker, Cave, and Chandler (2004) argued that intelligence is the ability to employ thinking and problem solving skills in all aspects of life. In other words, an overt superior problem solving ability is influenced by a covert construct of intelligence.

A persistent dilemma in the field of psychology is that intelligence tests fail to discover superior problem solvers in different contexts. Theories of intelligence, regardless of their psychological bases, were proposed to provide conceivable explanations of the function of intelligence in problem solving in different domains and contexts. Unfortunately, persistent and extensive evidence shows that traditional theories of intelligence do not account for an individual's ability to solve problems in real-life situations (Berg, 1992; Ceci, 1996; Heng, 2000; Sternberg et al., 2000; Wenke, Frensch, & Funke, 2005). Wenke et al. (2005) pinpoint that what intelligence should contribute for solving complex problems is not clear. Hence, I review traditional theories of intelligence as they relate to solving real-life problems to provide further explanation for my belief that the complexity of real-life problems cannot be measured by the traditional IQ tests.

Traditional Theories of Intelligence

When you ask laypeople or psychologists what intelligence is, they convey valid views about this concept. However, laypeople and psychologists have different stances; laypeople are driven by inadvertent observations of behaviors whereas the psychologists are intentionally oriented to explain intelligence. Accordingly, theories of intelligence are classified as implicit or explicit (Sternberg, 1985a). Scholars describe intelligence as perceived by laypersons in a more pragmatic way as implicit theories. Using this approach, scholars asked samples of people in different places to provide and rate the important traits of intelligent individuals. Factor analysis, in several studies showed that people perceived three major aspects of intelligence: (a) the ability to solve practical problems, (b) verbal ability, and (c) social competence (Neisser, 1976; Sternberg, 1981). This approach of studying intelligence has some limitations related to domains, ages, and cultures. That is, different people of different contexts, ages, and cultures view intelligence in diverse ways. Proponents of this creed are contextualists, who argue that intelligence is a complex construct that is sensitive to opportunities arranged and presented in a particular environment. Intelligence, in implicit theories, is an individual's ability to function in the external world.

In my opinion, the concept of intelligence is rooted in implicit theories and manifests types of competencies that individuals need in dealing with real-life problems or what is called "practical intelligence." For example, a skillful pilot is not one who exceeds his/her peers in aviation skills as measured by a paper and pencil test, but one who showed appropriate behaviors in dealing with situational problems (e.g., a failure of an aircraft's dynamics). Thus, situational problem solving cannot be understood outside of its context, and people or professions in a particular context may provide insightful criteria to judge who is considered to be practically intelligent.

By contrast, explicit theories of intelligence are proposed by psychologists and assumed to be validated empirically (Sternberg et al., 2000). These theories rely on actual performance of selected tasks to determine one's intelligence. Explicit theories fall mainly into two major categories, including psychometric and cognitive approaches. In the following, I highlight each approach as it relates to practical intelligence.

Scholars, who use the psychometric approach, assume that intelligence is a hypothetical construct that includes one or several mental entities called factors. In this approach, intelligence is measured basically by a large number of tasks. Scholars assume that scores on such tasks predict intelligence in school and the workplace. Spearman (1904), in his psychometric approach, suggested the *"g"* factor that underlies the common variance of people's performance on tests of intelligence. Other scholars hypothesized several factors using the same approach. For example, Thurstone (1938) identified seven factors, including verbal comprehension, verbal fluency, numbers, spatial visualization, memory, reasoning, and perceptual speed. Guilford (1967) proposed the Structure of Intellect model that includes 120 factors, recently extended to 150 factors. These theories, also called the differential theories, are based on the assumption that intelligence can be understood as a latent construct that accounts for the variance between individuals.

Scholars, from the cognitive approach point of view known also as information-processing theories, attempt to explain intelligence as mental processes that contribute to an individual's performance on tasks, rather than mental entities. Cognitive psychologists explain intelligence at various levels of cognitive functioning by two concepts: capacity of memory and information-processing. At one extreme end, intelligence is viewed as a functional speed in processing information. In this approach, many simple tasks to measure speed of information-processing are included in tests: pure speed, choice speed, and speed of lexical assess. Pure speed is measured by the reaction time of an individual to the test items. Choice speed is assessed by the time a person takes to select a correct answer from several options. Speed of lexical access is measured by the response time to a particular stimulus. At the other extreme, intelligence is viewed as complex problem solving that involves accuracy and problem solving strategies. However, the speed approach dominates tests of intelligence in the information-processing theories.

The psychometric and the cognitive approaches have been criticized by Sternberg (1985a) for their many shortcomings. First, the psychometric approach lacks a clear definition of what intelligence is. Second, psychometricians assume that intelligence is manifested in a latent construct, called the *"g"* factor, which accounts for the source of variance between individuals. Third, even though proponents of the psychometric approach acknowledge the existence of several mental entities that constitute intelligence, they all share the common belief that the *"g"* factor underlies all types of mental entities. Furthermore, psychometricians use similar methods to measure intelligence by using simple tasks and a statistical approach called factor analysis. Finally, psychometricians fail to explain how people reach a particular solution to a specific real-life problem.

The cognitive approach has been criticized for several defects. First, even though information-processing theories differ in the levels of cognitive processes they emphasize in tasks, they employ tasks similar to those used in psychometric approaches. Second, cognitive psychologists assume that intelligence can be depicted by information-processing speed regardless of other contextual influences on this construct. Third, intelligence is measured as speed of cognitive processing that neglects important aspects of problem solving. Fourth, all tasks that are being used in tests of intelligence are simple. These tasks, by no means, are ecologically valid, nor do they represent real-life problems.

Both views present intelligence tests as consisting of very specific tasks such as recognizing the meaning of words, seeing verbal or figural analogies, solving simple arithmetic problems, completing a series of numbers, visualizing spatial relationships, and so forth (Sternberg et al., 2000). These tasks, believed to be measuring basic cognitive properties (e.g., memory, reasoning, inference, speed), are criticized for their simplicity and lack of ecological validity. Richardson (2002) concluded that simple tasks, like laboratory tasks that usually have optimal solutions and are solved in short periods of time, cannot be generalized to complex real-life problems that people encounter on a daily basis.

A simple analysis of these tasks reveals critical limitations of tests of intelligence to assess problem solving ability in everyday life. First, these tasks are not compatible with real-life problems. They are well-structured in nature, meaning they have only one single absolute answer and one method leads to that answer (Richardson, 2002). For example, consider the following arithmetic reasoning problem: what number comes next in the following series: 1, 2, 5, 6, 9, 10,__. In this example, if a problem solver fails to make inferences about the two consecutive numbers (e.g., 5, 6) and between two consecutive pairs (e.g., 5, 6 and 9, 10), s/he may fail to find the right answer. Is this example a type of problem people encounter in their daily lives? Moreover, in my opinion, any test consisting of simple tasks would register individual differences if the time is held as a variable, as in most traditional tests. Another important limitation is that these tasks do not predict an individual's performance on external criteria such as success in the workplace, adaptation in social life, or effectively solving complex problems. Last, regardless of the simplicity of the tasks, what people encounter on a daily basis varies vastly with respect to time, context, and situation.

In addition, Wenke et al. (2005) argued that the main assumption that guides the construction of traditional intelligence tests is that simple tasks can capture the main properties of cognitive complexity. Contradicting this assumption is that what is assumed to be measuring general ability is not related to an individual's ability to solve complex real-life problems. Richardson (2002) asserted that most intelligence tests do not employ practical items that resemble everyday tasks. Wenke et al. concluded that the external validity of artificial tasks used to link intelligence to solving complex problems is highly questionable. Apparently, simple tasks were used for convenience and economic reasons (easy to analyze and score) to generalize performance on more complex problems (Richardson, 2002).

Accordingly, contemporary scholars question the external validity of tests of intelligence. In other words, the external validity of these theories has been criticized because scores on these tests do not predict an individual's ability to deal with complex real-life problems (Ceci, 1996; Neisser, 1976; Richardson, 2002; Sternberg, 1985a, 1985b). For instance, IQ test scores correlate significantly with school performance, $r = .50$, years of education, $r = .55$, social status and income, $r = .33$, job performance, r

= .30 to .50, and juvenile crimes, $r = -.17$. As indicated from these correlations, IQ scores were accounted for by only around 25% of schooling only; that is, around 75% of the variance is not explained by schooling. The correlations with respect to job performance were inconsistent. Even though the correlation is moderate, some scholars argued that these results also are questionable. That is, having a gatekeeper criterion, such as IQ test scores, to any social class institution will lead definitely to a positive correlation with these occupations. In other words, if we consider that the height of an individual is what determines which job he might get (e.g., shorter people are blue-collar workers, taller persons are lawyers), then height will positively correlate with job incomes. As a result, the correlation between IQ scores and performance in these domains was created artificially. This problem constitutes the strongest evidence against the traditional views of intelligence. Ceci and Liker (1986) concluded that whatever it is that IQ tests measure, it is not the ability to engage in complex problem solving. In my opinion, along with other major reasons, the low correlation is due to the type of problems embedded in the intelligence tests as opposed to what real-life problems include. Scholars contend that intelligence could not be understood outside of its particular context, given the fact that research findings showed very low correlation between performance on real-life problem solving and performance on intelligence tests.

In conclusion, no convincing evidence supports the argument that scores on tests of intelligence predict people's performance on complex real-life problems. Furthermore, I believe traditional approaches also discount intelligence as a developing construct that is influenced by the extent to which people are exposed to knowledge, experiences, and environmental catalysts. Apparently, implicit and explicit theorists measure intelligence in artificial ways by items that are not valid ecologically. Nonetheless, explicit and implicit theories provide a logical framework for recent scholars to conceptualize new theories of intelligence. I think the link between implicit and explicit theories of intelligence is vital to understanding practical intelligence as a dynamic construct. That is, problem solving ability as perceived by laypersons in a particular context and considered as intelligent behavior that should be predicted by tests of intelligence. In other words, if psychometricians and cognitive psychologists determine ways in which more ecologically valid tasks can be used to measure individuals' performance, they may be closer to explaining how intelligence functions in the real world. Unfortunately, the link between implicit and explicit theories is rather weak. Establishing this link, in my opinion, has to be the focus of intelligence theorists' endeavors at this time.

Empirical Support

Contradicting the view of intelligence as one of the best predictors of an individual's problem solving ability in academia and real life, a growing body of research shows that the traditional views of intelligence are not related to solving complex real-life problems. In the following section, I present several studies supporting the hypothesis that practical intelligence and academic intelligence are different constructs.

The methods of the following studies include quantitative and qualitative analyses (see Table 2.1). The majority of the researchers used correlational analyses to pinpoint the relationship between individuals' general abilities and other problem solving indices. Other researchers used qualitative analysis to show how practical intelligence unfolds.

Measurements of practical intelligence in the following studies included different scales, questionnaire items, and hypothetical ill-structured problems. Participants in these studies were from different school-age students and some samples contained adults. The studies took places in- and outside- of school settings. The studies in general focused on the cognitive competencies as they relate to people's performance on real-life problem solving.

Table 2.1

Review of the Studies of Academic Intelligence and Practical Intelligence

Study	Participant	Instrument	Analysis	Conclusions
Sternberg et al. (2000)	85 Children ages 12 and 15	Dholuo Vocabulary test The English Mill Hill Vocabulary Scale Raven Progressive Matrices Test of tacit knowledge for natural herbal medicines English and mathematics achievement test	Correlations	Practical intelligence as measured by the tacit knowledge is distinct from academic intelligence General factor *"g"* may not be general for all aspects of intelligence

Table 2.1–*Continued*

Study	Participant	Instrument	Analysis	Conclusions
Heng (2000)	296 eighth-grade students (154 gifted, 175 mainstream)	Practical Intellectual Practical Problems Questionnaire Academic achievement Clinical interviews	Quantitative Analysis: (Multiple regression analyses) Qualitative Analysis: (Coding Schemes)	Practical intelligence was not a predictor of academic achievement; practical intelligence is distinct form academic intelligence

Table 2.1–*Continued*

Study	Participant	Instrument	Analysis	Conclusions
Berg (1989)	217 fifth, eighth, and eleventh-grades students	Practical Intellectual Assessment Questionnaire Everyday Problems Questionnaire	Multiple Factors ANOVA	Correlation of average strategy knowledge scores and achievement test scores were smaller and not significant for the eight and eleventh graders; academic achievement and strategy knowledge scores were correlated moderately for fifth grade students

Table 2.1–*Continued*

Study	Participant	Instrument	Analysis	Conclusions
Ceci & Liker (1986)	110 men who were attending race track	Racing fact test and Predicting horses' post-time odds Wechsler Adult Intelligence Scale	Correlations	No correlations were found between IQ test and measures of handicapping skills

Sternberg and his colleagues (2001) investigated the relationship between practical abilities and academic achievement in a sample that consisted of 85 students (ages 12 to 15) in a rural area in Kenya. The goal was to further support a hypothesis derived from the Triarchic Theory of intelligence; that is, academic and practical intelligences are distinct constructs. The researchers used several measurements, including the Dholuo Vocabulary (DV) scale (r = .85), the English Mill Hill Vocabulary (EV) scale (r = .84), and the Raven Colored Progressive Matrices (RM) (r = .85). The dependent variable was performance on real-life problem solving that suited the participants' environment, with multiple choice questions. Performance on practical problems was not highly correlated with academic and IQ measurements. For example, after controlling for age and socioeconomic status (SES), low to moderate correlations were found between performance on practical problems and DV, -.20, EV, -.29 ($p < .01$), RM, -.16 . Interestingly, scores on tests of academic intelligence were positively correlated with each other. Researchers concluded that academic and practical intelligences have distinctive patterns.

A major theoretical issue raised by this study is that solving real-life problems does not correlate with performance on general academic domains as taught in schools. The question is whether children's performances on practical items are correlated positively to domain specific knowledge (e.g., academic knowledge about plants and different species). I would be surprised if performance on practical items was not positively and highly correlated with performance on items measuring domain specific knowledge, because cognition does not function in a vacuum. Perhaps the assumption that underlies this study was that performance on practical items was not related to academic performance in general, as is predicted by the *"g"* factor. I believe that the assessment of practical intelligence in this study was related to a very specific domain. Therefore, general academic knowledge may not be related to performance on practical items in specific domains. I suspect that knowledge should be measured at the same level of specificity to clarify the academic knowledge and practical intelligence relationship. Practical intelligence in a domain may partially relate to knowledge in that domain. For example, a leader of an organization who effectively forms workgroups to achieve important goals, might not have only tacit knowledge about different individuals and their competencies, but most essentially, s/he has academic knowledge about group dynamics and the task requirements. Another example is when a successful teacher develops a lesson plan for his/her students, not only s/he might consider available resources in her classroom and the school, but also s/he must be driven by theories of leanings, motivation, and class management while thinking about the lesson. Practical intelligence, in my conjecture, does not function in a vacuum, nor does it occur at the abstract levels of knowledge; instead, it integrates many types of information that have academic, contextual, and experiential bases that are important for the situation.

Consistent results with the Sternberg et al. (2001) study were found by Heng (2000) in Singapore when she studied the relationship between practical abilities and academic achievement. The sample consisted of 296 eighth-graders (154 gifted, 142 mainstream). Gifted students, in this study, were identified by three standardized tests: (a) analytical and abstract reasoning, (b) reading comprehension, and (c) vocabulary and quantitative reasoning. The students' practical intelligence was measured by the Practical Intellectual Assessment Questionnaire (PIAQ). The PIAQ was adapted from Berg's study in 1987. Developers of the PIAQ intended to measure social competence, skills lay people perceive as representative of everyday intelligence, and skills designed to tap the six problem solving strategies used to solve practical problems. Students were asked to rate the extent to which they describe their behavior as being compatible with the statements. The Cronbach coefficient alpha for the PIAQ ranges from .70 (mainstream) to .83 (gifted). Further, academic achievement measures were used including total percentage scores that students obtained at the end of the academic year and scores on the Primary School Leaving Examination—a national exam administered after sixth grade. The data were analyzed using a multiple regression model to examine the relationship between aspects of practical abilities and academic achievement and between practical problem solving strategies and academic achievement. The findings indicate that practical intelligence as measured by the PIAQ was not predicted by the academic achievement, $F(4, 289) = 1.56$, $p > .05$. The subcomponents of the PIAQ reveal very low correlations, with academic achievement ranging from .02 to .14. Berg (1989) also examined the relationship between students' abilities to use strategy knowledge and students' achievement. The sample consisted of 217 students from grade 5 and 8. She found moderate correlation between grade point average (GPA) and Everyday Problem Questionnaires in fifth grade ($r = .38$, $p < .01$), and other correlations were low and not significant.

Other researchers examined the relationship between people's performance on real-life problem solving and on traditional intelligence tests outside the school setting. In two studies, including expert handicappers at race tracks, Ceci and Liker (1986) identified 30 people who attended horse races every day of their adult lives and divided them into two groups, expert and novice, based on their knowledge about horses. The researchers asked these groups to handicap real races as well as a hypothetical one. They found the performance of handicappers in predicting race winners was not related to their scores on a traditional intelligence test ($r = -.07$, $p < .05$). The researcher concluded that the assessment of expert intelligence was irrelevant to solving complex problems. Interestingly, experts with low IQs used more complex, interactive modes than did non-experts with high IQs.

Some scholars claim that the major source of variance between academic and practical intelligence is related to the types of problems that are emphasized in intelligence tests, academic contexts, and in real-life situations (Ceci, 1996; Sternberg et al., 2000). Many believe that performance on problems with different structures entails different intellectual competencies (Richardson, 2002; Wenke et al., 2005). For example, when a problem is complex, problem solvers exhaust tremendous thinking efforts to define goals, generate and evaluate solutions. These tasks are achieved by using their flexibility of thinking, reasoning ability, justification skills, and critical thinking. Whereas, when a problem is simple and well-structured, the chance of employing these skills is very limited.

These studies have several limitations. First, the Sternberg et al. (2001) study consisted of a limited population from one village in Kenya. Another major limitation is related to whether tacit knowledge reflects practical intelligence. I believe that tacit knowledge is associated partially with aspects of practical intelligence. This type of knowledge is necessary, in a particular context, to succeed. Second, in both Sternberg et al. and Heng's (2000) studies, the reliability of practical intelligence instruments is not sufficient. Finally, Berg (1989) used novel problems for participants that might, in part, influence the performance because these problems are not ecologically valid for the study population.

In conclusion, a consensus between the above researchers reveals that neither academic performance, nor performance on traditional tests of intelligence is correlated with practical intelligence as manifested by individuals in real-life and the workplace. The results showed that other aspects of intelligence may exist; however, they are independent from IQ, and are neglected by traditional measures of intelligence (Sternberg et al., 2000). From this information, I arrived at two predictions. First, I predict low correlations will exist between performance on practical intelligence and the GPA of participants as a general index of academic performance. That provides further support to the distinctive features of practical intelligence. Second, I predict that moderate to high correlation will exist between performance on practical problems and related domain specific knowledge. My hypotheses were as follow:

Hypothesis: Low correlation will be found between participants' GPA and performance on a practical intelligence assessment.

Hypothesis: Moderate to high correlation will be found between participants' performance on real-life problem solving and the domain specific knowledge.

Practical Intelligence in Contemporary Theories of Intelligence

Contemporary theories of intelligence have been developed as a result of the shortcomings of traditional theories. Many scholars, influenced by different psychological stances, have attempted to reconceptualize the concept of intelligence and have developed new theories (Benner, 1984; Ceci, 1996; Gardner, 1983, 1993; Sinnott, 1989; Sternberg, 1985a, 1997b). The major goal continues to be a theory that explains, in a broader sense, how people behave and solve problems in real-life situations as well as in an academic context. Some scholars proposed theories based on their analysis and critique of traditional theories of intelligence. These theories are discovery-based rather than confirmatory-based. Others created new theories and validated them empirically. Even though these theorists aimed for an identical goal, they employed different methods of investigation. Furthermore, these theories share commonalities and vary in their components and conceptualizations. These theories need further empirical validation because they are in their proof phases. Therefore, a supplementary goal of the current study is to provide further empirical support for these theories. In the following, I discuss several contemporary theories of intelligence; these theories form the theoretical foundation for the current study, as they relate to practical intelligence.

Triarchic Theory of Intelligence

The Triarchic Theory of intelligence, proposed by Sternberg (1985a), is contrary to the traditional views of intelligence. In this theory, he attempts to link the internal and the external worlds of individuals. Sternberg integrates three different subtheories in a systems approach theory. These subtheories interact with each other to explain intelligence in a more pragmatic way. First, the componential subtheory of intelligence is related to cognitive processes; second, the experiential subtheory of intelligence is related to learning experience; and third, the contextual subtheory of intelligence is associated with a particular context or setting. All three subtheories work in an interactive way and apply to specific experiences that people encounter.

In the componential subtheory, Sternberg addresses intelligence through the internal world of individuals. He identifies three mental components that enable people to perceive, process, and respond to a particular stimulus. These components are comprised of a meta-component, a performance component, and a knowledge acquisition component. Notably, these components are part of the mental capacity of thinking. The meta-component includes higher order thinking processes, such as planning, monitoring, and decision making in task performance. The performance component includes actual execution of a task: encoding, comparison, and response to stimuli. The knowledge acquisition component includes the processes that are responsible for gaining new knowledge: selective encoding, selective combination, and selective comparison. The componential subtheory takes into account the mental mechanisms that underlay how people deal with problems.

In the experiential subtheory, Sternberg (1985a) explains the level of an individual's experience with a particular stimulus. People are stimulated by different experiences that have relatively different levels of novelty. Tasks that are novel for some people are familiar to others. Familiar tasks might be accomplished with less mental effort. In contrast, novel tasks require flexible cognitive processes in which an individual's intelligence unfolds. Sternberg argues that intelligence is best measured by relatively novel tasks. The experiential subtheory profoundly reveals the important role of experience in solving problems. That is, problem solving ability is influenced by problems people experience in their lives. As a result of experience, people tend to be more effective when they deal with problems they have encountered in the past. Yet, the experience is related to a context in which particular problems are emphasized and others are deemphasized.

In the contextual subtheory, Sternberg (1985a) states that all components apply to any experience and serve three functions in a real-world situation: to adapt, to select, or to shape an environment (Sternberg et al., 2000). Successful individuals tend to perform these functions as needed. In the contextual subtheory, Sternberg takes into account the role of the context as it relates to intelligence. Scholars argue that different contexts arrange occurrences and emphasize particular problems, while ignoring others. Thus, particular competencies develop to suit a particular context. This role of the context accounts for unique cognitive competencies that unfold in a particular environment (Ceci, 1996).

In his Triarchic Theory of intelligence, also called the Successful Intelligence, Sternberg (2003) defines successful intelligence as "one's ability to succeed according to what one values in life within one's socio-cultural context" (p. 400). This success is achieved through a balance of adaptation to, shaping of, and selection of an environment. In this definition, Sternberg highlights several functions for contextual and cognitive aspects. First, individual performance should be judged within a particular context. That is, intelligence should not be decontextualized when it is being measured; second, intelligence is an inner construct or ability that people use to accommodate their contextual demands; and third, intelligence is a function of problem solving in real-life situations.

The Triarchic Theory of intelligence was developed to compete with traditional views of intelligence. Thus, this theory addresses critical concerns raised by conventional views. First, the Triarchic Theory establishes the link between implicit and explicit theories in an attempt to broaden the view of intelligence as a function in real-life problem solving. Second, the theory integrates several critical elements that have been overlooked by traditional views, including metacognitive components, context, type of problems, and experience factors. Third, the assumption is that intelligence is a developmental construct that is highly influenced by opportunities that are offered in a particular environment.

Sternberg (2003) stated that validation of the theory of successful intelligence is in its early phase. He concluded that in the Rainbow Project (over 1000 participants), factor analysis yielded separate analytical, creative and practical factors. Further, hierarchal multiple regression analysis showed significant and substantial prediction of freshmen grades over and above social economic status, sex, Standardized Aptitude Test (SAT) scores, and high school Grade Point Average (GPA). Nevertheless, the Triarchic Theory of intelligence needs further validation.

The Triarchic Theory of intelligence has been criticized theoretically and empirically. From a theoretical point of view, I contend that intelligence is not a function of only cognitive, experiential, and contextual factors, but also that other non-cognitive constructs have a role in how people solve their real-life problems. Goleman (1995) argued that the great variance in how people solve problems depends on non-intellectual factors, including emotions, motivation, and several personality constructs, such as attitudes and self-efficacy. Gottfredson (2001) criticized the Triarchic Theory of intelligence for its lack of empirical supports, including the limitations of samples and occupations.

Intelligence, as proposed in the triarchic theory, is consistent in this study with my concept of practical intelligence. However, I believe other cognitive components such as several types of knowledge and how they are structured in one's mind may play an important role in practical intelligence. Even though the theory is somewhat validated, further research evidence is important to strengthen its empirical validity. In this research, I attempt to further validate the Triarchic Theory of intelligence and provide support for its components. Specifically, I intend to validate the role of the cognitive componential subtheory in practical intelligence.

Hypothesis: Cognitive components explain aspects of practical intelligence.

Bioecological Treatise on Intellectual Development

Ceci (1996) proposed the bioecological theory of intelligence. Ceci expands the traditional view of intelligence by incorporating developmental, cognitive, and social psychological factors to explain intelligence. The bioecological framework was developed based on the assumption that intelligence consists of multiple forms and those forms are not separated from the context in which they are developed. Ceci argued that cognitive complexity is domain specific where different environmental demands shape different patterns across cultures. In other words, even though these potentials are biological, their development is related to environmental exposure. Thus, abilities express themselves differently in different contexts (Sternberg & Kaufman, 1998). In addition, non-cognitive factors, such as motivation and personality, influence cognitive complexity.

The bioecological framework consists of three broad components. First, multiple cognitive potentials exist within an individual. Findings from cognitive, neuropsychological, and psychometric studies show the existence of multiple potentials. Ceci (1996) proposes two theoretical cognitive complexity models: (a) general processes, which include cognitive processes that operate in equal efficiency across all content knowledge domains; and (b) specific processes that relate in juxtaposition to a domain specific knowledge. The second broad component that plays a crucial role in cognition is context. The growth of cognitive potentials is influenced by exposure to critical experiences during early periods of cognitive development. Further, an environment encompasses the occurrence of these experiences supported by motivational, social, and physical catalyst agents, including parents, teachers, schools, and media. The third broad component is knowledge that is not separate from cognition. Complexity of cognition does not function in a vacuum; however, Newell and Simon (1972) argued that cognitive processes always co-occur with high levels of domain knowledge. Knowledge, in their theory, is essential for cognitive complexity because personality, motivation, and cognitive processes are critical determinants for knowledge acquisition.

Ceci's (1996) theory of intelligence is a discovery-based theory rather than empirical confirmatory. He drew on empirical research findings to develop his theory. As a result, this bioecological treatise of intelligence was not validated empirically. It needs this validation. Ceci, in developing his theory, was motivated by sociopsychological assumptions that environments have a substantial influence on intelligence. Ceci does not specify particular cognitive processes to conceptualize intelligence and how people solve problems. However, he hypothesizes that cognitive processes are transdominal; that is, these processes operate with some efficiency across different knowledge domains. These processes, with practice and development become powerful general competencies across different domains. He also accentuates the vital roles of declarative and structural knowledge in the development of cognitive complexity.

Ceci (1996) provides several insights for researchers. First, he emphasizes distinctively in his theory the role of knowledge and motivation in nurturing intelligence. When researchers may explore these components, they should do so in conjunction with people's performance on real-life problem solving. Second, the role of context is perceived as a critical catalytic agent. The role of the context is vital including opportunities, schools, problems, training, cultures, occupations, professions and so forth.

Multiple Intelligences Theory

Gardner (1983) is another psychologist who sought to broaden the traditional view of intelligence, in his theory, known as the Multiple Intelligences theory (MI). The MI, similar to the bioecological theory of Ceci's (1996), is a discovery-theory that has been derived from several theoretical backgrounds. This theory was developed based on eight signs of intelligence. First, potential isolation by brain damage; this criterion refers to the fact that some abilities might dysfunction, while others are still functioning (e.g., blind people). That means some abilities function in an isolated form from others. Second, the existence of prodigies and exceptional individuals; this criterion refers to those individual who possess high potential in one or more areas while they are less competent in others. Third, the existence of core operations or a set of operations that deals with information or any kind of input. Cognitive processes that operate on different types of information are a type of these operations. Fourth, a distinctive developmental history of intelligence; this means intelligence is nurtured though developmental stages and the environment is vital in its development. Fifth, an evolutionary history of human intelligence; that refers to the root of human intelligence and how it was developed over history. Sixth, support from experimental psychology; this criterion refers to methods of examining how people solve problems. Seventh, support came from psychometric findings. Eighth, the existence of encoding processes in the human brain that refers to symbol systems that carry different information to our brain. These criteria were used to judge the forms of intelligences.

Gardner (1983) defines intelligence as follows “a human intellectual competence must entail a set of skills of problem solving—enabling the individual to resolve genuine problems or difficulties that he or she encounters and, when appropriate, to create an effective product—and must also entail the potential for finding or creating problems—thereby laying the groundwork for the acquisition of new knowledge” (p. 60). This definition encompasses both a high level of human performance and the creative ability to deal with new situations in a particular setting. In agreement with Sternberg's (1985a) and Ceci's (1996) theories, Gardner considers the context as a critical factor for intellectual development.

The MI theory is a breakthrough in the field of the psychology of intelligence, and has been widely accepted in the educational setting. Many researchers have validated aspects of the MI theory empirically and confirmed the existence of multiple forms of intelligence (Maker, 1982, 2005; Maker, Rogers, Nielson, & Bauerle, 1996; Sarouphim, 2000, 2001, 2002). Uniquely, Gardner (1983) integrates in his theory creativity as an important aspect of intelligence. Further, Gardner does not exclude the contextual factors from how intelligence is developed; however, he makes them essential to the developmental progression.

The MI has been criticized by many researchers for several shortcomings. First, scholars question the extent to which the MI represents human minds and abilities (Shearer, 2004). Second, Gardner (1983), in the MI, does not specify how human brain mechanisms produce intelligent behaviors or products. Morgan (1996) viewed the MI as cognitive styles as opposed to multiple intelligences.

Theories of Expertise

What distinguishes successful lawyers who won high-profile cases from those who are apprentices or novices, and why do critically-ill people search for master doctors? Scholars refer to this phenomenon as expertise. Experts are defined, in a particular area, as "those people who are able to think effectively about problems in that area" (National Research Council [NRC](U.S.). Committee on Learning Research and

Educational Practice., Bransford, Pellegrino, Donovan, & ebrary Inc., 2000, p. 31). As the definition shows, expertise is effective problem solving related to a particular domain. Contradicting the traditional views of intelligence, scholars argue that expertise is a developing entity that distinguishes individuals who are successful from others in a particular domain (Sternberg et al., 2000). Researchers who are developing and validating theories of expertise study how experts in particular domains acquire superiority. In the following, I discuss some theoretical frameworks on theories of expertise and how they relate to the current research topic—practical intelligence

Theorists of expertise primarily focus on mental potentials that underlie an expert's performance or knowledge resulting from those processes (Sternberg, 2000; Sternberg et al., 2000). Eraut and Boulay (n.d.) discussed four approaches to illustrate expertise, including cognitive, behavioral, empirical, and personal competencies of experts. Most of the psychological literature is concerned with expertise from a cognitive point of view, particularly how experts make judgments and solve problems (Eraut & duBoulay, n.d.). In this study, I consider expertise from a cognitive point of view.

From a behavioral standpoint, Benner (1984) characterizes experts as those who perceive the situation as a whole, use past concrete situations as paradigms, and reach an accurate definition of the problem without wasteful consideration of a large number of relevant options. Scholars argued that experts notice meaningful patterns of information; they acquire a great deal of knowledge; they are flexible and they retrieve information and know their disciplines thoroughly (e.g., NRC et al., 2000). By contrast, beginners in novel situations rely on conscious, deliberate, analytical problem solving to deal with problems.

Dreyfus (1980, 1981) proposed a model consisting of five stages in which individuals acquire expertise: novice, advanced beginner, competent, proficient, and expert (cited in Benner, 1984). A novice is a beginner, one who has no-hands experience with a situation in which s/he is expected to perform. However, a novice possesses principles, theoretical, and context-free knowledge. An advanced beginner is one who demonstrates acceptable performance in real-life situations, and has some experience with the situation. A competent person is one who has experienced the situation for a relatively long period of time, two to three years in a job for example; however, s/he lacks speed and flexibility for proficient performance as a mastery level. A proficient performer perceives the situation as a whole rather than aspects of it; perception is a key concept in this state. Because of this ability, s/he recognizes the situation and compares it to a norm that s/he develops over time, decides whether it is an exceptional situation or not and then acts accordingly. A proficient person is one who makes judgments based on situational aspects that is whether they are less or more important components of the problem. An expert performer is characterized by flexible, automatized, and masterful performance. They no longer rely on analytical skills to understand the situation. With their tremendous background and enormous experience, they accurately diagnose problems and make decisions. The previous levels of expertise reflect changes in the general aspects of performance, shifting from reliance on abstract principles to the use of past concrete experience, changing and perceiving the demands in a situation and discerning relevant and irrelevant information, and shifting from passive observer to active performer.

Expertise is an important concept of problem solving in the cognitive approach. The literature shows that not only general ability, including memory and intelligence, differentiate novices from experts, but also extensive knowledge that affects how experts organize, represent, and interpret the situations and the problems in their environments. Expertise, therefore, is a form of practical intelligence in terms of its function. In the following, I discuss the theoretical cognitive basis of expertise.

Theorists of expertise focus on cognitive processes. These processes include planning, problem solving, reasoning processes, monitoring, evaluating, and decision making. Scholars argue that experts use sophisticated strategies in solving problems. Eraut and Boulay (n.d.) assert that novice physicians work from scientific principles, whereas experts work according to clinical principles. Sternberg et al. (2000) contend that experts spend more time than novices in planning and understanding the structure of a problem as a function of their metacognitive skills, whereas novices may attempt to solve the problem without spending enough time to represent the problem accurately. Therefore, experts tend to solve problems moving forward while novices are more likely to start with a known solution, or what is known as backward strategies. In doing so, experts may spend more time understanding the problem and less time in solving it, whereas novices spend less time in understanding the problem and more time in solving it. Further, Chi, Feltovich, and Glaser (1981) argued that the difference in a problem's representation is vital in understanding how experts and novices think. The internal representation of a problem and how it is related to an expert's cognitive system seems to account for solving problems. Expert educators, for example, tend to employ different teaching strategies to develop an understanding of a concept, while novices may use one particular strategy to develop that concept.

I assert that a problem's representation is one of the critical cognitive processes that accounts for how people solve problems. Consider, for example, a person who experiences a stomach pain. Actions to solve this problem may depend on how this individual defines the problem. If he defines the problem as an epidemic disease, influenced by news in the media, s/he will definitely visit an urgent care facility, whereas if s/he characterizes the problem as a result of eating an unfamiliar food, s/he might take some eupeptic curative. Representation of a problem may depend on other global cognitive or metacognitive processes, including planning, evaluating, and monitoring aspects of the problem. For instance, determining what information is relevant or irrelevant and is critical for defining the problem requires higher order thinking skills, including evaluation (Sternberg, 1985a).

Theorists of expertise take into account the type of knowledge. The type of knowledge and how it is organized in the mind is a critical component of an expert's mind. Benner (1984) argues that what distinguishes experts from novices is know-how. Know-how is a type of knowledge that is acquired via hands-on experience. For example, knowing how to respond to a criticism in public is know-how knowledge. Further, what distinguishes great chefs, painters, technicians, and so forth is know-how. Rolfe (1997) distinguishes between three levels of expertise pertaining to knowledge: novice, experienced, and expert. A novice is one with only academic knowledge and without know-how or experience. An experienced person may possess know-how without academic knowledge. An expert, however, possesses academic knowledge as well as know-how.

Scholars discern types of knowledge that are related to academic and situational contexts (e.g., Jonassen et al., 1993; Sternberg, 1999; Sternberg & Horvath, 1999). Knowledge is primarily of three types: declarative knowledge, structural knowledge, and procedural, including explicit and implicit knowledge. Declarative knowledge includes facts, ideas, events, concepts, principles, and laws, and so forth. Declarative knowledge is “knowing-that.” Procedural knowledge, by contrast, describes how learners use or apply their declarative knowledge (Jonassen et al., 1993). This type of knowledge refers to “know-how.” Procedural knowledge entails mental representation of how a problem can be solved. This type, for example, includes developing plans, evaluating arguments, and developing computer programs. Structural knowledge, as Jonassen et al. elucidate, is an intermediate type of knowledge that mediates between declarative and procedural knowledge. Structural knowledge is the knowledge of how concepts within a domain are interrelated. As a result, structural knowledge provides the conceptual basis for how these concepts are interrelated in a particular manner. Other scholars perceive structural knowledge as how a particular domain of knowledge is organized theoretically (Chi & Ceci, 1987; Chi et al., 1981; Gobbo & Chi, 1986). For example, Eraut and Boulay (n.d.) stated that expert medical decision makers work with highly structured knowledge, including procedural and experiential knowledge. In summation, the higher order types of knowledge are what distinguish experts from novices.

In addition to knowledge and how it is organized, cognitive processes, regardless of how they are acquired, are important competencies for expert problem solvers. Individuals with practical intelligence capitalize on their thinking skills and knowledge repository to solve problems. Consider, for example, scholars who may be confronted with several due dates for critical projects. Not only might they prioritize within and across projects, but also they may use experience from different interest groups (e.g., efficient and influential individuals) to deal with this problem. I believe intelligent people are those who make proper use of their resources, including cognitive processes and types of knowledge, to solve problems.

In conclusion, contemporary theorists of intelligence, as they attempt to contradict the general notion of intelligence, are in need of further empirical support and validation. These theorists expanded in more pragmatic ways the concept of intelligence. Modern theories are all based on the assumption that intelligence is a developmental construct. Theorists recognize the role of the context as a critical determinant for what constitutes practical intelligence. The current researcher employs these contemporary theories of intelligence as a theoretical framework.

Factors Influencing Practical Intelligence

An individual's ability in performance on real-life problem solving is influenced by complex interactions among many external and internal factors. I conceptualize these factors in two major categories: first, the internal factors include cognitive and non-cognitive competencies of individuals; second, the external factors include related aspects of contexts and problems. Berg and Calderone (1994) argued that the effectiveness of solving real-life problems is determined by an efficient interaction between an individual and a context. Scholars' consensus on the concept of people's performance on real-life problem solving emphasizes the role of both individuals and their environments in shaping intelligence. In the following section, I discuss the internal and external factors as they relate to people's performance on real-life problem solving.

First Part: The Internal Factors

When an individual encounters a real-life problem, the internal state of that individual is activated. The internal state includes both cognitive and non-cognitive competencies. Among the cognitive competencies are cognitive processes and knowledge, whereas the non-cognitive competencies include emotional, social, and personal factors. Problem solving, if the context is held constant for all individuals, is a result of interactions between the internal factors. Problem solving has been theorized by scholars using different models.

Problem Solving Models

Human problem solving ability is among the highest and most complex forms of intelligence, and it distinguishes mankind from other organisms (Newell & Simon, 1972). Huitt (1992) defined problem solving as "a process in which we perceive and resolve a gap between a present situation and a desired goal with a path to the goal blocked by known or unknown obstacles" (p. 2). This definition contains an action being taken by a problem solver to achieve a desired goal. Cognitive psychologists sought to uncover and pinpoint the thinking processes of how individuals solve problems and explain the processes using models. These models usually share common steps and phases (Newell

& Simon, 1972).

Many problem solving models exist (e.g., the Scientific Inquiry method, Creative Problem Solving, Thinking Actively in a Social Context, Classical Decision-Making Model, and many others) with a high degree of reliability and useful implications in the field of problem solving (Alegria, 1992; Hoy & Miskel, 2005; Treffinger, 1995; Treffinger, Isaksen, & Dorval, 2000; Wallace, Adams, Maltby, & Mathfield, 1993; Wallace et al., 2004). Theorists of these models elucidate steps of how people approach and reach a solution for a particular problem. Each step or phase includes a specific cognitive process aiming at achieving a subgoal during the course of problem solving. The specific cognitive processes are regulated by metacognitive components that give order and determine which process should be emphasized in a particular phase. Next, I describe selected problem solving models and compare and contrast them as they pertain to solving real-life problems. Then, I discuss higher order and lower order cognitive processes in how they predict how people effectively solve complex real-life problems.

Several problem solving models have been proposed by scholars. These models have their bases in theories of problem solving from cognitive psychology. Although scholars have an increased consensus in general problem solving steps and phases, they do not agree on specific steps in these models (Huitt, 1992). Among the early models of problem solving is the information-processing model proposed by Newell and Simon (1972). In their model, they argued that the task's environment combined with the intelligence of the problem solver determines to a great extent the solution. Furthermore, they argued that problem solvers rely on their long-term memory to access information about the problem and use short-term memory to process information. They asserted that effective recall of information from long-term memory enables a problem solver to select the relevant information. Short-term memory holds a limited amount of information. They postulated that the problem solving processes are executed in the problem space, which contains possible and actual solutions. The problem space consists of sets of elements, including knowledge about the task, a set of operations and the problem. Simply stated, the problem solving model proposed by Newell and Simon in the information-processing theory consists of three phases including input/encoding, process/operating, and output/producing. However, how people reach their desired goals has not been made clear by this model. One of the major criticisms of this model is that reliance on memory in problem solving may not provide an effective solution, especially when the problem is novel to a problem solver. For example, memory might not be a sufficient source for solving problems if a person travels to a new country where the context is completely novel; however, other reasoning abilities may be crucial in this situation. Dealing with novelty in a situation is an important aspect of intelligence, as stated by Sternberg (1985a).

Another problem solving model proposed in conjunction with the Triarchic Theory of intelligence emphasized the role of metacognition (Sternberg, 1985a). The metacognition component includes higher-order executive processes: planning, monitoring, and decision-making in task performance. Other lower-order processes are related to knowledge and learning acquisition. Sternberg specifies mechanisms by which an individual’s performance unfolds. His model consists of six higher-order processes that govern how people solve problems: (a) identifying problems, in which the problem solver has to define and determine the goal; (b) allocating resources, in which the problem solver decides how many resources such as money, time, and effort to allocate to different steps; (c) representing and organizing information whereby the problem solver makes an effort to define the problem and determine relevant from irrelevant information; (d) formulating strategies, in which the problem solver sequences steps and actions to solve the problem; (e) monitoring problem solving strategies, in which a problem solver tracks what has been done, is aware of what is being executed, and knows what needs to be accomplished; and (f) evaluating solutions, which includes developing criteria to evaluate and discussing advantages and disadvantages of each solution. Sternberg contends that metacognition has a critical role in problem solving.

Sinnott (1989) proposes a model for solving ill-structured problems. The model includes five major processes for the solution of everyday problems. The first process in Sinnott's model is to construct the problem space. This process includes analysis of the task, recognition of relevant elements that are usually large in ill-structured problems, and examination of multiple sub-problems as they pertain to the main problem. Perhaps the complex interaction of different facts, values, and interests is what leads people to define and solve identical problems in different contexts in different ways. Further, individuals may simultaneously influence or consider cognitive and non-cognitive association in the problem space. In doing so, the metacognitive components intervene, calling for past experience and controlling intellectual performance. The second process is to choose and generate solutions. In this process, the problem solver starts defining the goal and general solutions for the selected goal. The third process is to monitor the course of problem solving. This process includes monitoring problem solving behaviors including processes, shifts, interests, and choices. The monitoring process also helps individuals keep on the path in their problem solving. The fourth process is to recall information that places an important role on the memory of individuals while working on the problem. Last, during the function of cognition, non-cognitive elements interfere with the problem solving course. This intervention includes emotional elements such as feelings and motivation that may function as catalytic sources that the problem solver depends on during the course of problem solving.

Creative Problem Solving (CPS) is another model that people use to solve complex problems. The CPS model was developed by Parnes (1953) and extended by Treffinger and his colleagues (1995, 2000). At the heart of the CPS model are two important thinking processes: divergent thinking and convergent thinking. Divergent thinking is the process of generating many ideas about a specific problem. Convergent thinking, by contrast, is decision-making about the best option. The CPS model is a multi-step model that consists of three major components and six different steps. The first component is called understanding the problem. In this phase, the problem solver aims at clarifying any ambiguity and defining the problem. This component includes three steps: (a) mess-finding, using specific tools to construct the problem space; (b) data-finding, searching and evaluating many types and sources of information; and (c) problem-finding, defining the problem that needs to be solved. The second component is called generating ideas. This component consists of one step, which is idea-finding. This phase is effective when a problem solver seeks a number of interesting ideas and alternatives and needs assistance in generating many potential solutions. The third phase is planning for action, which consists of two steps: (a) solution-finding, a process that includes decision-making about promising options and determining the strength and weaknesses for each option; and (b) acceptance-finding, specifying procedures for implementing a solution and making a feasible plan by discussing assisters and resisters for this solution (Treffinger, 1995; Treffinger et al., 2000). A metacognitive component was attached to the model recently. This metacognitive component provides guidance for problem solvers to optimize the problem solving process based on the given situation. This guidance helps problem solvers to select a particular step for a specific purpose and not to deal with the CPS processes as whole. For example, if problem solvers want to make a decision about the best solution, they can use only a specific process, solution-finding. Therefore, problem solvers do not have to apply the complete model in a sequential manner, but rather to select steps as needed for a particular problem.

Even though these models and many others offer pragmatic steps in how people solve problems in general, they encompass some common phases and have similar underlying cognitive processes. The cognitive processes as they relate to previous problem solving models are summarized in Table 2.2. Based on this table, I conclude that at least two possible phases can be depicted as common in these models. The first is the phase of determining the goals of the problem solver, and second is developing the solution for a problem. Furthermore, in conjunction with the steps of the information-processing model, a metacognitive component can be inferred. This component reflects evaluation of solutions and monitoring of problem solving execution in general. Notably, the metacognition factor is associated with at least four of the five models. Indeed, many scholars emphasize the role of metacognition in solving practical problems by providing tools for planning, monitoring, supervising, evaluating, selecting lower-order cognitive processes, and implementing solutions for complex problems (Sinnott, 1989; Sternberg, 1985a).

Table 2.2

Cognitive Processes Encompassed in Selected General Problem Solving Models

	Theorists			
Processes	Simon	Sternberg	Treffinger	Sinnott
Find a Problem			*	
Construct the Problem Space	*			*
Define a Problem	*	*	*	*
Allocate Resources		*		
Represent/Organize Information		*		
Formulate Strategy		*		
Monitor Problem Solving		*		
Evaluate Solution		*	*	
Generate Solution	*	*	*	*
Gather Information			*	
Implement Solution			*	
Non-Cognitive Elements				*
Memory	*			*

Analyses of the processes that are associated with these models reveal what Treffinger (2000) refers to as convergent and divergent processes. For example, all models include analysis of a problem as a process for determining the goal and the direction a problem solver might take. Additionally, generating definitions, solutions, and plans are other important processes in all models. These processes are divergent in nature. Along with the process of problem solving, individuals tend to use convergent or critical thinking skill processes (e.g., analyzing aspects of a problem, evaluating several definitions and solutions, evaluating viability of solutions, and so fourth) for whatever is generated by divergent thinking (e.g., providing several definitions for a problem, proposing a number of solutions, developing justifications for proposed solutions, predicting a solution's consequences, and so fourth). The relationships among these components can be portrayed as two competing processes governed by a metacognitive component. Perhaps, convergent and divergent processes are governed by the metacognitive component that allows each one to function as needed.

The Cognitive Processes Model

Higher-Order Cognitive Processes Associated with Practical Intelligence

Metacognition

Definitions of metacognition. The complex nature of real-life problems evokes metacognitive competencies. Everyday problems have a different degree of novelty and complexity for different individuals in various contexts. These problems are usually ill-structured in nature, which means that they have multiple ways of being resolved, and have several effective solutions. These types of problems require induction of deeply implicit rules, including many variables that interact in multiple ways with each other. When dealing with real-life problems, intelligent problem solvers have to implement higher-order thinking processes, including planning, monitoring, controlling, allocating, and evaluating to better understand and successfully solve these problems. Those processes are what scholars refer to as metacognitive processes.

As with any psychological construct, the definition of metacognition has not been agreed upon. Swanson (1992) defined metacognition as the knowledge of how to control one's thinking, learning activities, and attitudes. Favell (1979) defines it as the experience and knowledge we have about our own cognitive processes. Hertzog (2002) perceived metacognition as a general construct that includes knowledge about cognition, beliefs about self and cognition, and monitoring. Perfect and Schwartz (2002) concluded that metacognition is a person's ability to actively monitor and regulate cognitive processes toward the achievement of practical goals.

These definitions share two conceptions of metacognition. One conception refers to one's ability to regulate and enforce commands on lower order thinking processes and behaviors and the other is knowledge about one's own strengths and weaknesses of thinking. Thus, two critical aspects of metacognition reflect an individual's perception about self and ability to regulate thinking. The perception of self refers to self-awareness and level of confidence in one's ability. The perception of one's ability refers to the regulation of one's own thinking during problem solving, not to be hindered by the situation. I contend also that the function of metacognition is to regulate the lower cognitive processes as well as non-cognitive aspects.

Theories of metacognition. The construct of metacognition is relatively new in problem solving. Nelson and Narens (1990) proposed a theory of metacognition that includes two processes: monitoring and controlling. Metacognitive monitoring is the process that allows individuals to observe, reflect, or experience their own cognitive processes. For example, a person who is able to determine his/her lack of information about a problem is employing metacognitive monitoring. Monitoring informs people about their inner state of cognition. Controlling includes the conscious and non-conscious decisions that are made based on the output of the monitoring processes. The metacognitive component of controlling is a process that is revealed by an individual's behaviors when engaged in the task of monitoring. For example, a person who lacks information does not jump into the solution stage, but may expend some time to gather more information about the problem. Perfect and Schwartz (2002) argued that monitoring means the ability to judge accurately one's cognitive processes and consequently to control it to act.

The relationship between monitoring and controlling was elucidated by Perfect and Schwartz (2002) at two levels of cognitive processes: encoding and retrieval. Perfect and Schwartz synthesized the research findings on monitoring and controlling and concluded that time allocation on a problem is not the only factor that is associated with encoding processes. Interests seem to play a serious role in monitoring and controlling processes. For example, when an individual encounters a difficult problem, not only does the complexity of the situation influence his problem solving ability but also controlling and regulating himself is associated with performance. In addition, metacognition has a link with an individual's ability to retrieve answers for a problem from his/her memory. For example, suppose that an individual wanted to remember a name of a prime minister of a foreign country in 1926. If the individual has a good monitoring strategy and knows that such information can be retrieved from his/her memory, she may persist and try to use different strategies to access such information. Thus, the control process comes into play. Evidently, both monitoring and controlling processes are important for the perception and solution phases of problem solving.

The metacognitive component is coupled with intelligence. Hertzog (2002) argued that metacognition has appeared in the field of psychology, including theories of intelligence and problem solving. Many scholars contend (e.g., Perfect & Schwartz, 2002; Shin et al., 2003; Sinnott, 1989; Sternberg, 1985a) that the metacognitive processes are critically important in problem solving. Problem solvers who employ metacognitive skills such as planning, monitoring, self regulating, evaluating, controlling, and justifying in different situations, have a greater chance for solving a problem effectively than those who lack these skills. As evidence, many contemporary scholars integrate a metacognitive component in their problem solving models. Sinnott emphasized the role of metacognition, specifically for ill-structured problems that people encounter in daily life.

Apparently, the nature of real-life problems as a type of ill-structured problem embraces more difficulty; problem solvers may not be successful in solving a problem if they depend solely on lower order processes. Sinnott (1989) argued that the relative nature of effective solutions (every problem can be solved in different ways) associated with real-life problems entails what she refers to as metatheory thinking. This type of thinking takes into consideration generalizations in theories within and between domains of knowledge to reach effective solutions. The metatheory to types of knowledge is similar to the metacognition to lower-order thinking processes. This task requires higher-order processes similar to metacognitive skills. Sternberg (1985a) and Treffinger (2000) state clearly in their models the critical role of metacognition in problem solving. Rebok (1989) contends that everyday problem solving activities consist of a conscious predetermination of a sequence of actions that achieve goals. Rebok elaborates that a good planner is one who establishes criteria, flexibly allocates cognitive resources, reviews and evaluates previous decisions, develops alternative plans, and formulates new plans. Others refer to the metacognitive component as competencies that are important not only for solving problems, but also for regulation and awareness of cognitive activity as well as the link between them.

Empirical support. The role of metacognition in problem solving has been investigated in different contexts with different age groups. Several researchers indicated the critical role of metacognition in problem solving. In the following, I provide evidence regarding the role of metacognition from different schools of thought.

The methods of the following studies employed quantitative analyses more than qualitative (see Table 2.3). The majority of the researchers used analysis of variance ANOVA to pinpoint the effect of the metacognition on performance in solving problems. One researcher used qualitative analysis in conjunction with quantitative to show how practical intelligence unfolds. Measurements of metacognition in the following studies included different scales, questionnaires, well- and ill-structured tasks, and interviews. Students in these studies were of different ages, and some samples consisted of college students. The samples consisted of different ability groups in creativity and intelligence.

The studies took place in school and laboratory settings. The studies in general focused on the cognitive competencies in solving real-life problems.

Table 2.3

Review of the Studies of Metacognition and Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Swanson (1992)	96 fourth and fifth grade students	Problem solving tasks Metacognitive questionnaire	Correlations ANOVA MANOVA	Gifted children produce higher metacognitive scores than comparison groups
Jaušovec (1997)	26 students-teachers	EEG Well- and ill-defined problems	Multiple factors ANOVA	The preparation phase of solving ill-structured problems provoked higher mental activity than did the preparation phase of well-structured problems. That is; reading and planning require more effort for ill-structured problems

Table 2.3–*Continued*

Study	Participants	Instruments	Analyses	Conclusions
Shin et al. (2003)	112 ninth-grade students	Instructional materials including scientific method for problem solving Well- and ill-structural problems instruments Metacognition Scale Scientific Attitude Justification Skills	A Multiple Regression Model	Regulations of cognition, including planning and monitoring skills, was a strong predictor of ill-structured problem solving in unfamiliar contexts

Swanson (1992) employed the metacognitive questionnaire to assess metacognition and the general domain of problem solving (internal consistency $r = .92$). In a sample consisting of 96 children from grades four and five (age $M = 11.20$), 26 children were classified as gifted, 38 children as high-average. The selection of children was based on one section of the Wechsler Intelligence Scale for Children-Revised (WISC-R). The results showed significant differences between ability groups (gifted and high-average students), $F(2, 93) = 3.02$, $p < .05$. A Duncan Multiple Range test indicated that gifted children required significantly fewer steps to solution than high and low average IQ children. The result also indicated a significant influence of metacognitive scores, $F(2, 93) = 5.41$, $p < .01$. The effect size for the metacognitive component as indicated by eta-square is low, $\eta 2 = .10$. These findings support the hypothesis that gifted children produce higher metacognitive scores than comparison groups. Perhaps gifted students make better use of time to plan and analyze in the initial phases of problem solving than other students and consequently produce fewer but effective problem solutions.

Other evidence came from neuropsychological science, which suggested that metacognition is critical in solving real-life problems. Jaušovec (1997) investigated the differences of cognitive processes people use when they solve well- and ill-structured problems in relation to electroencephalogram (EEG) activity. In the first experiment, Jaušovec predicted that the solution of an ill-defined problem would demand greater mental activity (less alpha power) than the solution of a well-structured problem. Four different problem types were presented to 26 participants. The result of the first experiment did not show significant differences between different types of problems, $F(3, 25) = .81$. Because of this result, Jaušovec divided the problem solving strategy into subprocesses to locate the effect of problem types on different cognitive processes. In the second experiment, Jaušovec divided the problem solving strategy into subcognitive processes: (a) reading the problem, (b) information selection, (c) planning the solution, and (d) solving the problem. Results showed interesting trends. Significant main effects for ill-structured problems, $F(1,24) = 5.31$, $p < .03$, and for reading the problem and planning the solution were revealed $F(1,24) = 9.22$, $p < .006$. The effect size of the metacognitive components ($\eta^2 = .28$) exceeded the effect size for the reading the problem ($\eta^2 = .18$) component only. These results showed the important role of metacognitive skills: encoding time to understand a problem and a planning phase to reach a proper solution.

Shin et al. (2003) investigated the cognitive skills required for solving well-structured and ill-structured problems in a science context. The sample consisted of 112 ninth grade students. The dependent measures were students' performance on mixed type problems. The independent variables included inventory of metacognition skills and justification skills. Factor analysis was performed on the metacognition scale and revealed four factors accounting for 89% of the total variance. These factors were reflection, planning and monitoring, problem solving strategies, and information selection strategies. A multiple regression procedure was implemented to determine the contribution of each independent variable for the variance of different types of problems. Regulation of cognition was a significant predictor for performance on ill-structured types of problems in an unfamiliar context $\beta = .20$, $t = 2.70$, $p < .01$. These variables accounted for 47% ($p < .0001$) of the variance. This study reveals further evidence to support the idea that real-life problems are effectively solved when the metacognition component is activated. Shin et al. (2003) insisted that the role of regulation of cognition in solving ill-structured problems needs to be clarified with different degrees of problem complexity for its vitality in solving real-life problems.

In the aforementioned research findings, the metacognition component has been investigated as time allocation, self-regulation, and planning and monitoring. Perfect and Schwartz (2002) noted that the research on metacognition in the field of cognitive psychology has focused on memory and meta-memory and time allocation in particular.

These studies have several deficiencies. All the above mentioned studies have a limited number of participants, and these participants were selected from specific populations. The limitations of sample influence the generalizability of the results of these studies. In the Shin et al. (2003) study, some statistical data were misreported. Another limitation pertains to the Jaušovec (1997) study. Jaušovec used two well- and ill-structured problems. He assumed that the two types are solved by different methods. Based on this assumption, the problem solving course of well-structured problems was divided by the author into three phases (i.e., read the problem, make a solution plan, and solve the problem) and for ill-structured problems was divided into five phases (i.e., read the problem, make a solution plan, try to solve the problem, select articles that might help in solving the problem, and use certain additional information). Then, participants were asked to perform each step. If they were not guided by this framework, participants might use different problem solving steps and strategies that could influence the performance. Furthermore, researchers focused on questionnaire inventories and time allocations to measure metacognition constructs. Thus, I believe the reliability and validity of metacognition scales would be strengthened if performance items were used. Shultz and Whitney (2005) concluded that biases can occur in questionnaire inventories in two ways: (a) central tendency error that refers to situations where respondents tend to use only the middle of the scale and are reluctant to select extreme ones, and (b) severity error or leniency error that refers to situations where respondents tend to use extreme responses. In both cases, these extreme responses influence the reliability, validity, and utility of the scale scores. Therefore, metacognition has to be investigated using performance items rather than typical performance inventories. To determine appropriately if an individual, when solving everyday dilemmas, employs planning, monitoring, controlling, and judging the quality of solutions, items on a scale have to be deployed in a maximal performance form.

Perfect and Schwartz (2002) argued that much is still to be done in terms of pulling together various threads of metacognition in a unified field. Therefore, I intend in this study to further explore the role of metacognition from different perspectives, including how problem solvers plan actions to develop strategies, evaluate different alternatives, and select relevant from irrelevant information. Thus, an important goal of the current study is to investigate the role of the metacognitive components in people's performance on real-life problem solving. I predicted that metacognitive processes contribute to people's performance on real-life problem solving.

Hypothesis: Metacognitive component accounts for practical intelligence.

Domain-General and Domain-Specific Cognitive Processes

Do people use domain specific or domain general cognitive processes when solving real-life problems? Ceci (1996), from the contextualists' point of view, depicts two types of cognitive processes: domain general and domain specific. The domain general cognitive processes operate with equal efficiency across different domains of knowledge. The domain specific processes are coupled with specific domains of knowledge. The later processes become domain general with development and practice. However, Ceci did not identify specific types of cognitive processes that operate in a general domain or a specific domain. Other scholars believe that cognitive processes that people use when solving real-life problems are domain general (Shin et al., 2003; Sternberg, 1985a, 1997b; Sternberg et al., 2000; Treffinger et al., 2000).

Empirical Support

Research on the generalization of problem solving showed complex variables associated with how people transfer problem solving strategies. The trend in the following studies is that problem solving ability is domain specific. That is to say, individuals developed problem solving strategies that are domain specific. These strategies might not be transferable to other domains. In the following section, I provide support for this theory.

Both qualitative and quantitative techniques were employed in the following studies (see Table 2.4). In both studies, authors used ANOVA to test the relationship of general problem solving skills and factor influence generalizablitiy. Instruments used in the following studies included transportation problems, plan-a-day problems, computer based problems, Creative Problem Solving, and standardized tests of intelligence. Participants were different aged students and different ability groups. The studies took place in school settings and in general focused on cognitive competencies in solving real-life problems.

Table 2.4

Review of the Studies of Domain-Specific and Domain-General Problem Solving

Study	Participants	Instruments	Analyses	Conclusions
Cramond et al. (1990)	78 sixth, seventh, and eighth-grade students	Creative Problem Solving (CPS) Creative Problem Solving with transfer strategies (CPST)	ANOVA	CPST groups possess higher degree of transfer of problem solving strategies
Kanevsky (1990)	89 children ages 4 and 5	Tower of Hanoi Puzzle	Repeated measures design Qualitative analysis	High IQ and older children generalized the information gained more accurately than average and younger children

For example, Cramond, Martin, and Show (1990) conducted a study to examine whether, after training, students generalize Creative Problem Solving (CPS) to different contexts and transfer their learning. Participants were 78 gifted students from grades 6, 7, and 8. These students were identified as gifted based on a standardized achievement test (SAT) and teacher recommendations. Students were assigned randomly to three different conditions: (a) The first experiment consisted of 28 students who were taught traditional CPS, (b) the second experiment included 25 students who received CPS training for transfer (CPST), and (c) the control group did not received any training. The dependent measure consisted of three real-life problems suitable for CPS and three problems that were not. Significant differences were found between the three groups, $F(2,75) = 3.86$, $p < .05$. The Post Hoc analysis revealed that students who were taught by CPST exceeded the control group only. However, CPST practicality is not high. Perhaps, the short time span of the experiment did not contribute to the transferability.

In another study, Kanevsky (1990) explored ability-related differences in how children generalize problem solving strategies. The sample consisted of 89 children (22 high IQ, and 20 average IQ children ages 4 and 5; 25 high IQ, and 22 average IQ ages 7 and 8). The ability measurements were the Stanford-Binet and the Slossen Intelligence tests. Both quantitative and qualitative methods were used to analyze the data. The dependent measures were two computer-based well-defined problems modified from the Tower of Hanoi Puzzle—three rings of different sizes arranged on top of each other in one column, from the largest to the smallest, and the task is to remove the three rings with minimal moves from that column to one of the two other columns, ending with the same size arrangement of the rings. The finding of the study showed significant interaction between ability and task, $F(1,82) = 12.46$, $p < .01$, which indicates that the average ability children showed less accuracy and were in need of help in comparison to high IQ children. The author concluded that generalization of learning from task to task depended on ability, age, or both. The results of this study should be taken with caution because the tasks did not reflect a complex real-life problem.

The methods of the previous studies raised several concerns. First, even though Kanevsky's (1990) results aligned with the assumption that age and ability contribute to performance in solving problems, the author did not discuss the level of the difficulty and complexity in problems used. I found the level of complexity to be an important factor in problem solving performance. Second, Cramond et al. (1990) did not take into account the quality of student solutions. Third, very important statistics were absent from Cramond et al. study.

The preceding studies showed that generalization of problem solving strategies depends on several factors, including an individual's ability, age, the type of tasks, and training. However, the investigation of whether cognitive processes are domain specific or domain general is beyond the scope of this study. The focus of this study, however, is on general cognitive processes, regardless of their origins, that account by empirical evidence for how people solve their real-life problems. The author of this study identified several cognitive processes that explained how people solve their real-life problems. In the following, I discuss important cognitive processes and provide empirical support for their association with practical intelligence.

Lower-Order Cognitive Processes Associated with Practical Intelligence

Many scholars have articulated that in addition to the metacognitive skills, lower-order cognitive processes are prerequisite skills for solving complex real-life problems (Berg et al., 1998; Shin et al., 2003; Sternberg, 1985a; Sternberg et al., 2000; Wagner & Sternberg, 1985). Scholars emphasized the role of specific cognitive processes for solving everyday problems: problem definition, flexibility of thinking, and selection of solutions. These processes theoretically exemplify two types of cognitive functioning: convergent and divergent. As mentioned earlier, convergent and divergent processes often are used at different stages during the problem solving course. In my review of the literature, I found the association of the above mentioned cognitive processes is explicitly pronounced in how people solve their real-life problems. In the following, I elucidate on these processes separately.

Defining a Problem

Defining a problem is a process in which a problem solver has to decide and specify the goal that will focus his/her direction and effort (Treffinger et al., 2000). Berg et al. (1998) clarified that problem definitions reflect on aspects of self and the context in which a problem is activated, in that a problem definition reflects both internal and external conjectures of an individual. Sternberg et al. (2000) noted that a problem definition is a complex psychological reality that includes an individual's expectations and influences problem solving strategies. Therefore, definitions vary vigorously according to many internal and external constraints.

Berg et al. (1998) introduced the concept of problem interpretations as a means of how people define problems. When people define problems, they rely on aspects of their internal and external worlds. In doing so, they weight several aspects of self and a context to interpret the problem situation. Furthermore, an interesting link between problem definition and problem solving strategies has been constructed by Berg. Problem definition is probably the most complex task that occurs where individuals rely on their own characteristics, such as interest, experience, ability, gender, and age as well as the contextual features, including familiarity and complexity of the problem. I believe that how people define a problem is a subjective reality that originates within an individual at the time when a problem is triggered. Yet, limited researchers have focused on how people define a problem.

Empirical support. Problem definition seems to be a critical determinant of the problem solving strategy proposed by individuals (Berg, 1989; Berg et al., 1998). Defining a problem directs and shapes the problem solving strategy that people endorse. In the following, I provide evidence that defining a problem is among the most important factors associated with practical intelligence.

The method of the following studies employed qualitative and quantitative analyses (see Table 2.5). Authors used open-ended problems to measure how people define a problem. Participants in these studies were of different ages including preadolescents, college students, middle aged adults, and older adults. The authors in general focused on how individuals define problems. Berg et al. (1998) included a huge sample size and consider one of the important studies in the role of problem definition in solving problems. Other instruments were used in these studies, including questionnaires and inventories.

Table 2.5

Review of the Studies of Defining a Problem Process and Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Berg et al. (1998)	480 participants 107 preadolescents 124 undergraduates 118 middle-aged adults 131 older adults.	An interview Open-ended assessment of: Problem definitions, strategies.	Chi-square Logit model	Definition of a real-life problem is influenced by age of participants Selecting a solution strategy is influenced by how individuals define problems
Klaczynski (1992)	98 adolescents	Developmental goal orientation Interpretation styles of practical problem solving strategies	ANOVA MANOVA	Problem solving is influenced by the underlying representation that an individual develops about the problem

For example, Berg et al. (1998) examined individuals' problem definitions as guided by problem solving goals. They predicted that a problem definition would be a more important predictor of selection of strategy than would be the context in which the problem was elicited. In a sample consisting of 480 individuals from different age groups (107 preadolescents, average age $M = 10.09$; 124 college students, $M = 21.91$; middle age adults, $M = 48.17$; & 131 older adults; $M = 73.7$), the dependent measures included open-ended problems where participants were asked to describe unconstrained everyday problems they had experienced. Then they were asked to describe constrained problems that are related to particular domains: family, friends, health, school, work, or leisure. Participants were asked then about the problem solving strategies they used to resolve these problems. The researchers assessed how participants defined the problems by coding and examining the problems' descriptions of whether they reflected competence and/or interpersonal concerns or both. The inter-rater reliability ranged from .79 to .83.

The results showed a significant association between age and goal for both unconstrained-domain problems [χ^2 (9, N = 480) = 25.0, $p < .001$] and for the constrained-domain problems [χ^2 (9, N = 480) = 38.7, $p < .001$]. For the unconstrained problems, preadolescents mentioned problems that focused more on competence goals. College students and middle aged adults focused predominately on interpersonal goals, and older adults' goals were evenly split among the group categories (neither, competence, interpersonal, or both). For the constrained domain problems, the pattern of the results was slightly different. Interpersonal goals were salient for preadolescents, and competence goals were prominent for college students. Middle aged and older adults mentioned similar concerns for this type of problem. The results indicated that when individuals were unconstrained to the domain, their definitions often reflected the larger and broader contexts in which they find themselves in everyday life.

Furthermore, age and goal effects were investigated as they relate to problem solving strategies in the unconstrained domain problems. In other words, the authors answered the question: was there a relationship between problem solvers' ages and problem definitions on one hand and solution strategies on the other hand? A logistic model was implemented for predicting strategy (cognitive regulation, self-action, regulation or inclusion of others) with age (preadolescent, college, middle, older), and goal (interpersonal, competence, both, neither) as predictor variables. The logistic model for predicting strategy from age and goal produced a mode with first-order effect of the dependent variable, strategy, and two way association: Strategy x Age group and Strategy x Goal. Most individuals reported self-action (42%), followed by regulation or inclusion of others (36%), and cognitive regulation (21%). The Strategy x Goal association indicated that strategies varied significantly according to the nature of individuals' goals. When individuals' goals included only interpersonal concerns or when both competence and interpersonal concerns were reported, individuals were less likely to report self-action and more likely to report regulations or inclusion of others. When individuals' goals included competence concerns, they were less likely to report strategies for regulating or including others. When individuals' goals involved neither competence nor interpersonal concerns, individuals were most likely to report self-action.

In another study, Klaczynski (1992) investigated the relationship among education trajectory, developmental goal orientation, and practical intelligence. The participants consisted of 98 high school students (42 sophomores, 56 seniors). Three instruments were administered, Developmental Goal Orientation, Interpretation Styles of Practical Problems, and Practical Problem Solving Strategies. The results showed that vocational students were concerned primarily with goals involving the acquisition of adult status, such as marriage, steady employment, and independence. College-preparatory students reported more achievement-oriented goals, such as doing well in school, gaining admission to quality colleges, and scoring well on entrance exams, and they placed more importance on these goals. Furthermore, the results showed that problem solving ability was influenced by the underlying representations and perception of an individual. That was evidenced by the relationship between a student's style of interpreting practical problems and the solutions s/he subsequently proposed.

The methods of the previous studies have several strengths and limitations. Berg et al. (1998), in particular, provided an important qualitative insight about the role of problem definition in how people solve their life problems. That is, people tend to be influenced by the problem definition they develop when they select a solution strategy. Additionally, researchers showed that different age groups perceived a problem in different ways. In both studies, the researchers employed open-ended questions to pinpoint how individuals define their real-life problems. Since defining a problem is a subjective process, no quantitative method of scoring was employed in measuring how people define problems. I believe that problem definition can be quantified based on the degree of its relevance to the problem. On the other hand, these researchers did not take into account many factors, such as socioeconomics, experience, and academic intelligence. These factors may be associated with the variables included in these studies.

In conclusion, problem definition is a critical predictor of strategies for solving real-life problems. Chi and Ceci (1987) suggested that problem definition and problem solving are influenced by the mental context people bring to the problem. I noticed in the previous studies that individuals reported problem solving strategies that to a large extent fit their problem definitions in different contexts. Berg et al. (1998) were among the early researchers to reveal the relationship between problem definition and problem solving. Sternberg et al. (2000) stated that a need existed to search the role of problem definition as developmental variation in everyday problem solving. Moreover, I believe problem definition as a process associated with practical intelligence has to be explored in relation to different intellectual and contextual features. The following hypothesis is examined in this study:

Hypothesis: Properties of problem definition explain aspects of practical intelligence.

Flexibility of Thinking

Flexibility of thinking is another critical competence in dealing with real-life problems. Consider how students can comprehend a concept with a teacher who fails to integrate diverse instructional strategies in a lesson. Spivack and Shure (1982) conceived flexibility as a generation of a number of safe and effective solutions for a problem, in that flexibility indicates adaptability and increased potential to deal with problems. This perception indicates both the quantity and the quality of flexible thinking. Torrance's

(1966) perception of flexibility is to generate a large number of diverse ideas (cited in Colangelo & Davis, 1997).

Flexibility is a process at the heart of divergent thinking, as mentioned earlier. Flexibility in problem solving is perceived as an important competence in generating ideas, diverse strategies, multiple causes and effects, a variety of solutions, and consequences for a particular problem. These aspects are important skills for solving real-life problems in particular. For example, a great number of problem solving theorists (see Table 2.2) included the generating-solutions phase for solving everyday problems (Berg, 1989; Crawford & Channon, 2002; Sinnott, 1989; Treffinger et al., 2000).

Empirical support. Flexibility of thinking is an important factor in solving real-life problems. The assumption underlying the contribution of the flexibility of thinking to practical intelligence is that the more various strategies an individual provides, the most likely an effective solution may emerge. If a person provides a limited number of strategies for a problem, the chance of finding an effective strategy is small.

The method of both studies mentioned below employed quantitative analyses (see Table 2.6). These studies investigate practical intelligence in relation to flexibility and fluency of thinking. Measurements of practical intelligence included different scenarios, neuropsychological batteries, and open-ended questions. Participants in these studies were from different school levels, adults, and older people. Most importantly, Crawford and Channon (2002) provided important criteria to evaluate solutions of everyday problems with a detailed description for implementing these criteria.

Table 2.6

Review of the Studies of Flexibility of Thinking and Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Patrick & Strough (2004)	95 adults	Relocation intentions Everyday problem vignettes	*t*-test Logistic regression Chi-square	Flexibility of thinking predict performance on everyday problems
Crawford & Channon (2002)	30 older adults	Real-life awkward situations Neuropsychological battery	*t*-test ANOVA	Older adults produce fewer solutions, but their solutions are higher in quality. The author concluded that greater life experience is the higher contributing factor to performance on real-life problem solving

Patrick and Strough (2004) examined the predictive contributions of flexibility and experience in relation to relocation intentions—consider moving in later life. The sample consisted of 95 older-adults (mean age = 72.1). The instruments included in everyday problem vignettes were used to examine problem solving strategies. Strategies were assessed through an open-ended question "what should the person do?" This question aims to examine aspects of strategic processing: strategy type, total number and unique number of strategies. The researchers used the hierarchal logistic regression model to address whether strategic flexibility was used according to experience. The researchers compared the total and unique strategies generated by those with experience and those without experience. The results showed that adults with experience offered significantly more strategies ($M = 5.06$) than those without experience ($M = 3.80$), $t(93) = 2.35$, $p < .05$. No differences between the two groups emerged for the number of unique strategies, $t\ (93) = 1.19$. Approximately 15% of adults with experience suggested at least one cognitive strategy, whereas none of these strategies were used by those without experience, $\chi 2\ (1, 95) = 6.63$, $p < .01$. The total number of strategies, experience and the interaction of the model at the second step was significant, $\chi 2\ (3, 93) = 10.73$, $p < .01$. The seven predictor-model including age, gender, health change, financial difficulty, total strategies, previous experience, and the total strategies x experience reached a significant level, $\chi 2\ (7, 93) = 6.63$, $p < .02$. Adults who offered more total strategies and individuals with previous experience were significantly more likely to effectively solve everyday problems. According to Patrick and Strough, flexibility accounts for 25-35% of the total variance in solving real-life problems.

Crawford and Channon (2002) investigated the role of fluency of thinking in a sample consisting of 60 individuals from two age groups. The first group consisted of 30 individuals between the ages of 60 and 80 (M = 68.27), and the second group included 30 participants between the ages of 19 and 37 (M = 25.27). The age difference was relatively large. The dependent measure included eight different scenarios involving everyday awkward situations. Each scenario was designed to measure an individual's ability to generate solutions and make judgments about the solutions. Results showed that older people produce fewer solutions than younger people (low in fluency), $t(58) = 4.05$, $p < .0001$. However, older people solutions reflect a higher quality for two different criteria: (a) average of problem appreciation, $t(58) = 2.48$, $p < .05$, $d = .64$; and (b) social appropriateness, $t(58) = 3.45$, $p < .01$, $d = .89$. The quality index was calculated based on the rating of quality divided by the total number of solutions given. On the problem solving task, older adults provided fewer strategies but more quality solutions. Perhaps older adults were less competent in fluency, yet they were highly flexible in producing quality solutions. That quality might be a function of flexibility of thinking.

In the methods of the above mentioned research, flexibility was scored slightly different. Patrick and Strough (2004) examined three aspects of flexibility: strategy type, total number of strategies, and unique number of strategies. In Crawford and Channon's (2002) study, the number of strategies was an index of fluency, whereas flexibility of thinking was calculated based on the diversity of production and quality of solutions. Both flexibility and fluency of thinking are divergent competencies that people use in solving ill-structured problems; however, flexibility of thinking is what accounted for how people solved their real-life problems in the previous studies.

Several shortcomings are embedded in the previous studies' methods. First, the sample in the Patrick and Strough (2004) study did not show a high variability with regards to participants' age. Participants were older people. Second, in Crawford and Channon (2002) study, one scoring method was based on time of cognitive processing. A limited time for achieving a particular task does not necessarily enable a person to provide an effective solution. Third, the problem complexity in their studies had not been taken into consideration in the analyses.

Flexibility of thinking is not only related to an individual's ability of production of varieties of alternatives in the solution phase, but also is related to different phases during the problem solving. I think that flexibility of thinking functions in different phases, including constructing the problem space, defining the problem, searching for methods, and generating solutions and criteria for evaluation. Thus, the role of flexibility of thinking has to be further examined as it relates to different problem phases. In this study, I predict that flexibility of thinking is related to people's performance on real-life problem solving.

Hypothesis: Flexibility of thinking explains aspects of practical intelligence.

Selecting a Solution Strategy

Everyday problems impose different contextual and individual demands on problem solvers. These demands are perceived diversely by individuals in different life epochs and contexts. Sternberg et al. (2000) argued that the fundamental hypothesis in how people select their strategy to solve a problem is that greater experience with everyday problems leads to better problem solving. In addition, contextual and longevity factors are associated with individuals' selection of problem solving strategies.

Problem solving strategies that people use to deal with their real-life problems are diverse. For example, Sternberg et al. (2000) stated two types: the primary control strategies, that reflect independence and problem-focused action, are more effective in some situations than the secondary control strategies, that include reliance on others and emotion-focused actions. The literature I reviewed showed that people employed many problem solving strategies to a similar problem. Hereafter, I provided and synthesized empirical findings about problem solving strategies as they emerged from the literature and who I made use of them in this current study.

Empirical support. Selecting a solution strategy was found to be differentially developed across varied ages. That is to say, different age groups tend to focus on particular solution strategies. Furthermore, selecting a solution strategy was context dependent. In this section, I provide evidence that selecting a solution strategy is perceived as differentially effective by different age groups.

In the following, I present four studies on selecting solution strategies (see Table 2.7). The methods of the following studies employed quantitative analyses more than qualitative. The statistical procedure was multi factor ANOVA. Instruments of practical intelligence in the following studies included different scales, questionnaires, hypothetical ill-structured problems, and the Wechsler Adult Intelligence Scale (WAIS). Participants in these studies were from students of different ages and some samples contained adults. In two studies, the sample sizes were high. The studies in general focused on the problem solving strategies perceived as effective by different age groups.

Table 2.7

Review of the Studies of Selecting Solution Strategies and Practical Intelligence

Study	Participant	Instrument	Analysis	Conclusions
Blanchard-Fields et al. (1997)	282 participants	Everyday Problem Solving Inventory Attribution and appraisal ratings of everyday problems Familiarity ratings	Multiple factors ANOVA	Different age groups perceived different strategies as more effective than others in various domains
Berg (1989)	217 fifth, eighth, and eleventh-grades students	Practical intellectual Assessment Questionnaire Everyday Problem Questionnaire	Multiple factors ANOVA	Different solution strategies were seen by different age groups as differentially effective in solving real-life problems

Table 2.7—*Continued*

Study	Participant	Instrument	Analysis	Conclusions
Klaczynski (1994)	76 medical and non-medical students	Developmental Task Questionnaire Everyday Problem Solving Instrument	Multiple factors ANOVA	Aspects of practical intelligence oriented toward tasks individuals want to achieve

Balnchard-Fields et al. (1997) used the Everyday Problem Solving Inventory (EPSI) to examine qualitative age differences in everyday problem solving in interpersonal and social situations as well as in more instrumental (e.g., in supermarket) situations. The EPSI included four types of strategies drawn from the work on stress and coping:

1. Problem-focus strategy to deal directly with a problem that involves self-initiated overt behaviors.
2. Cognitive-analysis that refers to cognitive efforts to manage ones' subjective appraisal of a situation, to understand it better, to solve the problem through logical analysis, or to reinterpret the situation from a different point of view.
3. Passive-dependent strategy that includes an attempt to withdraw from a situation, the absence of self-initiated behavior to alter a situation, or actions that involve dependence on another person to solve the problem, and avoidant denial strategies (i.e., attempts to control the meaning of a situation through cognitive avoidance, denial of the situation or of one's personal responsibility in it, selective attention to things other than the situation itself.
4. Self-regulation strategy that includes attempts to manage one's affective reaction to a situation through the suppression of one's emotions.

The results showed that participants indicated multiple category strategies for both constrained and unconstrained domains to solve everyday problems. For example, 91% of the participants were reported as having at least one strategy. For the unconstrained domain, 31% of strategies were classified into more than one category (27% into two categories, 3% into three categories, 0.1% into four categories). Of the constrained domain problems, 20% of the strategies were classified into more than one category (18% into two categories, and 2% into three categories).

Berg (1989) examined knowledge of problem solving strategies that children and adolescents perceived as effective in dealing with everyday problems. Specifically, she explored whether a certain strategy was perceived as differentially effective by different age groups for approaching everyday problems in school settings as compared with outside the school. The participants in this study consisted of 217, fifth (n_1 = 87, mean age = 11 year 5 months), eighth (n_2 = 64, mean age = 14 y 1 m), and eleventh grade students (n_3 = 66, *M* = 17 y 4 m). The everyday Problem Questionnaire (EPQ) was administered. The EPQ consisted of twenty everyday problems accompanied by six different problem solving strategies: (a) plan to take action, (b) seek more information, (c) change perception of the problem, (d) adapt to the problem, (e) shape environment, and (f) select another environment. These six strategies were chosen from the work on contextual theories of intellectual development. These strategies involve behaviors and actions from problem solvers. Participants were asked to rate six alternative strategies on a 7-point scale. The results showed that particular strategies were perceived significantly effective, $F(4, 965) = 261.09$, $p < .01$. Adapting to a problem is the most effective solution and changing the environment is the least. The selection of strategies was dependent on the context and on the problem. The effect size is high, as indicated by $\eta^2 = .52$. The results showed strong evidence that people tend to perceive different problem solving strategies as differentially effective for different contexts.

In another study, Klaczynski (1994) examined the solution participants gave for everyday problems in relation to the primary developmental tasks confronting them. The study took place in a university medical school. Participants were 23 first-year (mean age = 23.8) and 20 fourth-year (mean age = 30.2) medical students. A comparison group consisted of 16 first-year (mean age = 24.4), and 17 fourth-year (mean age = 29.4) graduate students from a non-medical department within the same university. The Everyday Problem Solving Inventory (EPSI) was administered, aimed at assessing to what extent the developmental tasks students faced influenced the types of strategies they used to solve everyday problems. Six problem situations were presented to the participants, followed by eight solution strategies where participants had to indicate the importance of each strategy to the problem. Three strategies were associated with getting by (internal consistency .88), three strategies were related to the adjustment and preparation (internal consistency .85), and two strategies were associated with graduate students' tasks (internal consistency .69). These strategies were domain specific. The results from EPSI supported the prediction that students would rate as most important those strategies consistent with the developmental tasks confronting them. For example, first year medical students rated getting by strategies as more important than both first-year graduate students and fourth year medical students. Fourth-year medical students rated adjustment and preparation strategies as more important than fourth year graduate students and first year medical students. A 2 (school type) x 2 (year in school) x 3 (solution strategy) multivariate analysis of variance, with type of solution as the within group variable, was conducted with participants; average rating for type of strategy as dependent variables. Significant School x Year x Strategy interaction, $F(2, 66) = 11.81$, $p < .00$, with a moderate effect size, $\eta^2 = .26$; significant School x Strategy, $F(2, 66) = 7.19$, $p < .001$, with a low effect size, $\eta^2 = .18$, and significant Year x Strategy interactions, $F(2, 66) = 24.70$, $p < .001$, with high effect size, $\eta^2 = .43$. The results showed that context and age have more influence on problem solving strategies than the context alone. First-year medical students rated getting by strategies as significantly more important for solving problems than did fourth-year medical students, $F(1, 71) = 41.51$, $p < .001$, with moderate effect size, $\eta^2 = .37$. The following analyses indicated that first-year medical students rated getting by strategies as significantly less important than fourth-year medical students, $F(1, 71) = 49.25$, $p < .001$, with high effect size, $\eta^2 = .41$. Individuals not only had changed the solution they used for everyday problems as they progressed from one task to the next, but also as they encountered new demands and conflicting expectations. They changed consequently the way they interpreted and explained events within these contexts. These results provide evidence that people vary their problem solving strategies as a function of differential problems, contexts, experiences, and ages.

The findings of the preceding studies showed extensive details about problem solving strategies that were perceived as differentially effective for different problems, contexts, and life spans. However, since several strategies were perceived as effective for one problem in different contexts, quantifying the effectiveness of these strategies seems to be irrational and does not have convincing justifications. That is, the contextual demands compelled people to consider many important subjective situational factors as they related to problems. These factors by virtue differ from context to context, from time to time, and from person to person. If a quantifying has to be made for effective strategies, a problem and all the external factors have to be held constant.

In the previous studies, problem solving strategies were presented to participants by inventories, asking them to rate how likely they were to use problem solving strategies in different situations. These strategies, in general, consisted of individuals' perception of a problem on the one hand and individuals' actions toward a problem on the other hand. Perhaps, individuals with presubscribed strategies may not be able to propose creative solution for open-ended problems. Thus, integrating both open-ended and closed-ended items may explain how individuals solve problems.

The methods of the previous studies' consisted of some deficiencies. In the Blanchard-Fields et al. (1997) study, strategies were classified narrowly in four categories and this might affect the results. Broader classification might provide more clarity to the results and illustrate to the discussion. The sample size, in Klaczynski's (1994) study, was limited and from a specific populations.

Finally, people, as they age, tend to interpret problems in different ways and use different problem solving strategies. In Table 2.8, I summarized problem solving strategies that people used as emerged from the literature. I attempted to use these strategies as a theoretical framework to build upon for the current study. Even though quantifying the effectiveness of problem solving strategies may be possible if other variables hold constant, the use of the strategies in this research is to pinpoint how experts' ratings of these strategies relate to participants' performances on real-life problem solving. Successful problem solving involves the proper fit of strategies to the specific demands of a problem on the one hand and personal interest on the other hand in response to changes in situational factors (Berg, 1989; Berg et al., 1998; Ceci, 1996; Sternberg et al., 2000). Ability to select solution strategies involving evaluation of several strategies is associated with performance on real-life problem solving. I predict that people who select effective strategies perform better on real-life problem solving that those who are not.

Hypothesis: Selecting a solution strategy predicts performance on practical intelligence.

Table 2.8

Summary of Strategies People Used to Solve Real-Life Problems

Category	Strategy
Problem-Focus Strategy	Plan to take an action
	Seek more information
	Adapt to the problem
	Shape or change environment
	Select another environment
Cognitive-Analysis	Change perception/reinterpret the problem
	Manage subjective appraisal of a situation to understand
	Use logical approach
	Deny the existence of the problem
Passive-Dependent Strategy	Withdraw from a situation
	Absence of self-initiated behavior
	Actions that involve dependence on others
	Avoidant strategies
Self-Regulation Strategy	Manage one's affective reaction

The Types of Knowledge Model

Knowledge is a primary condition for solving problems. Newell and Simon (1972) emphasized the role of content knowledge in solving problems as a prerequisite condition in constructing the problem space. Shin et al. (2003) emphasized that a well-developed domain of knowledge is a requirement for solving both well-and ill-structured problems. They argued that when solvers do not possess an integrated domain of knowledge, they use weaker strategies in searching for a solution path.

Knowledge as a term refers to all levels of information including facts, ideas, concepts, principles, generalizations, theories, and meta-theories. These levels of information vary between domains, problems, and individuals. However, what is the contribution of different types of knowledge to the people's performance on real-life problem solving? In my opinion, two important aspects of knowledge seem to be related when people deal with their real-life problems: perception and class or type of knowledge. In the following section, I discuss the two major aspects of knowledge with the focus on class of knowledge as a main model to be explored in the current study of problem solving and practical intelligence.

Perception of Knowledge

Perception of knowledge (e.g., theories of learning) is a subjective reality. Scientists explain truths or realities through lenses of theories. Theories are well substantiated explanations of the world's phenomena. Even though truth may exist in the world, perception of the truth through lenses of principles and theories is subjective reality that is proposed by scientists. Many theories survive for a while and then collapse (e.g., Galton's theory of intelligence). Similarly, people in their daily life make assumptions and develop beliefs about certain issues and problems. These assumptions and beliefs might not be true; however, they may influence how people behave in real-life situations. An individual perhaps develops a knowledge system over time with experience. This system certainly influences behaviors consciously or unconsciously. The rule of these beliefs and assumptions needs greater exploration by researchers.

Epistemic beliefs are the assumptions that an individual makes about the degree of certainty in knowledge that encompasses the ill-structured problems. Schraw, Dunkle, and Bendixen (1995) argued that people's epistemic belief about knowledge is a critical component for solving real-life problems that are ill-structured in nature. For example, the role of the government in public life is among the controversial topics that are influenced by two conflicting values embedded in conservative and liberal theories. Yet, an optimal solution for the government's disfunctionality in public life is still a dilemma for philosophers. Scholars claim that epistemic assumptions differ between people and consequently people reach different solutions for the same problem (Schraw et al., 1995). In contrast, well-structured problems can be solved without making epistemic assumptions, because they require certain rules that lead to absolute solutions. For example, determining the speed of a computer processor is regulated by precise laws of science and is not subject to a personal belief. The relative reality of knowledge is an important concept in how laypersons or even professionals perceive, interpret, and solve problems. Schraw et al. tested the role of epistemic beliefs empirically and found that epistemic beliefs about knowledge explain significant variations in solving ill-structured problems.

Types of Knowledge

Class of knowledge is another critical element for solving ill-structured problems. A knowledge domain may consist of a variety of knowledge types, including declarative knowledge, structural knowledge, and tacit knowledge. Declarative knowledge pertains to facts (e.g., who invented the transistor?), concepts (e.g., energy), generalizations (e.g., Newton's law of motion). Structural knowledge refers to how a domain of knowledge is organized (e.g., the relation between different concepts, generalizations, and theories). Declarative knowledge provides the conceptual basis and necessary condition for structural knowledge (Davis & Curtis, 2003). Tacit knowledge is defined as knowledge that is not explicitly taught, yet is critical for performance on real-life problem solving (Sternberg et al., 2000). Tacit knowledge is implicit knowledge within a particular domain and often is not verbalized.

In my review of literature, I found structural and tacit knowledge are well studied as critical predictors of how people solve problems. Thusly, what is the role of structural and tacit knowledge in people's performance on real-life problem solving? In the following section, I discuss each type of knowledge and provide empirical research support for knowledge contribution in solving real-life problems.

Structural Knowledge

Researchers in cognitive psychology suggest that the way a domain of knowledge is structured accounts for superior problem solving. Day et al. (2001) believe that as individuals constantly develop their own knowledge in a particular domain, their structural knowledge (in their minds) resembles the representation of the domain (theories). Therefore, expert scientists tend to solve problems more effectively than novices because they launch from principles and theories. Diekhoff (1983) defines structural knowledge as "the knowledge of how concepts within a domain are interrelated." (cited in Jonassen et al., 1993, p. 4). Davis et al. (2003) defined structural knowledge as a unique way in which an individual organized and interrelated concepts, ideas and rules within a domain" (p.192). Scholars argue that to know how things work you must know why (Chi & Ceci, 1987; Jonassen et al., 1993). The *why*-knowledge provides a conceptual basis for structural knowledge. Procedural knowledge allows individuals to solve problems, form plans, and make an argument that requires the understanding of how concepts, ideas, and facts are interrelated or connected. That is structural knowledge.

Several theories provide conceptual foundations for the concept of structural knowledge. For instance, the schema theorists propose that objects, events, and ideas are stored in one's mind as schemas. The relationship between schemas is what gives a particular event, idea, or concept a meaning. For example, people have schemas about the computer that consist of slots including the screen, keyboard, CPU, and other related components. People possess unique schemes about different domains, including concepts and phenomena. They tend to develop specific schemas depending on their experience, knowledge, and abilities. Schemas vary in their complexity. The relationship between different schemas and the formation of complex schemas requires the construction of structural knowledge. For example, when people learn new knowledge, their cognitive structures change as a result of making new meanings and connections. Others perceive structural knowledge as a cognitive structure (see Nagy, 1984; Preece, 1976; Shavelson, 1972). Structural knowledge as a cognitive structure refers to how knowledge is interconnected within and across domains in one's mind. Others perceive this type of knowledge as conceptual knowledge that integrates declarative knowledge in a particular domain (Tennyson & Cocciarella, 1986). Scholars posit that meaning does not exist without forms of structure or organization of knowledge in the mind. Without such structure or organization, abstract knowledge may be impossible (cited in Jonassen et al., 1993).

Empirical support. Structural knowledge in a domain is an important factor for solving problems in that domain. This type of knowledge was found to be an important predictor for solving real-life problems. In the following, I provide evidence that structural knowledge accounts for practical intelligence.

The method of the following studies employed both quantitative and qualitative analyses (see Table 2.9). The purpose of these studies was to investigate the role of structural knowledge in problem solving. Instruments to measure structural knowledge were based on open-ended and closed-ended tasks and standardized tests. Participants, in these studies, were students of varied ages and college students. In the following part, I described the studies in detail.

Table 2.9

Review of the Studies of Structural Knowledge and Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Shin et al. (2003)	112 ninth-grade students	Instructional materials including scientific method for problem solving Well- and ill-structural problems measures Domain knowledge inventory Metacognition scale Scientific attitude Justification skills	Multiple regression model	Structural knowledge is a significant predictor of performance on ill-structured problems

Table 2.9–*Continued*

Study	Participants	Instruments	Analyses	Conclusions
Day et al. (2001)	89 right-handed male participants	Raven's Advanced Progressive Matrices Pathfinder computer-program	Correlations *t*-test Multiple regression	Experts' knowledge of dinosaurs is more structured and they produce more implicit information than novice
Gobbo and Chi (1986)	14 male children age seven	20 dinosaur pictures	Descriptive analysis Qualitative coding ANOVA	Experts' knowledge of dinosaurs is more structured than novices. This knowledge allow expert children to use this knowledge in a more effective way in solving dinosaurs problems

For example, Shin et al. (2003) investigated the role of structural knowledge in solving well-structured and ill-structured problems in science. The dependent measures were students' performance on three types of problems: a well-structured problem, an ill-structured problem in a familiar context, and an ill-structured problem in an unfamiliar context. The independent variables consisted of domain of knowledge, including declarative and structural types of knowledge. A multiple regression procedure was implemented to determine the contribution of type of knowledge to performance on solving problems. Results showed that domain of knowledge, including both declarative and structural knowledge, was a significant predictor for performance on a well-structured type of problem, $\beta = .38$, $t = 5.04$, $p < .0001$. The results also showed structural knowledge was a significant predictor of performance when solving ill-structured problems in a familiar context, $\beta = 2.87$, $t = 2.43$, $p < .05$, and in an unfamiliar context, $\beta = .48$, $t = 6.57$, $p < .0001$. The authors argued that well-structured problems require well developed knowledge of content related to the problems, regardless of the context.

Day et al. (2001) predicted that trainees whose knowledge structures were more similar to an expert structure would have high levels of learning skills. In other words, there would be a positive correlation between knowledge structure accuracy and skills acquisition. Further, trainees whose knowledge structures were more similar to an expert structure would score higher on a test of retention than trainees whose structures were less similar to an expert. That is, there would be a positive correlation between accuracy of structural knowledge and skill of retention. In support of their predictions, trainees whose knowledge structure was more similar to an expert's referent structure performed substantially better than those who were not similar. Correlation between knowledge structure and learning the skills ranged from $r = .43$ to $.45$, $p < .001$, and the effect size, as calculated by the correlation coefficient of determination, is low ($r^2 = .19$). Consistent with the prediction, the *"g"* factor was correlated significantly with the accuracy of a trainee's knowledge structure ($r = .45$, $p < .001$). Performance on structural knowledge was correlated with skill-based performance and school retention. The findings of this study support the notion of structural knowledge as a facilitator of learning and problem solving. Day et al. concluded that current thinking in cognitive science suggests that the amount of knowledge stored in memory and the organization of knowledge are of equal importance.

Gobbo and Chi (1986) examined how expert children use their knowledge in a more efficient way than novice children as a function of how their knowledge is structured. The researchers predicted that the structural knowledge of experts is more cohesive and integrated than that of novices and the experts ought to be able to use their knowledge structure in ways novices cannot. The researchers presented concepts of dinosaurs to determine how experts and novices learned new concepts. Participants in this study consisted of 14 male children seven years of age. A pre test was administered to determine subjects' degree of expertise with respect to knowledge. Based on the pretest scores, five participants were assigned to the experts group and five to the novices group. Four students were eliminated form the study because they scored between the cut point scores. Two tasks were administered; a production task and a sorting task. The production tasks provided more information about the underlying structure of knowledge.

The children's production task was scored by two independent judges; the interrater reliability was between 92% and 98%. The qualitative and quantitative results of this study were divided into five categories.

1. Type of Information. Experts and novices produced about the same total amount of explicit information. This is not surprising because explicit information was available for both groups. By contrast, the experts produced a significantly greater amount of implicit information than novices. A proposition is defined as a unit of information about a feature of dinosaurs. Expert children, upon seeing pictures of dinosaurs, were able to activate a representation of dinosaurs and produce implicit information about them from their knowledge. On the other hand, novices produced fewer statements of knowledge about dinosaurs' implicit nature.
2. Syntactic Connectives between Propositions. Sixty-nine percent of experts' knowledge was connected syntactically but only 49% of novices' predictions were connected in this way.
3. Thematic Content. Experts showed integrated domain of knowledge. They changed topics of discussion with much greater frequency (.88) than novices (.29) and the difference was significant ($F = 10.79$, $p < .01$).
4. Semantic comparison. Expert Children used their knowledge more effectively than the novices. Experts were able to use their knowledge of dinosaurs in an analytical way to compare dinosaurs either directly or via specific features. However, the inferential statistics did not show a significant result because of

a small sample size ($F = 13.18$, $p < .067$).

5. Judgments about Dinosaurs' Diet. Experts used features to determine the diet whereas novices were not consistent in their answers. These results indicated that experts were able to use general reasoning rules, such as induction by generalization.

Benner (1984) examined the differences between practical and theoretical knowledge of nurses in his book "From Novice to Expert." He argued that philosophers observed that knowing that is different than knowing how: practical knowledge. Benner contends that expertise develops when people test and refine hypotheses and propositions in practical situations. Therefore, experience is a prerequisite condition for expertise. For example, a proficient storyteller is different from a beginner. This difference might be attributed to know-how of telling a story rather than knowledge of the story. However, the experience in this context does not refer to passage of time or longevity; rather, experience reflects a deliberative practice with the situation.

The methods of the above mentioned studies have several strengths. The samples of these studies were from different ages. Two samples were high in total number of participants. Shin et al. (2003) integrated both well- and ill-structured problems to measure structural knowledge. Gobbo and Chi (1986) provided more extensive detailed about structural knowledge using qualitative methods. Only Shin et al. took the familiarity of the context into consideration. The effect size of structural knowledge as revealed by Gobbo and Chi is moderate, according to Cohen's criteria. In the Shin et al. study, the effect size of structural knowledge alone was not calculated; structural knowledge, justification skills, and science attitude accounts for around 48% in solving ill-structured problems in an unfamiliar context. Indicating only how much structural knowledge accounted for is necessary for other researchers. On the other hand, Gabbo and Chi's (1986) study included a limited number of male participants only. These limitations are a drawback of the author's conclusion regarding the role of structural knowledge.

The results of the preceding studies suggest that structural knowledge is an integrated part of the superior problem salver's cognition. On one hand, experts tend to acquire and possess structural knowledge that is different from what novices possess. On the other hand, structural knowledge helps them efficiently solve problems better than novices. An integrated domain of knowledge seems to be an essential component of effective problem solving. Shin et al. (2003) argued that general problem solving strategies can be used across several domains; however, people's success may depend on the adequacy of the structure of domain knowledge. Sinnott (1989) stated that when post adolescents develop their ability to solve ill-structured problems, their knowledge structure became more integrated and relativistic. Yet, little evidence is available of the effect of the interaction between structural knowledge and general problem solving strategies and cognitive competencies. For example, Jonassen et al. (1993) concluded that domain-specific problem solving relies on a well developed structural knowledge domain. They also noted that no literature is available to support the use of cognitive maps for conveying structural knowledge.

The role of structural knowledge in solving real-life problems is further examined in this study. The author aims to explore the relationship between structural knowledge of individuals and their practical problem solving ability. The hypothesis to be tested is as follows:

Hypothesis: Structural knowledge explains aspects of practical intelligence.

Tacit Knowledge

Practical intelligence is associated with tacit knowledge. Tacit knowledge is incompatible with academic knowledge. People acquire tacit type of knowledge through experiential activities without consciously knowing the processes of learning. Sternberg et al. (2000) view tacit knowledge as an aspect of practical intelligence. Tacit knowledge is the knowledge that has been learned from past experiences in achieving personal goals. This type of knowledge is a form that is acquired by doing.

The concept of tacit knowledge was first introduced by Polanyi (1958). The assumption is that this type of knowledge is based on what people know more than what they can verbalize. According to Polanyi, this form of knowledge is implicit in nature. Tacit knowledge is comprised of a wide range of concepts, sensory information, and images that can be brought to a situation to make sense of it. This type of knowledge is what one needs to succeed in a particular context. However, it is not explicit. Individuals develop tacit knowledge through interactions of conscious and subconscious past experiences; through which they develop contextual reasoning while solving problems in a particular domain. A researcher who develops skills in analyzing data, with time and experience will definitely be able to predict the pattern of the result from just looking at a set of data. This knowledge is not taught in schools; however, it is important for solving research problems.

According to Sternberg et al. (2000), tacit knowledge distinguishes people with practical intelligence from less competent people. They view the concept of tacit knowledge as a natural knowledge that various people have a different understanding about. This type of knowledge is contextually bounded. The concepts in tacit knowledge are not mutually exclusive. For example, technology as a term may refer to many entities (e.g., computers, cars, phones, and many others). The distinguishing features of tacit knowledge may lead different people to talk about similar things under a particular category, yet they may not be able to agree on features of that category. For example, in a working environment, two people may argue about the level of workers' productivity. They both may be right; yet, the productivity concept does not reflect consensus. According to Sternberg et al., scholars disagree about what is tacit knowledge and what is not. Perhaps it is not necessary to reach a consensus of what tacit knowledge is; yet, a higher degree of agreement between experts is enough to distinguish this type from what is not tacit.

Sternberg et al. (2000) suggested three features that distinguish tacit knowledge from other types of knowledge. That is (a) tacit knowledge is acquired with little support from the environment, (b) it is procedural in nature, and (c) it has a practical application. First, the acquisition of tacit knowledge in a particular context occurs with little support from the context. Tacit knowledge is not school-type knowledge. Individuals in a particular context develop knowledge that rarely is verbalized. For example, in a social context, when people encounter a problem, the problem is not treated with complete rationality. Other considerations seem to be critical, such as authority, personalities of the people involved, values, and social norms. Second, this type of knowledge is procedural in that it is related to actions. For example, when people tend to predict properly the consequences of certain behaviors or actions in a particular context, they possess tacit knowledge. The third feature of tacit knowledge is the one of practical use. The more highly valued the goal and the more tacit knowledge supports the goal, the more effective is the tacit knowledge. For example, knowing the level of motivation of students may help the teacher put more focus on those who are in need of incentives. The previous features of tacit knowledge are coherently related to each other.

I believe that tacit knowledge and structural knowledge are two distinct concepts. Even though they both relate to the question of how rather than what, a differentiation should be made between tacit-type and structural-type knowledge. Structural knowledge is related to explicit knowledge, whereas tacit knowledge is implicit. They both relate to a particular context and domain; however, they resemble a higher-order level of abstraction. Therefore, academic knowledge and knowing how to perform an academic task are not types of tacit knowledge, even though these tasks are of personal value. Academic knowledge is explicit in that it is articulated and validated in a domain and reflects high agreement. Academic knowledge supports performance on a particular task in a particular domain, but not within a different context when the same problem emerges. Knowing the tacit knowledge imbedded in that context is important to perform the task in a competent fashion. For example, knowing how to develop software to overcome some routine problems in a department may not be enough to convince the department head of the value of your project. In addition, being able to deploy a program requires tacit knowledge about the department head, employee, and consequences of this action.

In conclusion, tacit knowledge is among the best predictors of practical intelligence. Evidently, tacit knowledge alone is not sufficient for effective performance on practical tasks; other cognitive and non-cognitive factors contribute to people's performance on practical problems. In the following, I provide empirical support for the role of tacit knowledge in practical intelligence. Further, I pinpoint the need to investigate the role of tacit knowledge in conjunction with structural knowledge and the cognitive processes.

Empirical support. Tacit knowledge is a new concept in psychology, which is sensitive to different cultures. Sternberg et al. (2000) and his colleagues validate empirically the contribution of tacit knowledge to everyday problem solving. In the following, I provide a series of studies carried out by Sternberg and others on the role of tacit knowledge.

The purpose of the following studies is to investigate the role of knowledge learned from experience to people's performance on everyday problem solving (see Table 2.10). The studies employed quantitative analyses more than qualitative. The majority of the researchers used correlational analyses to pinpoint the relationship between tacit knowledge and performance on real-life problem solving. Measurements of tacit knowledge and problem solving included scales and questionnaire items as well as real-life scenarios. Participants in these studies were from different age groups. The studies took place in school settings and in the workplace.

Table 2.10

Review of the Studies of Tacit Knowledge and Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Sternberg et al. (2001)	85 children Ages 12 and 15	Test of tacit knowledge for natural herbal medicines Mill Hill Vocabulary Scale Dholuo Vocabulary Scale English and mathematics tests Socioeconomic questionnaire	Correlation	Tacit knowledge shared a great variance with practical intelligence
Wagner & Sternberg (1985)	127 participants 54 business managers, 51 business graduate 22 undergraduate students	Tacit Knowledge Inventory	Correlations	A significant relationship was found between tacit knowledge performance and the individuals‘ levels in the company; with number of years in school, and salary

Table 2.10–*Continued*

Study	Participants	Instruments	Analyses	Conclusions
Wagner (1987)	64 business managers	Work related situations	Factor analysis	Results supported the generality of the tacit knowledge
Nevo and Chawarski (1997)	65 scientists	Self-reported indices of practical intelligence Tacit Knowledge Scale Criterion of success	Correlation	Practical Intelligence and tacit knowledge are related to job performance
Heng (2000)	296 eighth-grade students (154 gifted, 175 mainstream)	Practical Intellectual Assessment Questionnaire Practical Problems Questionnaire Academic achievement measures Clinical interviews	Multiple regression analysis Coding Schemes	Students with practical intelligence exhibited a high degree of tacit knowledge that is important in solving real-life problems

Sternberg and his colleagues (2001) investigated the relationship between practical ability and academic achievement in a sample consisting of 85 students (12 to 15 years of age) located in a rural area in Kenya. The goal was to provide further support for a hypothesis derived from the Triarchic Theory of intelligence; that is, academic intelligence and practical intelligence are distinct constructs. The dependent variable was performance on real-life problem solving with multiple choice questions suited to the participants' environment. This measure is what researchers call tacit knowledge measurement. It was developed based on contextual problems that are related to the use of natural herbal medicines for illness. This instrument is intended to measure how people can treat various illnesses and consisted of 22 stories that included illnesses that were followed by 5 multiple choice options of possible treatments, in which the examinee had to decide which one was the best. The internal consistency of the instrument was .60. The correct answers were determined based on the adults' judgment from the community. Performance on the tacit knowledge test was significantly correlated with all standardized and academic tests.

The ability to solve real problems was also investigated in relation to experience in the workplace. Wagner and Sternberg (1985) investigated the knowledge of practical problems. The sample consisted of 127 participants, including 54 business managers with an average experience of 16.6 years, 51 business graduate students with an average experience of 2.2 years, and 22 undergraduate students with 0 years of experience. They developed a test to measure tacit knowledge based on interviews of five successful managers from different companies. The test consisted of 12 work-related situations with

9 to 20 response options. Significant correlations were found between tacit knowledge performance and company level, r = .34, number of years in school, r = .41, and salary, r = .46. Further, in another study, Wagner (1987) investigated the role of tacit knowledge in the business domain for 60 business managers: 35 business graduate students and 60 undergraduate students. Scores were based on the difference-method from 13 business experts. The results showed that means of tacit knowledge scores were 244 for business managers, 340 for business graduate students and 417 for the undergraduate students. The results indicate that tacit knowledge increases with experience in work. The findings supported the idea that practical problems might have different developmental trajectories and that experience plays an essential role in solving real-life problems.

Nevo and Chawarski (1997) explored individual differences between immigrant scientists in levels of practical intelligence and tacit knowledge as they relate to success in professional careers. The sample consisted of 65 scientists from Russia who had immigrated to Israel. The instruments included self-report indices of practical intelligence and external indices of tacit knowledge from the scientists' supervisors, which reflected the criterion of success in the workplace. The results showed a significant correlation between practical intelligence and rating of professional success (r =.41, p < .01, r^2 = .17). Further, a significant correlation between tacit knowledge and rating of the professional was found (r =.60, p < .01, r^2 = .36). These results showed that practical intelligence and tacit knowledge are important factors in the process of adaptation to the requirements of life in a new country. The researchers suggested that individual difference in practical intelligence and in tacit knowledge explain a significant proportion of professional success in the workplace.

Heng (2000) examined the relationship between the practical abilities and tacit knowledge of a sample of intellectually gifted adolescents, based on their tacit knowledge of self-as learner and the profiles of students who were high in practical intelligence as compared to those low in practical intelligence. The sample consisted of 296 eighth grade adolescents in Singapore (154 gifted, 142 mainstream). For the qualitative analysis, high practical learners, regardless of whether they were gifted or mainstream students, tended to display a heightened sense of self-as-learner. These students displayed an astute awareness of a body of implicit knowledge that students asserted as being imperative to success. By contrast, the low practical abilities' students were less often substantiated in ways that reflect tacit understanding of self in relation to the external world. They tended to be engulfed by social expectations and overwhelmed by immediate academic concerns.

The methods of the previous studies have several strengths and some weaknesses. First, the number of participants in most of the studies was high. Second, research methodologies including both quantitative and qualitative were implemented. Third, the effect size of tacit knowledge is moderate to high. On the other hand, the methods of the previous studies have several shortcomings. First, some of them are limited in their sample sizes and the populations of these studies are very specific. Second, the reliabilities of the instruments of practical intelligence in Sternberg et al. (2001) and Heng (2000) are not sufficient. Third, in most of the studies, researchers used scales to measure practical intelligence; however, assessment based performance would be more suitable to measure this construct than using only scales. Further, tacit knowledge was not made clear; the tacit knowledge as a concept was mixed with experience, adults' knowledge, or job knowledge as a concept.

The preceding studies indicated in sum that practical intelligence was related to tacit knowledge. Perhaps the findings of the previous research help to explain why older adults, experts in a particular field and skillful people outperform others in dealing with practical problems. The bulk of knowledge they possess in particular areas contributes vitally to their performance. The foregoing studies measured tacit knowledge as it related to a specific domain in a particular context. These studies integrated several aspects of tacit knowledge as they related to people's performance on practical problem solving in different contexts. Therefore, I intended to examine the role of tacit knowledge in practical intelligence.

Hypothesis: Tacit knowledge explains aspects of practical intelligence.

This section ends with the emphasis that knowledge has been recognized as a critical condition for the development of intelligence. Edward and Mercer (1987) provided us with the insight that school learning involves ritual knowledge more than understanding knowledge. Ritual knowledge has little support in people's performance on problem solving in real world situations (cited in Richardson, 2002). Early scholars called an individual's knowledge crystallized intelligence that is acquired through learning. Even though declarative knowledge is important, structural and tacit knowledge are vital for solving real-life problems, as suggested by many scholars. I believe that structural knowledge is related to domain knowledge (e.g., math, science) whereas tacit knowledge is culturally bound (e.g., Native American cultures, family, the workplace).

Sinnott et al. (1989) argued that problem solvers have to decide which part of knowledge is involved in the problem space prior to solving it. Most importantly, I believe that effective problem solvers may think critically about how each domain is structured and gauge the theories within and across domains to develop convincing solutions. Perhaps the importance of gauging theories within and across domains explains why effective solutions for complex real-life problems can be reached by collaboration between experts from different fields. I end this part by predicting that the knowledge model, including declarative, structural, and tacit knowledge, is a vital contributor to practical intelligence. Thus, I intend to test the following hypothesis:

Hypothesis: The knowledge model accounts for people's performance on real-life problem solving.

The Interaction of Cognitive Processes and Types of Knowledge

The interaction between cognitive competencies, including metacognitive and cognitive processes and types of knowledge, appears to have a significant role on how people solve their real-life problems. This role has been emphasized by contemporary theorists of intelligence (Benner, 1984; Ceci, 1996; Sternberg, 1985a). Theoretically, the interaction of the two cognitive models, cognitive processes and knowledge types, is what scholars refer to as expertise. However, this role has rarely been integrated in a single study. The prominent goal in the current study was to discover how these factors collectively associated with practical intelligence. Below, I provide a theoretical basis for the interaction factor as it emerged from the literature.

The interaction between the cognitive processes and types of knowledge emerged from the field of psychology on expertise. Expert problem solvers, from a cognitive point of view, have distinguishable features from novices. For instance, experts' knowledge is not simply a list of facts, ideas, or formulas; their knowledge also includes organization of the core concepts and principles in a particular domain. Experts also notice patterns of information, have a great deal of knowledge, focus on the applicability of knowledge in a particular context, and are flexible in retrieving information and approaching new situations (NRC et al., 2000). Two important aspects of expertise arise from these features: cognitive processes and types of knowledge. Further, an important trait exhibited by experts is what is known as metacognition that enables them to recognize the limits of their current knowledge and recognize the insufficiency of attempts to solve the problem. Consequently, they adopt different strategies to deal with these problems. For example, experts tend to step back from attempts to define a problem and spend more time in understanding it, relocating their resources, and planning actions. In short, an expert's ability to reason and solve problems depends on a well organized domain of knowledge that affects how they perceive problems, represent it in their cognition, and most importantly how they use metacognitive skills to determine how they approach and solve problems.

Empirical Support

The interaction between the cognitive model and the knowledge model has not been investigated enough. The interaction between the two models, if any of these models contribute to practical intelligence, should be equal or higher in the effect size from either model alone. In the following, I provide the role of interaction of both models to practical intelligence (see Table 2.11).

Table 2.11

Review of Studies of Interactive Cognitive Components to Explain Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Patrick & Strough (2004)	95 Adults	Relocation intentions Everyday problem vignettes	*t*-test Logistic regression Chi-square	Adults with experience and flexibility of thinking provide effective solutions
Shin et al. (2003)	112 ninth-grade students	Instructional materials including scientific methods for problem solving Well- and ill-structural problems instruments Domain knowledge inventory Metacognition scale Scientific attitude	A Multiple regression model	Several cognitive factors explain practical intelligence more than any one alone

Patrick and Strough (2004) examined the predictive contribution of strategic flexibility and experience with problems. The researchers used a hierarchal logistic regression method. To determine whether flexibility accounts for experience, the researchers compared the total and unique strategies generated by those with experience and those without. The results showed that adults with experience offered significantly more strategies ($M = 5.06$) than those without experience ($M = 3.80$), $t(93) = 2.35$, $p < .05$. The total number of strategies, experience and the interaction of the model at the second step was significant, $\chi2\ (3, 93) = 10.73$, $p < .01$. In sum, adults who offered more total strategies and individuals with previous experience were significantly more likely to effectively solve everyday problems.

Shin et al. (2003) investigated the role of justification skills and structural knowledge in solving ill-structured problems in an unfamiliar context. They found that justification skills ($\beta = .32$, $t = 4.30$, $p < .0001$), structural knowledge ($\beta = .48$, $t = 6.57$, $p < .0001$), and regulation of cognition ($\beta = .20$, $t = 2.70$, $p < .01$) were significant predictors of performance on this type of problem. These variables accounted for 47% ($p < .0001$) of the variance.

The methods used in the following studies have several strengths and deficiencies. The methods in these studies employed advanced statistical models to determine the contribution of several cognitive and non-cognitive factors to practical intelligence. The researchers employed different methods to assess practical intelligence. On the other hand, the authors did not indicate the contribution of each factor separately. The samples of these studies were limited in their population's diversity. In the Shin et al. (2003) study, some important statistical data are missing.

The authors of the aforementioned study suggested a vital relationship between the cognitive competencies and types of knowledge people possess about particular problem situations. They inquired about the role of structural knowledge with metacognitive processes. However, the role of cognitive competencies as they relate to particular knowledge type has yet to be explored. Presumably, the interaction between these types of knowledge and the cognitive competencies accounts for people's performance on real-life problem solving. Further, Shin et al. (2003) insisted that the role of regulation of cognition in solving ill-structured problems has to be clarified with different degrees of complexity.

Finally, I conclude that expertise is a key concept that distinguishes superior problem solvers of ill-structured problems in a domain. Solving real-life problems has been recognized as a developing form of expertise by many scholars (Ceci, 1996; Schraw et al., 1995; Sternberg et al., 2000). The assumption that underlies this line of thinking is that problem solving is a developing construct and both cognitive processes and knowledge types have a crucial relationship to its development. Therefore, I predict that people with a higher level of cognitive competencies and knowledge in a particular domain solve problems in more effective ways than those who have lower levels.

Hypothesis: People with higher levels of cognitive processes and types of knowledge perform better on practical intelligence than those with lower levels.

The Non-Cognitive Factors

Cognitive abilities are not the only factors that determine an individual's performance on real-life problem solving. Contemporary scholars in the fields of psychology and sociology provide evidence that a person's performance in solving real-life problems is determined by many cognitive, non-cognitive, and environmental factors (Ceci, 1996; Goleman, 1995; Sternberg et al., 2000). Trifimow, Sheeran, Lombardo, Brown, and Armitage (2004) articulated that affect, the conscious subjective aspect of feelings and emotions, and cognition are distinguishable from each other, and behaviors can be driven more by affect than by cognition or vice versa. Scholars contend that non-cognitive factors explain a great deal of variation of an individual's performance when solving real-life problems. Richardson (2002) and Shin et al. (2003) argue that humans have complex values, beliefs, attitudes, motives, self-concepts and feelings that make them more or less competent in solving problems. Even though the literature reflects mixed terminologies for these constructs, my conceptualization of the non-cognitive factors includes, but is not limited to, some personality aspects, such as attitude, emotion, motivation, interpersonal skill, and self-efficacy. I find these aspects are important predictors of an individual's ability to perform on real-life problem solving. In the current study, I investigate the role of the non-cognitive factors in people's performance on real-life problem solving.

Personality

Scholars define personality as "consistent behavior patterns and intrapersonal processes originating within the individual" (Burger, 2004, p. 4). According to this definition, personality is a multidimensional construct that includes all people's intellectual and nonintellectual characteristics. Character is a unique element in an individual person. An individual's traits, abilities, attitudes, beliefs, interests, values, self-concept, knowledge, emotions, motivation, and limitations all shape her or his character. In the following, I present major theories of personality and how they explain people's behaviors.

Grahman Wallas (1908) stated that "man's impulses, thoughts, and acts result from the relation between his nature and the environment into which he is born" (Stone & Schaffner, 1988, p. 30). Actions of individuals therefore can be explained by the specificity of the context and the individual's character. Environmental factors include men, women, children, home, town, culture, mainstream ideology, and everything that affects a person's personality. Studying the contribution of some non-cognitive factors is a secondary goal in this research. The researcher provides a general overview of the role of the non-cognitive factors in problem solving.

Theories of Personality

Personality has been conceptualized from different schools of thought. Psychoanalysts view people's behavior as being a result of the working of the unconscious mind. Behaviorists explain an individual's behavior as being the result of conditioning and expectation. The biological approach refers to inherited predispositions. Humanists argue that personal responsibility and feelings of self are critical causes of behaviors (Burger, 2004). In this review, I focus on the psychoanalytical, behavioral, and social theories of personality that explain human behavior.

Central to the psychoanalytic view of human behavior is Freud's theory of personality. The personality structure in his view includes id, ego, and superego. The id is the locus of the life force that underlies the individual's urges; it a repository of human biological urges. As urges become socialized, the conscious emerges as a result (ego). The ego attempts to deal with an id in a rational way that is limited to a particular context and environment. Certain norms or standards of prohibition and compulsions develop in a particular context in which they guide the ego to function. These restraints and compulsions are systemized in the superego (Burger, 2004; Stone, 1974; Stone & Schaffner, 1988). Freud (1930) believed that many of our actions result from motives of which we are not aware. He found that an adult's personality is comprised of the conscious, unconscious, and partly conscious desires and beliefs. Freud's three major components of personality: the id, the ego, and the superego, are central to personality development. For example, a newborn child's psyche consists of undirected physiological needs and aggressive instincts. These basic needs are fulfilled by pleasure and satisfaction. During childhood, the id sometimes is subject to frustration due to lack of fulfillment of a particular desire. For example, as the child develops ways to achieve fulfillment of his/her desires, the ego is developed through this interaction. The ego operates according to the reality principle. The ego makes decisions about how to fulfill a particular need. The third component is the superego that develops during the upbringing process as a moral judicial branch of personality. The growth of an individual's controls parallels the growth of social controls. As the superego develops by cultural exposure, boundaries are established between accepted and prohibited roles of human conduct in a society (cited in Stone & Schaffner, 1988).

According to the psychoanalytical theory of personality, our behaviors are results of the action of our subconscious minds. The competing demands of an individual's desires and feelings about right and wrong produce an inevitable conflict within the personality that the ego attempts to reconcile. Usually, the ego attempts to resolve the inner conflict by defense mechanisms: the ego is confronted by the demands of the id and the superego on one hand and the external world on the other hand. For example, a child, when crying and insisting on having a toy that does not belong to him, is influenced by the id with a premature development of right and wrong in his superego.

Behavioral theorists explain behavior in terms of learning experience though stimulus-response association. Form the classical conditioning theory point of view, Skinner (1967) stated that when one stimulus is preceded by another, the one that occurs first becomes a signal for the one that occurs second (cited in Burger, 2004). For example, children who develop a particular attitude toward other ethnic groups through the process of nurturing may observe their close relatives' feelings and attitudes every time they meet a member of a particular ethnic group. If the child's relatives reacted with positive feelings toward the given ethnic group member, then the child will behave and think in a similar way. This classical conditioning process occurs below the conscious level (Burger, 2004). Another behavioral concept is the instrumental conditioning theory that shows how we acquire our behavior. Behaviors that are followed by positive outcomes are reinforced and behaviors that are followed by negative reinforcement are weakened. Rewarding a child when he/she shows a particular behavior makes the behaviors likely to occur again (Baron, Byrne, & Baron, 2004).

Other scholars have taken a different behavioral approach to linking personality constructs to problem solving. For example, Huitt (1992) identified several personality constructs as they relate to different problem solving steps. He argued that extraverted people are oriented to the outside world. They feel comfortable working in groups using the processes of brainstorming and thinking aloud. Introverts reflect in an inner world, brainstorm internally, and incubate the problems. Intuitive people, who are driven by concepts and principles, can be effective during classifying, categorizing, deductive reasoning, and synthesizing. Logical thinkers fit the analysis phase of the problem. People oriented to judging can help in evolution, planning and finding optimal solution. Huitt concluded that aspects of personalities are important for problem solving and decision-making. A type of personality perhaps influences how people solve their real-life problems.

Social theorists contend that behavior is developed by social norms. Festinger (1954) argued that in the process through which we compare our behaviors to others to determine whether our views are correct or not, we develop an attitude similar to the social group to which we are exposed. In the social learning theory proposed by Rotter (1954; 1982), human behavioral potential is the result of two factors: expectancy and reinforcement value. Individuals deciding to involve themselves in a particular interaction consider the consequences of the action (cited in Baron et al., 2004). If the consequences present possible rewards, we tend to perform an action. Expectancies are the kind of standards people develop over time and they are reinforced by the culture, leading to a stable behavior pattern within a particular context. Reinforcement value is the degree to which we prefer one reinforcer over another. People tend to have a set of attitudes toward different issues. Thus, people develop expectancies and are inclined toward different issues over time. To predict how an individual will behave in a situation, we need to know his/her expectancy (possible behaviors) and reinforcement value (Burger, 2004).

Attitudes

An attitude has a unique association with solving real-life problems. Fazio and Roskos-Ewoldsen (1994) proposed a theory called the attitude-to-behavior process model, emphasizing that behavior is determined by a specific attitude and previous knowledge of what is acceptable and appropriate in a particular situation (knowledge of social norms). In other words, an event activates an attitude that influences perception of that event. At the same time, knowledge about what is socially appropriate behavior shapes the definition and solution of a problem (Fazio & Roskos-Ewoldsen, 1994).

Rokeach (1968) defined attitude as “an enduring organization of beliefs around an object, situation, or people predisposing one to respond in some preferential manner” (cited in Stone & Schaffner, 1988, p. 63). Baron defines attitudes as “evaluation of various aspects of the social world” (Baron et al., 2004, p. 118). These definitions reveal that people in particular situations may be influenced by a specific predisposition. For example, people could have a positive, a negative, or neutral attitude toward the practice of social justice in a society. These attitudes may influence an individual’s behaviors when involved in the practice of social justice. Moreover, an individual may behave in different ways in highly similar situations when influenced by different attitudes. Different individuals may behave differently in highly similar situations (e.g., consider voters in a presidential campaign) where the motive of their behavior is internal rather than external. The important role of attitudes for individuals is to help people find meaning in the world in which they live (Stone & Schaffner, 1988).

Most psychologists believe that attitudes are developing constructs acquired through the process of learning; however, there is some evidence that attitudes are also an inherited aspect of personality (Baron et al., 2004). Critical aspects of attitude development are situational, social, and cultural exposure. Baron et al. stated that many of our views are acquired through the process of interacting with and observing people's behaviors. Psychologists believe that, to a great extent, attitudes are developed though learning; therefore, learning theories as discussed earlier are applicable to how attitudes are developed.

What are the functions of one's attitudes? Our perception of the world is rarely neutral. Attitudes can be viewed as our automatic reaction to the world in which we live. Scholars emphasize that research on brain activities shows that we, as human beings, tend to classify immediately a stimuli we encounter as either positive or negative (Baron et al., 2004; Burger, 2004; Marcus, Neuman, & MacKuen, 2000). In doing so, we trigger a mental framework or schema that helps us to interpret the kind of information we perceive: issues, objects, people, or groups. Attitudes allow us to express our central values or beliefs (e.g., political identity); they are ego-defensive mechanisms that help people protect themselves (Baron et al., 2004; Stone & Schaffner, 1988).

In summary, the important factors that determine the attitude-behavior link are the attitude's strength, origins, and specificity. Researchers have argued that the stronger the attitudes, the greater their impact on behavior (Petkova, Ajzen, & Driver, 1995). Also, the origin of the attitude is another determiner of the attitude-behavior link. If an attitude originated from personal experience, it tends to be much stronger than the one developed by knowledge only. Another important aspect of attitude is specificity—the extent to which attitudes are focused on a specific object, issue, or situation.

Empirical Support

The contribution of attitudes to performance on solving real-life problems has a unique pattern. Attitudes contribute to people's performance on problem solving if the attitudes have been measured at the same level of the individuals' interests in these problems. For example, a person might have a strong attitude toward home budget management; this factor might predict how effective an individual is in solving problems in that domain.

In the following studies, scholars used several quantitative methods to investigate the role of attitudes in problem solving (see Table 2.12). Instruments of practical intelligence in the following studies included different scales and hypothetical ill-structured problems. Participants in these studies were students of different ages and some samples contained adults. One study consisted of a high number of participants.

Table 2.12

Review of the Studies of the Role of Attitudes in Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Armitage & Conner (2000)	517 hospital workers	Attitude Intention Attitudinal ambivalence	ANOVA	Strong attitudes were more predictive of behavior than ambivalent ones
Shin et al. (2003)	112 ninth-grade students	Instructional materials including scientific method Well- and ill-structural problems instruments Scientific attitude	A multiple regression model	Attitude was an important predictor of success in solving ill-structured problems in a familiar context
Katz (2001)	100 students	Social-Religious-Political Scale Conservatism Scale South African Wechsler Adult Intelligence Scale	ANOVA	No relationship between conservatism attitude and performance on IQ test

Table 2.12–*Continued*

Study	Participants	Instruments	Analyses	Conclusions
Nelson & Milburn (1999)	101 undergraduate students	Essay test Hypothetical conflict situation Conflict Resolution Strategies Checklist SAT Verbal scores Class grades Militaristic Attitudes Scale Religious/social authoritarianism scale Gun control scale	*t*-test Correlation	Militaristic attitude scores did not correlate with the total score of problem solving ability

Armitage and Conner (2000) conducted a study to investigate uncertainty in the attitude-behavior link. They asked hospital employees to express their attitude toward eating a low-fat diet (positive and negative feelings) and their intention to do so. Five months later, these people completed the same measure, indicating whether they had actually eaten fatty foods during the intervening months. On the basis of their responses, participants were divided into those with ambivalent and non-ambivalent attitudes. Ambivalent attitudes were weaker predictors of behavior than non-ambivalent attitudes.

Shin et al. (2003) investigated the role of attitudes in solving well-structured and ill-structured problems in astronomy. Students' science attitudes were among other independent predictors. Factor analysis performed on science attitude (70-item scale, internal consistency r =.85). These factors included career, experimental preference, social importance of science, normality of scientists, attitude toward science classes, and openness to new ideas. A multiple regression procedure was implemented to determine the contribution of each independent variable to solving real-life problems. Scientific attitude was a significant predictor of performance on the ill-structured problems only in a familiar context ($\beta = .15$, $t = 2.42$, $p < .05$).

Katz (2001) investigated the relationship between general conservatism and components of intelligence in South Africa. The sample consisted of 100 students between the ages of 18 and 37. No significant differences were found between participants of high and low scores on conservatism and full-scale and verbal IQ as measured by the South African Wechsler Adult Intelligence Scale (WAIS). I think predicting general ability such as intelligence from a general attitude such as conservatism could be misleading, because both are functioning in broad domains. Therefore, to be precise in making the attitude-behavior link, specificity in the task and attitude should be maintained.

In another study, Nelson & Milburn (1999) investigated the relationship between problem solving competencies and militaristic attitudes. The militaristic attitude was defined as tendencies to favor use of military force (vs. conciliation) to resolve conflict with other nations and to favor reliance on military strength (vs. cooperation with other nations) as a means of maintaining national security. The sample consisted of 101 college students. Different measures were used, including problem solving cases for international conflict resolution strategies focusing on hypothetical threats from Iran against the United States, and a militaristic attitude scale. The militaristic scale was highly correlated with conservative values similar to power and negatively correlated with values similar to nonviolence. Students were divided based on their social dominance orientation: Republicans and Democrats. Militaristic attitudes correlated moderately with Religious/Social Authoritarianism, that was defined as an individual's desires to impose religious and moral standards on other people, (r = .45). The militaristic attitudes also correlated moderately with the Social Dominance Orientation, the extent to which one desires that one's in-group dominate and be superior to out-groups, (r = .35). Most importantly, the militaristic attitude scale did not correlate with the total score of problem solving ability. A possible explanation for the findings is that the attitude specificity was not met in this study; that is, the attitude scale was a general measure of attitude and not related to the particular case presented.

The methods of the previous studies contained of several shortcomings. First, Armitage and Conner’s (2000) study focused on specific attitude and specific behavior. This specificity has does not lead to generalization in the results. Second, the Shin et al. (2003), Katz, (2001), and Nelson & Milburn (1999) studies are limited in their samples and the domain. Third, Nelson and Milburn used a hypothetical scenario for assessing problem solving ability. Performance on hypothetical situations does not necessarily reveal true ability of an individual.

In summary, generally attitudes do not predict how people behave in different situations. An individual’s behavior is a complex phenomenon. Indeed, many scholars believe that perception of real-life problems is a subjective reality, meaning that different individuals recognize a problem in totally different ways. In a sense, the ways we interpret the situation influence our behavior, which is determined by our character. The climate and the conditions associated with problems smooth the background for individuals to act. Research findings on the influence of attitude on behavior reflect two critical factors that determine how people behave in a particular situation: strength and specificity. An attitude predicts behavior if the attitude is strong and specifics of the problems presented (Burger, 2004). General scales of attitudes may relate to an individual’s behavior in some situations.

Self-Efficacy

Self-efficacy is another contributor to problem solving ability. Self-efficacy refers to an individual’s beliefs about her/his capabilities for performance. An individual’s perception of self is a powerful determinant of cognition and action (Richardson, 2002).

Bandura (1977) defines self-efficacy as “a cognitive evaluation of the fit between one’s abilities and the task requirements to achieve a desired outcome” (cited in Sinnott, 1989, p. 268). Sinnott stated that people appear to integrate task information regarding their capabilities of problem solving and to regulate their behaviors accordingly. For example, problem solvers, when comforted with a complex task, have two possible decisions: to quit or to persist. Solving a problem cannot be achieved unless an individual has made a clear decision to solve it and expended a necessary effort to overcome the problem. Klaczynski (1997) argued that the analyses of everyday problem solving show that when people encounter a problem that has little interest to them, they expend only a little effort in solving it and their true abilities may not be activated.

The development of self-efficacy is related to different experiential and personal factors. According to Bandura (1977) the past successful experiences of individuals are important sources of self-efficacy. When people recall their prosperity and accomplishments, they activate mastery experiences that lead to attempts at solving a problem in the new situations (cited in Sinnott, 1989). By contrast, recalling failure history often leads to low self-efficacy and withdrawing situations. Further, Bandura also contended that verbal persuasion is an effective strategy convincing one’s self of his/her ability. For example, individuals who convince themselves of their capability to solve problems are inclined to make attempts. These attempts are very important to the acquisition of the experience of problem solving. Self-efficacy is a critical characteristic that is regulated by metacognition. This characteristic energizes individuals to move forward in solving problems.

Empirical Support

Several studies showed that self-efficacy is a strong predictor of performance in solving real-life problems. In a meta-analysis of over a hundred studies, scholars found self-efficacy and work performance to be positively and strongly correlated (cited in Davis & Curtis, 2003).

The methods in the following studies employed both quantitative and qualitative analyses (see Table 2.13). The samples consisted of diverse age groups. Both well-structured and ill-structured problems were used to assess ability to solve problems. Kanevsky (1990), in particular, did not use real-life problems in her study. Blanchard-Fields et al. (1997) used several categories to classify solutions of everyday problem solving. Further, they used problems in three different domains and took familiarity with problems into consideration during the analysis of the results.

Table 2.13

Review of the Studies of Self-efficacy and Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Kanevsky (1990)	89 children ages 4 and 5	Tower of Hanoi Puzzle	Quantitative analysis includes repeated measures design Qualitative analysis	Children with a high ability of problem solving displayed more confidence in their ability to find solution and were more able to evaluate their needs of assistance
Blanchard-Fields et al. (1997)	282 participants	Everyday Problem Solving Inventory Attribution and appraisal ratings of everyday problems Familiarity ratings	Multiple factors ANOVA	Perceived ability to solve problems was a strong predictor in selecting solution strategies

Kanevsky (1990) investigated the relationship between self-confidence and performance in solving problems. The sample consisted of four groups: 20 participants of younger children (between ages 4 and 5) and average IQ (*M* IQ = 103.2 to 105.2), 22 participants of younger children and high IQ (*M* IQ = 153.5 to 155.4), 22 participants of older children and average IQ (between ages 4 and 5), and 25 participants of older children and high IQ. These children were classified in ability groups based on the Stanford-Binet intelligence test. The qualitative analysis showed that high ability groups are more self-confident in their ability than low ability children.

Balnchard-Fields et al. (1997) examined perceived ability to solve problems in relation to everyday problem solving. The sample consisted of 282 participants from different age groups. They used the Everyday Problem Solving Inventory that consisted of 24 problems in three domains: managing a home, as a consumer, and resolving conflicts with friends. They used a hierarchical multiple regression model to analyze the data. They found that a perceived ability to solve the problem situation was a robust predictor of strategy endorsement. For example, in the consumer domain, individuals' perceived ability to solve problems was a significant predictor in problem focused strategies ($\beta = .09$, $p < .05$) and in avoidant-denial strategies ($\beta = -.20$, $p < .01$). In the home domain, ability to solve problems was also a significant predictor in problem focused strategies ($\beta = .18$, $p < .01$), in the cognitive analysis strategies ($\beta = .23$, $p < .01$), and in the avoidant-denial strategies ($\beta = -.15$, $p < .05$). In the friend domain, ability to resolve problems was a significant predictor in the problem focus strategies ($\beta = .27$, $p < .01$), in the passive-dependent strategies ($\beta = -.21$, $p < .01$), and in the avoidant-denial strategies (β = -.29, $p < .01$). The role of self-efficacy, as part of a person's character that is developed to a great extent by past successful and unsuccessful experiences, may enable or hinder an individual's ability to solve a problem.

The methods used in the Kanevsky's (1990) study indicated some limitations. First, the well-structured problem of the Tower of Hanoi used by Kanevsky is not a type of real-life problem. Therefore, the results cannot be generalized to ill-structured types of problems. Second, the high and low ability groups were classified by the Stanford-Binet intelligence test and the performance on the well-structured problem was similar with participants' performances on the intelligence test. This might indicate that the traditional intelligence test is associated with closed-ended problems. Thus, participants' abilities to perform on real-life problem solving as a type of ill-structured problems may not be related to performance on intelligence tests.

In summary, perceived ability to solve problems seems to be a good predictor of problem solving. This factor along with a non-cognitive factor, such as motivation and self-efficacy, might explain a great variance in practical intelligence. In this study, I intended to investigate the role of self-efficacy on performance on real-life problem solving. The author of this research predicts the following:

Hypothesis: Self-efficacy explains aspects of practical intelligence.

Emotion

People's emotions normally are aroused by problems they encounter in everyday life. These emotions also may foster or deter problem solving abilities. The difference between self-efficacy and emotion is that self-efficacy becomes persistent in one's personality; however, emotion is not relatively stable and is influenced by the situation. For instance, consider an individual whose emotion has been aroused by a pathetic scene about orphans on the TV screen. This individual may immediately take an action to attempt to help end the suffering of these children. In contrast, when a supervisor criticizes a person in a meeting, regardless of the validity of the content, that person may be demotivated or unenthusiastic about the work environment. Emotion seems to play an important role in how people perceive and solve a real-life problem.

Scholars acknowledge the critical role of emotional intelligence (EI) in daily life activities and problem solving (Goleman, 1995; Mayer & Salovey, 1997). For example, Sinnott et al. (1989) stated that emotions can be significant in preventing individuals from breaking mental sets and moving toward understanding a problem. Goleman claimed that around 80% of success in life, which is not explained by IQ scores, is accounted for by many variables, one of which is emotion. Lopes, Salovey, Cote, and Beers (2005) articulated that emotion regulation is important for social interaction because it impacts behavior.

Emotional intelligence, according to Salovey and Mayer (1997) is the capacity to understand emotional information and to reason with emotions. They divide emotional intelligence abilities into these capacities: (a) to accurately perceive emotions, (b) to use emotions to facilitate thinking, (c) to understand emotional meanings, and (d) to manage emotions. In the following section, I provide empirical support for the role of emotion in performance on real-life problem solving.

Empirical Support

Even though scholars tend to differentiate between EI and other forms of intelligence, the link between the cognitive competencies and emotions as a non-cognitive factor is vital. Salovey and Mayer (1997) link EI to cognition. Particularly, the EI model is consistent with intelligence as a concept in the contextual approach because EI is influenced by the context. The contextual approach distinctly links EI to problem solving ability in real-life situations.

The following studies employed quantitative methods to investigate the role of emotional intelligence in problem solving (see Table 2.14). The researchers used several methods to assess both problem solving ability and emotional intelligence. Measurements of practical intelligence, in the following studies, included different scales. Participants in these studies were from different high school-age students, college students, and adults. The studies took place in- and outside-school settings. The studies in general focused on emotional intelligence as it relates to people's performance in problem solving.

Table 2.14

Review of the Studies of Emotion, Motivation, and Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Lopes et al. (2005)	76 college students	Emotion regulation ability scale Quality of social interactions	Multiple regression	Individuals with high emotional regulation ability possess higher quality of social interactions
Siegel et al. (1976)	105 adults 33 adolescents 49 adult hospital employees 53 high school sophomores	Problem solving thinking Otis-Lennon Test of Intelligence	ANOVA	Emotional problem solving is related to intelligence and was not related to social problem-solving ability
Jordan & Troth (2004)	350 college students	Emotional Intelligence Scale Conflict resolution	Correlation	No relationship between emotional intelligence and problem solving

Table 2.14–*Continued*

Study	Participants	Instruments	Analyses	Conclusions
Shin et al. (2003)	112 ninth-grade students	Instructional materials including scientific method for problem solving Well- and ill-structural problems instruments Domain knowledge inventory Metacognition scale Scientific attitude Justification skills	Multiple regression	Motivation was not a predictor of performance on ill-structured problems

The theoretical perception of EI is supported by empirical research findings. For example, EI is critical for social interactions. Lopes et al. (2005) explored the role of the emotional regulation scale of abilities in conjunction with indicators of the quality of social interactions. Participants included in this study were 76 junior and senior undergraduate students. Emotional regulation was used to assess emotional intelligence. The quality of social interactions scale was used to assess interpersonal sensitivity and prosocial tendencies. A multiple regression model was used to analyze the data. They found that emotional regulation abilities were significant predictors of reciprocal friendship nominations [$\beta = .27$, $t(66) = 2.16$, $p < .05$]. That is individuals who performed higher on emotional regulation viewed themselves as more interpersonally sensitive and were seem favorably by peers.

In another study, Siegel and Platt (1976) predicted that the ability to perform on real-life problem solving in a social context would be related directly to the ability to solve emotional problems in both adolescents and in adults. The sample consisted of four groups: 105 adults, 33 adolescents (both samples psychiatric patients), and 49 hospital employees and 53 high school sophomores. Two instruments were used in this study: Problem-solving thinking and the Otis-Lennon Test of Intelligence. The Pearson correlation between emotional intelligence and IQ scores was moderate and significant ($r = .27$, $p < .01$).

Some scholars argue that EI is very important for job performance, leadership, and other areas of organizational life (Spector, 2005). Jordan and Troth (2004) investigated the relationship between EI and problem solving performance in teamwork situations by examining the ability of team members to resolve conflicts. The sample consisted of 350 college students. EI did not correlate with an individual's performance on the survival task. That supports the idea that when individuals are alone as problem solvers, their emotions may be not be triggered; however, emotion arousal may be associated with a groups' performance. Teams with higher EI perform better than teams with lower levels. Daus and Ashkanasy (2005) concluded that EI clearly has a positive relationship with organizational behavior. The argument is that high EI enables team members to manage their own emotions and the emotions of others that have important consequences of regulating team performance.

Motivation

Motivation is another aspect of EI that intensifies and directs one's efforts to achieve goals and develop abilities. Richardson (2002) found that cognitive performance varies with each level of engagement in a task. Jonassen (1993) argued that affect seems to provide meanings to stimuli that amplify and increase the speed of learning. He contended that cognition provides behavioral flexibility and affects function as a motivational power for behavior (cited in Trafimow et al., 2004). Researchers found a weak correlation between maximal and typical performance (Ceci, 1996; Richardson, 2002). Maximal performance involves tasks that have high motivational components.

Shin et al. (2003) found contradicting results for the hypothesis that motivation is important for problem solving. They carried out a study to explore the role of the motivation factor in solving well- and ill-structured problems in the domain of science. Shin et al. did not find motivation to be a predictor for effectiveness of problem solving.

Perhaps that is because motivation and emotions are a highly changed aspect of personality. These constructs are influenced particularly in group setting interactions. Moreover, perhaps motivation and emotion should be measured at the same level of specificity with the task. For example, enthusiasm in working with a programming language is a general task for many programmers; however, specifying the program and interest of individuals to work on a specific program is what I mean by the specificity of motivation with the task.

The methods of the pre-mentioned studies included several deficiencies. In the Siegel et al. (1976) study, reliability and validity of the instruments were not included. The population of this study includes patients in a hospital. In Lopes' (2005) study, the quality of social interaction was measured by the Likert scale. The sample size was relatively small when considering the number of variables included in this study. This concern may result in type II error. In all studies, the samples consisted of very specific populations.

The author believes that the role of emotions in solving real-life problems has a two-way interaction. High EI people may influence cognition, and cognition has an important influential role on emotions because when people think, emotions are aroused, whether in a positive or negative way. The author predicts that motivation is associated with performance on real-life problem solving.

Hypothesis: Motivation is among the predictors of practical intelligence.

Interpersonal Competencies

A critical line of research emphasizes the interpersonal basis of solving real-life problems. Based on the assumption that two minds work better than one, people in solving their everyday problems are inclined to seek the support of others. For example, the success of planning a picnic, a field trip, a party, developing a research project, or resolving a community problem depends on the intellectual skills of people involved together.

Perhaps performance on most daily tasks is contingent on interpersonal skills. Two major assumptions are profoundly important for practical intelligence performance on real-life problem solving: (a) most of everyday problems occur in a social context, and (b) the difficulty in real-life problem solving is related to the incapability of an individual to break the mind set that dictates one’s perception of the problem. Therefore, people depend on others to help them rethink, redefine, and resolve the problems they encounter. In many forms of everyday problem solving, people tend to consult others about their problems because they may be overwhelmed by the situation and are not able to think logically, or they lack the virtual resources that others have to capitalize on. The interpersonal basis of real-life problem solving is a relatively new emerging concept in the field of problem solving in adulthood. However, solving real-life problems is an authentic concept in teamwork and behavioral organizational studies. Scholars have distinguished between two forms of interpersonal support: direct and indirect collaboration. In the direct form of collaboration, two or more individuals come together in active, joint, and mutual engagement to define, plan, and solve a problem. In the indirect form of collaboration, people meet informally to solve a problem; this form may occur in a different time, space, and with collaborators who do not share an interest in the problem (Meegan & Berg, 2002). The latter form is most relevant to solving real-life problems that people encounter. The effective collaboration between individuals compensates for the shortcomings of the problem solving ability of an individual.

Collaborative effort, if supported by effective personal skills, may result in optimal outcome. Collaborative problem solving capitalizes on communication skills, supportive problem solving strategies, thinking skills, shared knowledge, and effective interactions that a particular group may have. I believe that if optimal conditions and skills are recruited in a group to work out a particular problem, the group’s effort functions as a super brain or computer that produces an effective solution with higher accuracy. By contrast, lack of optimal skills that fit a problem as well as deficiency of skills that a team has will result in poorer performance. Nevertheless, a group effort in many cases is more than the sum of individuals.

Research on collaborative problem solving showed that groups outperformed individuals in different contexts. Meegan and Berg (2002) synthesized research findings on team collaboration and showed that group effort in problem solving was higher than the sum of individuals' performances in workplace, home, and social settings. In another line of research, Robbins (2003) calls the outcome of the collaboration effort the synergy factor. Jordan and Troth (2004) predicted that teams would perform better than individuals on the problem solving task. Further, they expected that teams with higher emotional intelligence would be more likely to report adopting conflict resolution patterns than others with lower levels. In support of their predictions, they found teams with higher levels of emotional intelligence performed better than teams with lower levels of emotional intelligence. Studies have showed that both interpersonal and cognitive processes can have facilitative and hindering effects on solutions.

In conclusion, the literature on organizational psychology includes empirical findings suggesting that groups always perform better than individuals and rarely perform at an individual's level. Staudinger and Baltes (1996) argued that collaboration is a well-suited strategy to enhance an adult's use of wisdom related knowledge (cited in Meegan & Berg, 2002). Therefore, these results inspire a promising usage of the interpersonal basis of solving real-life problems for the interest of the current study. A critical obstacle with solving real-life problems is that the latter do not have optimal solutions. Further, solutions may differ according to the situations, people, and problem constraint. An interest of the current research is to determine the solutions for the proposed real-life problems based on two groups of people: adult and experts. Adults, on the one hand, who have accumulated real-life knowledge about practical problems, may provide a group with effective solutions driven by their own experiences. Experts, on the other hand, who are scientists in relation to the problems' domain, may suggest different solutions for real-life problems.

Second Part: The External Factors

Practical intelligence cannot be separated from the context in which it is activated and developed. Diverse environments create a wide range of cognitive demands. Experience in a particular context might not be transferable to another. People who are successful in solving real-life problems in a particular context may not be able to solve these problems in another context. Further, different problems within a particular context have differing degrees of complexity and structure that influence how people solve them. In this part, I discuss two related aspects of the external factors: (a) types of contexts and (b) types of problems and their influence on practical intelligence. My review of the literature in this part is designed to provide a general theoretical foundation and empirical findings about how external factors are related to people's performance on real-life problem solving.

The Context Factor

Intelligence and problem solving abilities have been perceived by scholars as functioning within a particular context (Ceci, 1996; Sternberg et al., 2000). Contextualists, when studying intelligence and problem solving, take into account the role of a particular setting in how problem solving abilities are developed. Contextualists have different positions on how intelligence is developed; at one extreme, theorists reject the assumption that a particular cognitive construct exists across cultures, while in a less extreme view, theorists argue that intelligence as a construct can be studied across different cultures because it shares common cognitive properties (Sternberg et al, 2000). I think intelligence is a complex construct that is very sensitive to environmental as well as experiential trajectories offered in a particular context that fosters or inhibits its growth.

Scholars do not have a clear definition of context. In one view, context is defined as "any environmental stimuli that determine behavioral response" (Jaeger & Rosnow, 1988, p. 66). In another view, context is all physical, social, and cultural attributes that influence and shape an individual's cognition. A broader view of a context is what Sternberg (1985a) refers to as "a full set of environments in which individuals live"(p.

329). These extreme perceptions of the context have led many to criticize contextualists for not making clear what they mean by this term (Sternberg et al., 2000). Despite the ambiguous use of the term, contextualists contend that problem solving abilities are highly influenced by experiences and opportunities that are offered in a particular context. That is, any variation in these types of opportunities will result in different responses.

Contextualists make several assumptions about how intelligence is developed in a particular context. First, they assume that different demands posed by different contexts shape how people perceive and interpret these demands and consequently adopt strategies to respond to these demands. Second, strategies that accomplish adaptation differ across various contexts. For example, norms in a culture usually define adaptive behaviors. Third, strategies for adaptation also differ across individuals. Fourth, the effectiveness of solving real-life problems is determined by interaction between individuals and the context with which they interact (Berg & Calderone, 1994; Sternberg, 1985a). These assumptions emphasize both the role of cognition and the role of the context. Nevertheless, how context influences individual cognition has further elucidations.

The influence of the context on intelligence development is depicted at different levels of context. First, Ceci (1996) argued that different environmental demands are associated with different developmental patterns of individuals' abilities. Cultures may emphasize collectivism or individualism of problem solving (Meegan & Berg, 2002). Ceci elaborated that cultural context is an integral part of cognition, because the cultures control the types of events that affect cognitive development. Each culture presents limited experiences that people interact with where the development takes place (e.g., workplace, occupation, family). Further, Klaczynski (1994) stated that social institutions within a particular environment place various demands on individuals in different life spans that occur throughout the life course. People are confronted with compelling and conflicting necessities that impel them to negotiate and modify their practical intelligence for reconciliation. Meegan and Berg argued that the absence of formal schooling in late life showed that adult's cognition is developed through to the collaboration between individuals in a particular context and time. Therefore, life-span developmental history may contribute to people's performance on real-life problem solving. In the following, I discuss evidence of the influence of particular contextual aspects on cognition.

Empirical Support

Berry and Irvine (1986) proposed a four-level model to conceptualize context. At the highest level is the ecological context (e.g., cultures, social values, belief systems, professions, and traditions). At the second level is the experiential context of an individual (e.g., education, work, and experience). At the third level is the performance level that is bound to a particular behavior in a particular context that is stimulated by a problem, perception, competencies, and problem solving strategies. At the lowest level is the experimental level that is controlled by researchers. At this level, researchers try to manipulate particular variables to determine their contributions to the dependent variable. At each level, I found reports that the problem solving competencies of individuals were influenced by any variation at any context level as proposed by Berry and Irvine.

The researchers of the following studies employed quantitative methods to reveal the role of context in problem solving (see Table 2.15). Participants in the following studies were from different occupations and different ages. The researchers used real-life problems in different domains, including illness problems, race forecasting, and computer games.

Table 2.15

Review of the Studies of Context and Problem Solving

Study	Participants	Instruments	Analyses	Conclusions
Wagner & Sternberg (1985)	127 participants	Tacit Knowledge Inventory	Correlations	Groups from dissimilar occupation differ in performance on the tacit knowledge scale
Ceci & Liker (1986)	110 men attendees at a race track	Racing fact test Predict horses' post-time odds Wechsler Adult Intelligence Scale	Correlations	Superior handicapper did not perform well on stock market types of problems
Cohen (1996)	24 preschool children	Problem solving task	ANOVA	Children were able to solve problems that were embedded in "play store", which exceeded their age

For example, at the ecological level, the ability to perform well on real-life problem solving was investigated in relation to experience in the workplace by Wagner and Sternberg (1985). They investigated practical intelligence in a sample consisting of 127 participants in different institutional contexts, including business managers, business graduate students, and undergraduate students. The groups differed significantly in the type of knowledge they possessed about business ($p < .0001$). The findings showed support for the idea that practical intelligence might have different developmental trajectories, and that experience and age played an essential role in solving real-life problems. At the experiential level, Ceci & Liker (1986) investigated the performance of handicappers in the stock market. The sample consisted of 110 participants. They found that superior problem solvers (race track handicappers who used a complex algorithm model to solve a complex problem) could not transfer their expertise to stock market problems. At the performance level, Cohen (1996) studied the impact of the context on three to five year-olds' performance in math, and found that when mathematical concepts were embedded in the "play store" context, children were able to solve math problems. School children had no problems in solving traditional math problems (e.g., 4+9=), but they were less able to solve the same problem in different contexts (e.g., supermarket). Street vendors solved real math problems better on the street than they did in academic setting (Carraher, Carraher, & Schliemann, 1985). At the experimental level, when researchers changed the context (laboratory vs. video game) as a factor, performance differed as a result (cited in Ceci, 1996).

The findings of the previous studies generally provide support for the thesis that a trivial differentiation in the context level will result in differences in performance. Scholars perceive context as a very complex factor that influences an individual's ability to perform on real-life problem solving (Carraher et al., 1985; Ceci, 1996; Sternberg, 1985a; Sternberg et al., 2000). As supported by the results of the preceding studies, the influence of the context on problem solving abilities was obvious. However, what if the context is held as a constant and different types of problems are presented to individuals within the same context? Hereafter, I discuss the role of problem complexity and structure in problem solving.

Problem Type

The structure of a problem is another factor that facilitates or holds back an individual's ability to perform on real-life problem solving (Wenke et al., 2005). Several models exist to illustrate how problem structure is conceptualized. In my analysis of the literature, I find two main criteria that dominate the classification models: complexity and certainty. The complexity models account for the level of difficulty of a problem, whereas the certainty models take into consideration to what extent the problem is defined and thus has a clear goal.

Early scholars thought that degree of complexity was an important criterion to determine how well a problem is structured. They perceived complexity as the number of elements and interactions between these elements in a problem. According to this model, a problem is perceived as complex if many variables and elements are associated with it. For example, memorizing a name of a place is considered to be a simple problem because it involves few elements (e.g., an individual's ability, familiarity, maturity) whereas preventing an epidemic disease is considered a complex problem because it is influenced by many factors. Lately, scholars have realized that reliance on the number of elements in a problem is not enough to define its complexity. A qualitative criterion in addition to the quantitative one should be considered (Schoderbek, Schoderbek, & Kefalas, 1985). Therefore, not only the number of elements in a problem is taken into account, but also the attributes of each element as well. The attribution component refers to whether a particular element's behavior or function is predictable. According to this view, a conflict between two people is considered to be a complex problem because peoples' behaviors often are unpredictable. In contrast, a failure in a factory plant's unit, regardless of the complexity of the system, is perceived as a simple problem. Denny, Pearce, and Palmer (1982) argued that the complexity of problems is associated with performance. The more complex the task, the more mental performance is required and probably the outcome is less proficient. In other words, the less complex the problem is and the more experience an individual has with the task, the more s/he will be proficient and efficient in the solution. Complexity of problems can be depicted along a continuum from simple to complex. Nonetheless, complexity is hard to pinpoint because it is also a relative concept.

Certainty pertains to how well a problem is defined. If a problem is clearly defined and structured in a manner that a problem solver has to work directly to find a method and a solution, this class of problems is called well-structured problems (e.g., 4-3=). If a problem is not well-structured and has to be defined in the first place, that type is called ill-structured (e.g., __Δ__=10). Problems can be ranged from well-defined to ill-defined. Most importantly, scholars argue that real-life problems are types of ill-structured problems. Some scholars insist that increasing the uncertainty of a problem results in increasing the complexity. Thus, an ill-structured problem is considered by many as a complex one.

An evolving applicatory model based on the framework of Getzels and Csikszentmihalyi (1967), that integrates both complexity and certainty, was developed by Maker and Schiever (2005).They developed an educational model for classifying problems to help teachers make a proper transition between textbook problems and real-life problems as well as serving researchers to devise effectively assessment instruments. In this model, the authors classify problems based on whether a problem, method, and solution are known by the presenter or the solver. The continuum consists of six different types ranging from well-structured to ill-structured problems.

Collectively in these studies, scholars emphasize one concept: problems do not have the same degree of structure. With regard to practical intelligence, many emphasize that real-life problems are more complex, ill-structured types with distinctive features than are problems included in traditional intelligence tests (Ceci, 1996; Neisser, 1976; Richardson, 2002; Sternberg et al., 2000). Therefore, problem solving ability is influenced not only by an individual's ability, but also to a great extent by the problem structure and complexity.

Even though several models exist to classify problems, well-structured and ill-structured types of problems are the most prominent categories in the field of psychology. Well-structured problems are characterized by scholars as: (a) having a definite goal with a stated problem; (b) having only one solution; (c) using a definite criterion for the solution; (d) prescribing a procedure to achieve a particular solution; (e) including all elements of the problem, and involving a limited number of rules that govern the problem in a specific domain of knowledge (Maker, 2005; Schraw et al., 1995; Shin et al., 2003; Sinnott, 1989; Volkema, 1988). Examples of these types are textbook problems, multiple choice questions, and most standardized test items.

By contrast, ill-structured problems are characterized as: (a) having an unclear goal and needing to be formulated; (b) having multiple solutions and possible alternatives or no solution at all; (c) possessing multiple criteria for evaluating solutions; (d) requiring multiple procedures to reach a solution; (e) presenting uncertainty about which rules, concepts, and constraints are necessary for the solution; (f) having conflicting assumptions, evidence, and opinions; and (g) requiring solvers to develop a convincing argument for the solution. These types of problems, for many, are examples of what people encounter in daily life at home, in social life, in the workplace, in their profession, and in the global community. For example, how to control nuclear programs in the global community is an example of an ill-structured problem.

Empirical Support

Theoretically, many scholars argue that ill-structured problems trigger different cognitive processes from those of well-structured ones. Some argue that well-structured problems evoke convergent thinking and ill-structured problems activate divergent thinking. Empirically, researchers have confirmed these hypotheses. In the following, I provide empirical evidence from different cognitive approaches to pinpoint this dichotomy.

Researchers of the following studies employed quantitative techniques to investigate different problem types in problem solving (see Table 2.16). Statistical procedures used were correlation, ANOVA, and a multiple regression model. Instruments were scales, questionnaires, hypothetical ill-structured problems, the WAIS and EEG. Participants in these studies were students of different ages and college students. The sample sizes were high for two of the studies. In general, the studies focused on both well- and ill-structured problems with different degrees of complexity.

Table 2.16

Review of the Studies of Problem Types and Cognitive Competencies

Study	Participants	Instruments	Analyses	Conclusions
Shin et al. (2003)	112 ninth-grade students	Scientific methods for problem solving Well- and ill-structural problems instruments Scientific attitude	A multiple regression model	Different problems require different cognitive competencies
Muammar et al. (2004)	3434 students from the first-grade to the eleventh-grade	DISCOVER Spatial Assessment	Correlation	Performances on different problems in the Spatial Analytical Assessment were not highly correlated. Performance on open-ended problems and closed-ended problems required different cognitive competencies

Table 2.16–*Continued*

Study	Participants	Instruments	Analyses	Conclusions
Jaušovec (1997)	26 students-teachers	EEG Well- and ill-defined problems	Multiple factors ANOVA	Different problem structures entail different cognitive processes
Jaušovec & Jaušovec (2000)	27 students-teacher	EEG Open-ended problems Closed-ended problems	ANOVA	Different problem types activate different brain regions

From a cognitive psychology point of view, Shin et al. (2003) investigated the cognitive skills that are required for solving well-structured and ill-structured problems in science. The dependent measures were students' performances on three types of problems: a well-structured problem, an ill-structured problem in a familiar context, and an ill-structured problem in an unfamiliar context. The independent variables included an inventory of metacognition skills and justification skills (e.g., developing arguments). A multiple regression procedure was implemented to determine the contribution of each independent variable to the variance of solving different types of problems. Justification skills were significant predictors for performance on well-structured problems ($\beta = .43$, $t = 5.64$, $p < .0001$). Justification skills also were significant predictors of performance on ill-structured problems in a familiar context ($\beta = .46$, $t = 3.88$, $p < .0001$). Lastly, justification skills, ($\beta = .32$, $t = 4.30$, $p < .0001$), and regulation of cognition, ($\beta = .20$, $t = 2.70$, $p < .01$), were significant predictors of performance on ill-structured problems in an unfamiliar context. The authors argued that well-structured problems require justification skills and may not require metacognitive skills. By contrast, ill-structured problems require justification skills and regulation of cognition, including planning and monitoring skills, especially in an unfamiliar context, due to uncertainty in the situation. Shin et al. concluded that if the problem is not structurally complicated enough, students may not use their regulation of cognition or metacognition to solve the problem.

Muammar, Maker, and Kuang (2004) carried out a correlational study on students' performances on different tasks in a spatial analytical domain. The sample consisted of 3434 students from different grade levels, K to 12. Based on the theoretical framework of the problem continuum proposed by Schiever and Maker (1991), spatial analytical problems ranged in structure from type I (i.e., well-structured) to type IV (i.e., ill-structured) in the DISCOVER assessment. The Pearson correlation coefficients between performance on well-structured problems and ill-structured problems for all group levels were statistically significant and ranged from low to moderate correlations for different group levels (K-2, r [1307] = .252, $p < .01$, 3-5, r [1319] = .426, $p < .01$, 6-8, r [581] = .230, $p < .01$, 9-12, r [227] = .239, $p < .01$). These results showed that even in a very specific domain (e.g., spatial analytical), students' performances on different types of problems were not highly correlated.

Other evidence came from neuropsychological studies, Jaušovec (1997, 2000) carried out a series of studies to investigate the differences in brain activity when solving well and ill-structured problems in relation to brain activity using an electroencephalogram (EEG). He found that ill-structured problems evoke different cognitive processes than well-structured problems. Jaušovec (1997) also investigated the different cognitive processes people used when they solved well and ill-structured problems by measuring EEG activity. In the first experiment, Jaušovec predicted that the solution of an ill-defined problem would demand greater mental activity (less alpha power) than the solution of well-defined problems. Four different problem types were presented to a sample of 26 participants. These problems were classified according to their degrees of structure as follows: (a) closed-problem and closed solution calling for convergent or logical thinking, (b) open-problem and closed-solution (e.g., insight problems), (c) open-problem and open-solution, and (d) closed-problems and open-solution. The last two problems evoke divergent thinking and call for creative thinking. No significant difference was found between different types of problems, $F(3, 25) = .81$. Furthermore there was no significant interaction between performance on different types of problems and different locations in the brain.

The results of this study provoked the researcher to investigate the role of different problem types on lower-order cognitive processes. In the second experiment, Jaušovec (1997) divided the problem solving strategy into sub-cognitive processes including (a) reading the problem, (b) selecting information, (c) planning the solution, and (d) solving the problem. Insightful findings were uncovered. A significant effect of reading the problem [($F(1,24) = 5.31$, $p < .03$, $\eta^2 = .18$] and a significant effect of planning the solution [$F(1,24) = 9.22$, $p < .006$, $\eta^2 = .28$] were found in solving ill-structured problems. Further, a significant interaction between the type of problems and different brain locations was deduced [$F(15, 360) = 4.27$, $\eta^2 = .15$, $p < .0001$] when solving ill-structured problems. These results showed that ill-structured problems provoked a higher mental activity in reading and planning solutions. By contrast, a reversible pattern of the previous results was observed during solving well-structured problems. A significant main effect was found favoring the solution stage for a well-structured problem versus an ill-structured problem [$F(1,24) = 4.95$, $p < .036$, $\eta^2 = .17$]. These findings indicated that higher-order cognitive processes were associated with complex problems. The results indicated that an ill-defined problem was more demanding during the preparation stage of solving the problem (e.g., reading and planning) than was a well-defined problem. Well-defined problems required more cognitive efforts during the solution phase. In addition, ill-structured types of problems activated more brain regions than well-structured types. The author concluded that different types of problems trigger different cognitive processes. Further, the effect size of the metacognitive component was relatively high ($\eta^2 = .28$).

In 2000, Jaušovec explored cognitive processes that involved solving different types of problems using the same method (EEG). Participants in this study consisted of 49 student-teachers in a psychology class. The researcher classified the participants into four groups based on their creative ability (Torrance creativity test) and their intelligence (WAIS): gifted, possessing high IQ and high creativity; creative, possessing high creative ability but average IQ score; intelligent, possessing a high IQ score but average creative ability; and average possessing an average IQ score and average creativity. Participants in the first experiment were exposed to two levels of complex problems; a transportation problem and a plan-a-day problem. These problems matched real-life problems but called for convergent and logical thinking and they were described as closed problems with closed solutions. Jaušovec predicted that the pattern of EEG activity would differ in relation to intelligence and creativity for solving closed-ended problems. The General Linear Model (GLM) was conducted for the transportation problems. The results showed a significant interaction effect between different brain hemispheres, location (different areas in brain), and creativity [$F(7,315) = 3.27$, $p < .018$, $\eta^2 = .07$] and a significant interaction of complexity, location, and intelligence [$F(7,315) = 3.26$, $p < .01$, $\eta^2 = .07$]. The GLM for the plan-a-day problem revealed a significant interaction between the level of creativity and the hemisphere [$F(1,45) = 4.41$, $p < .041$, $\eta^2 = .09$] and the level of creativity, hemisphere, and location [$F(7,315) = 3.97$, $p < .009$, $\eta^2 = .08$]. A significant interaction was found between the level of intelligence, complexity, and location [$F(7, 315) = 4.09$, $p < .01$, $\eta^2 = .08$]. The results supported the hypothesis that to a greater extent the EEG patterns differed in relation to the level of respondents' intelligence and were less influenced by the level of creativity when solving closed-ended problems. A trend was observed in that gifted and intelligent individuals displayed less mental activity than average and creative individuals.

In the second experiment, the sample consisted of 48 student teachers who were divided into four groups, as in the first experiment. The EEG was observed while participants were solving four open-ended problems with two levels of complexity. The author argued that these types of problems called for discovery and divergent thinking processes. The same statistical procedure was implemented in this study. For the transportation problem, a significant effect was found for level of creativity [$F(1,44) = 25.23$, $p < .0001$, $\eta^2 = .50$] and a significant interaction effect between creativity and type of problem [$F(3,132) = 3.00$, $p < .044$, $\eta^2 = .06$] and level of creativity and location [$F(21,924) = 3.59$ $p < .006$, $\eta^2 = .08$]. The between group factor, level of intelligence, had a significant interaction effect with hemisphere [$F(1,44) = 5.02$, $p < .03$, $\eta^2 = .10$] and an interaction was found between hemisphere and level of creativity [$F(1,44) = 7.10$, $p < .01$, $\eta^2 = .14$]. The results indicated that creative people showed less mental activity than did average individuals for all 19 locations in the brain for both problems. Gifted and creative individuals showed higher power (less mental activity) than did average and intelligent students.

The results for both experiments suggested that the neurological activity displayed by individuals with different abilities, including intelligence and creativity, differed while solving open or closed-ended problems. In both cases, less mental activity was related to higher creativity and/or higher intelligence. However, creative individuals showed greater cooperation between brain areas than did gifted ones who showed decoupling of brain areas. That is, open-ended problems are associated with greater brain functionality. In sum, the structure of problems may facilitate or hinder an individual's problem solving abilities.

The methods of the above mentioned studies included several limitations. The Muammar et al. (2004) study included problems that ranged in difficulty levels; however, these problems have not been ordered from the easiest to the hardest in the spatial analytical assessment. This order might influence the performance on the spatial tasks of the DISCOVER Assessment. The population of this study was from school-age students and did not include adults. In the Jaušovec's (1997, 2000) studies, the EEG measures of brain activity does not reveal the content of cognitive processes, only the time of activity and brain area. Further, the sample sizes of his studies were relatively small and not diverse. Most importantly, Jaušovec hypothetically developed the steps of solving both well- and ill-structured problems. These steps have been inserted forcefully on how participants solve the problems.

In the previous studies, authors showed that different structures of problems evoke different cognitive competencies. However, one of the previous studies took the problem structure as a covariate into account and isolated this aspect from performance on problem solving. Also no one used this aspect as dependent measure. I believe that this factor should be included as a covariate as well as the familiarity with problems when looking at practical intelligence. As a whole, the studies presented in this section indicated that people performed better with tasks similar to their experience and on less complex problems in a familiar context. These aspects apparently indicated to some degree the role of the external factors in problem solving. Finally, familiarity and complexity were found to be critical aspects of an individual's ability to deal with real-life problems.

Third Part: The Experiential Factor

The experiential factor that accounts strongly for people's performance on real-life problem solving is a product of an optimal interaction between the internal competencies and the external opportunities offered in a particular context of one's life span. According to Sinnott (1989), intelligence is a function of an individual's particular affective, cognitive, physical, and biological characteristics interacting with cultural values and socio-cultural institutions. The experiential factor, in my opinion, is what people frequently capitalize on when encountering different situations. This concept may be manifested in longevity, maturity, experience, and wisdom. The arbitrary separation I made for the internal and external factors in the previous sections does not depict accurately practical intelligence functions. However, the separation was made only to help readers in understanding the phenomena. In this section, I present several theoretical frameworks and empirical research findings to conceptualize the experiential factor.

Sternberg (1985a) proposed the experiential subthoery in his Triarchic Theory of intelligence. This subtheory takes into account two major aspects of intelligence development from the cognitive psychology point of view: (a) the ability to deal with novel tasks and situational demands, and (b) the ability to automatize processing of information. Sternberg contends that the ability to think is not merely to work with learned concepts, but the learning of new concepts is what accounts for intelligence. The process of dealing with new tasks in this subtheory is controlled by a global processing, including planning, monitoring, and revising strategies that direct lower-order processes. In that, he emphasizes the role of the metacognitive competencies in intelligence. During processing information of novel tasks, people rely on global processing competencies. By contrast, when people work on tasks similar to previous experience, they rely on automatic and local processes. With tasks in which people have little experience, they use greater metacognitive effort. As experience and expertise develop with a particular task, people use less effort on global processing and greater transfer to local processing that with time has become automated.

In another theoretical framework, Denney et al. (1982) proposed a problem solving model of the development of intelligence across the life span. This model is influenced by the contextual approach of studying intelligence. Denney's model accounts for the differences in the ability of adults to solve practical problems. The most important point in this model is that he makes a distinction between unexercised potential and the exercised potential of individuals in solving problems. The unexercised potential refers to performance levels that result from the absence of training on tasks. The exercised potential is related to a proficient level of performance that is an outcome of higher levels of practice. Therefore, late adulthood effective problem solving ability in real-life situations is influenced by a higher level of practice with particular problems in a specific context.

These models explain how intelligence developed in adulthood. The main assumption that can be extracted from these models is that intelligence is a developing construct that is to a great deal influenced by opportunities that are offered to a particular individual in his/her life span. The greater exposure to problems in a specific field and deliberative training significantly improve intelligence functions. The enhanced problem solving ability for adults and experts consequently is a result of an experiential factor that they have developed over time by practice. This tenet is slightly consistent with the expertise model that Benner (1984) proposed when she explained the role of experience and longevity in problem solving.

Empirical Support

Age seems to be a critical factor in explaining practical intelligence. Older adults are reported as superior in solving real-life problems even though their IQ scores declined. Scholars studied problem solving as a function of aging in different contexts. They provided us with enlightenment of adults' behaviors in comparison to younger people.

Researchers in the following studies investigated age in relation to problem solving. Both quantitative and qualitative methods were employed in the following studies (see Table 2.17). Statistical procedures were *t*-tests, correlation, ANOVA, and a multiple regression. Instruments of practical intelligence in the following studies included different scales, questionnaires, hypothetical well- and ill-structured problems, neuropsychological batteries, and IQ tests. Participants in these studies were children, School-age students, adults, and older people. The sample sizes were high in three studies.

Table 2.17

Review of the Studies of the Role of Age and Practical Intelligence

Study	Participants	Instruments	Analyses	Conclusions
Crawford & Channon (2002)	30 older adults	Real-life awkward situations Neuropsychological battery	*t*-test ANOVA	Older people provided more quality solutions than younger group
Berg (1989)	217 fifth, eighth, and eleventh-grades students	Practical Intellectual Assessment Questionnaire Everyday Problem Questionnaire	Multiple factors ANOVA	Strategies were perceived differentially effective by different age groups Younger people adopted adults' strategies in solving problems
Berg et al. (1998)	480 participants	An interview Open-ended assessment of: Problem definitions, strategies	Chi-square Logit model	Significant difference in how people define problems

Table 2.17–*Continued*

Study	Participants	Instruments	Analyses	Conclusions
Blanchard-Fields et al. (1997)	282 participants	Everyday Problem Solving Attribution and appraisal ratings of everyday problems Familiarity Ratings	Multiple factors ANOVA	Significant age differences were found between four age-groups Different age groups perceived and solve the problems in different ways
Kanevsky (1990)	89 children ages 4 and 5	Tower of Hanoi Puzzle	Quantitative analysis includes repeated measures design Qualitative Analysis	Significant interaction was found between age and the task used in this study Older children generalized problem solving more than younger children

Table 2.17–*Continued*

Study	Participants	Instruments	Analyses	Conclusions
Owsley et al. (2002)	173 participants	Rey Auditory-Verbal Timed Instrumental Activity of Daily Living (TIADL) Primary Mental Ability Basic Skill Task	Multiple regression model	Only processing speed was associated with performance on TIADL. Older adults with slow processing speed required longer time to complete the task

Crawford and Channon (2002) predicted that older people, with their enhanced experiences and real-life knowledge, would perform better than younger adults on real-life problem solving. Participants in this study were 60 individuals from two age groups. The first group consisted of 30 individuals between age 60 and 80 ($M = 68.27$), and the second group included 30 participants between age 19 and 37 ($M = 25.27$). The age difference was relatively large. The dependent measure included eight different scenarios involving everyday awkward situations. Each was designed to measure an individual's ability to generate solutions and make judgments about the solutions. Results showed that older people produce fewer solutions than younger people [$t(58) = 4.05$, $p < .0001$, $d = 1.05$]. However, older peoples' solutions reflect a higher quality for two different criteria: (a) average of problem appreciation [$t(58) = 2.48$, $p < .05$, $d = .64$]; and (b) social appropriateness [$t(58) = 3.45$, $p < .01$, $d = .89$]. The quality index was calculated based on the rate of quality divided by the total number of ideas given. The older group reported higher satisfaction with their solutions [$t(58) = 2.94$, $p < .005$, $d = .76$]. On the problem solving task, older adults provided fewer varieties but more quality solutions. Both groups performed at a similar level when asked to rank their alternative solutions. The authors concluded that the greater life experience of older people was the biggest contributory factor in maintaining real-life problem solving performance mediated by enhanced knowledge structure or more efficient access to and use of such knowledge.

In a different study, Berg (1989) addressed the age differences and students' profile of knowledge of strategies as elements of the problem solving strategies they use. Students' strategy knowledge increased significantly with age [$F(2, 193) = 10.72$, $p < .01$,

$\eta^2 = .10$], which reflects more consistency with parents and teachers strategy knowledge. Correlation between students and teachers was .21, $p < .01$, students and parents was .27, $p < .01$, and between parent and teachers was 0.39, $p < .01$. That was also evidence that adults in different contexts, whether experts or mature adults, have different approaches to solving real-life problems. The researcher concluded that as they progressed in age, children adopted adults' problem solving strategies. In a larger sample with different age groups, Berg et al. (1998) examined the age differences in how individuals defined problems. They also examined individuals' problem definitions as indexed by problem solving goals. The sample consisted of 480 individuals from different age groups: (107 preadolescents, average age $M = 10.09$; 124 college students, $M = 21.91$; middle aged adults, $M = 48.17$; & 131 older adults; $M = 73.7$). The dependent measures included open-ended problems where participants were asked to describe everyday problems they had experienced in general and in particular domains including family, friends, health, school, work, or leisure. Then, participants were asked about the problem solving strategies they used to resolve the problems. In the general domain of problems, the results showed significant age differences in how groups defined everyday problems. For example, the preadolescents' strategies involved self-action that was observed more frequently than cognitive regulation. For college students and middle aged adults, strategies that involved self-actions were less likely to be reported and strategies involving cognitive regulations were reported more frequently. The strategy and goal association indicated that strategies varied significantly according to the nature of individuals' goals. When individuals' goals, interpersonal concerns, or competence and interpersonal concern were included, individuals were less likely to report self-action and more likely to report regulation or inclusion of others. When individual goals included competence concerns, they were less likely to report strategies for regulating or including others. When individuals' goals involved neither competence nor interpersonal concerns, individuals were most likely to report self-action. In sum, both age and goal influence problem solving strategies. In the specific domain of problems, the interaction between strategy and domain of problem indicated that when problems occurred in the family, individuals were less likely to report self-action. When problems occurred in the friend domain, individuals were more likely to report regulating or inclusion of others. For problems that occur in the health domain, individuals were more likely to report self-action and less likely to report regulation or including others.

Blanchard-Fields et al. (1997) examined qualitative age differences in everyday problem solving in interpersonal and social situations as well as in more instrumental situations. The researcher expected to find age differences in everyday problem solving strategies. Participants in this study consisted of 282: 66 adolescents between the ages of 15 and 17 (average age *M* = 16.11), 62 younger adults between the ages of 20 and 29 (*M* = 22.29), 78 adults between the ages of 30 and 44 (*M* = 39.42), middle-aged adults between the ages of 45 and 59 (*M* = 49.67), and 76 older adults between the ages of 60 and 79 (*M* = 68.29). The instrument included the Everyday Problem Solving Inventory (EPSI) that consisted of 24 everyday problems that were evenly distributed into three content domains: consumer problems, managing a home, and resolving conflicts with friends. For each problem, four possible problem strategies (i.e., problem focus; cognitive analysis; passive dependent; avoidant denial strategies) were presented. Participants were asked to rate how likely they were to use each of the four possible strategies. A mixed model ANOVA was conducted, including age group as the between-subject design, and problem domain and problem solving strategy as within-subject design. The results indicated a significant main effect of age and problem solving strategy ($p < .001$). Problem solving strategies interacted significantly with age group and domain ($p < .001$). Further, age group x domain x problem solving strategy interaction was significant [$F(24, 2034) = 4.82, p < .001$]. The detailed analysis of the results showed that in the home management domain, significant age differences were found for all four problem solving strategies: problem focused [$F(3, 344) = 3.26, p < .02$], cognitive analysis strategies [$F(3, 344) = 17.53, p < .001$], passive dependent [$F(3, 344) = 13.65, p < .001$], and avoidant denial [$F(3, 344) = 2.85, p < .03$]. The results indicated that middle aged and older adults endorsed problem-focused strategies more often than adolescents. In addition, both adolescents and younger adults endorsed significantly more passive dependent strategies than the three older age groups. In the consumer domain, the researchers found similar results to the home management domain. A significant age differences was found for all four problem solving strategies: problem focus [$F(4, 344) = 3.93, p < .004$], cognitive analysis [$F(3, 344) = 3.17, p < .02$], passive dependent [$F(3, 344) = 3.18, p < .02$], and avoidant denial [$F(3, 344) = 4.13, p < .003$]. Adults, middle aged adults, and older adults endorsed cognitive analysis strategies significantly more often than younger adolescents. Adolescents, on the other hand, were significantly more likely to endorse passive dependent strategies than older adults. Adolescents and younger adults endorsed avoidant denial strategies significantly more often than older adults. By contrast, in the friend domain, significant age differences were found only for cognitive analysis [$F(3, 344) = 4.53$, $p < .002$], passive dependent [$F(3, 344) = 22.52$, $p < .001$], and avoidant denial strategies [$F(3, 344) = 3.09$, $p < .02$]. Passive-dependent strategies were endorsed more frequently by younger adults and adolescents than the three older groups. Finally, older adults endorsed significantly more avoidant denial strategies than young adults in the friend domain. Age, again, remained a significant predictor above and beyond the effects of all other variables. The results of this study showed that older adults are more proactive than passive when dealing with instrumental situations. Further, middle aged and older adults did have the advantage of accumulated experience in the consumer oriented situations.

In another study, Kanevsky (1990) explored age related differences in how children generalize problem solving strategies. The results showed significant interaction between age and task [$F(1,82) = 10.12$, $p < .01$, $\eta^2 = .11$]. This result indicated that the accuracy of solution increased with age and that older children outperformed younger children. The qualitative analysis of the data showed that younger children accepted help more frequently than older children. The author concluded that generalization of learning from task to task depended on ability, age, or both. Even though the margin of age between the two groups is relatively small, older children were more effective in generalizations than younger children.

The aforementioned studies showed consistent results. In one sense, researchers agreed to the extent that problem solving in adulthood takes different forms than adolescent or younger people. In another sense, adults tend to consider more aspects and criteria in solving real-life problems and, consequently, reach more effective solutions to different problems in different contexts. However, another line of research showed that adults' ability to solve problems decreased with longevity.

In contrast to the previous studies, other scholars reported a slump in problem solving ability in adulthood. For example, Owsley, Sloane, McGwin and Ball (2002) conducted a study to determine whether various aspects of cognitive functioning were associated with everyday performance. Participants consisted of 173 older adults between the ages of 65 and 90. The three cognitive processes, memory, reasoning, and visual processing speed, were assessed using different psychological measurements. Everyday performance variables were measured by the Timed Instrumental Activity of Daily Living (TIADL) that included several basic daily life activities. Implementing a multiple regression model, the results showed that after controlling for demographic variables only speed processing was a good predictor of performance on TIADL. The authors concluded that older adults required more processing speed to complete everyday tasks than younger adults people.

Several concerns about the methods of the previous studies should be taken into account with respect to the two trends that were revealed from the preceding studies concerning adult problem solving. First, adults showed higher performance with respect to solving real-life problems. Second, they showed a decline in their ability to solve particular problems. I believe the major source of difference is the type of problems embedded in these studies. In studies that support the superiority of adulthood problem solving ability, problems correspond to real-life situations. They share similar properties, which included complexity, reality, and uncertainty. By contrast, problems associated with a decreased pattern of adult problem solving ability had similar properties—well-structured problems. They were simple, irrelevant to real-life situations, have one absolute answer, and measure the speed of processing. These types of problems by no means are ecologically valid for determining intelligence. The latter studies did not take into consideration the complexity and the ecological validity of real-life problems.

In conclusion, Berg (1992) stated that no developmental theory is available to explain practical intelligence. Age differences in everyday intelligence influence dramatically how people perceived problems and what their goals were in solving them. While younger adults focused on the intellectual aspect of practical problems, older adults tend to consider social and emotional factors. Sternberg et al. (2000) assumed that "if we understand the differences in the ways these tasks are formulated and solved at different stages of development, we will be closer to understanding the developmental dynamics of practical intelligence"(p. 47).

Hypothesis: Older adults outperform younger students on practical intelligence tasks.

CHAPTER III

METHOD

In this chapter, I describe participants included in this study. This section also consists of a general description of the Practical Intelligence Instrument (PII) battery, procedures for developing the PII to measure practical intelligence, and the validity and reliability of the instrument. The author specified the sample size and steps of the administration of the PII. Included hereafter are the statistical hypotheses and procedures that were used to analyze data to answer each research question.

Participants

Participants in this study included a total number of 116: 98 students and 18 employees from an academic institution in the southwestern United States. Volunteers were recruited. Participants included 35 males and 81 females; their age ranged from 18 years and 4 months to 62 years and 6 months (Mean = 28 years and 2 months). The data for this study were derived from a convenience sample. In Tables 3.1, 3.2 and 3.3, the number and percent of the distributions of degree, ethnicity, and majors are shown. The majority of the participants were studying toward a bachelor's degree, were White non-Hispanic, and majored in humanities.

Table 3.1

Number and Percent of Participants' Distribution across Degrees

Degree	Number of Participants	Percent
Bachelors	67	57.8
Masters	18	15.5
Doctoral	20	17.2
Other	11	9.5
Total	116	100

Table 3.2

Number and Percent of Participants' Distribution across Ethnicity

Ethnicity	Number of Participants	Percent
Black/Non-Hispanic	6	5.2
Hispanic	19	16.4
Asian or Pacific Islander	13	11.2
American Indian or Alaskan Native	2	1.7
White Non-Hispanic	71	61.7
Nonresident Alien	3	2.6
Unknown	2	1.8
Total	116	100

Table 3.3

Number and Percent of Participants' Distribution across Majors

Major	Number of Participants	Percent
Humanities	68	58.6
Science	37	31.9
Undecided	6	5.2
Did not indicate	5	4.3
Total	116	100

General Description of the Practical Intelligence Instrument (PII)

The author of this study developed a Practical Intelligence Instrument (PII) through multiple phases to assess two dimensions: cognitive processes and types of knowledge. The first dimensional construct included cognitive processes that operate on complex ill-structured types of problems. The second dimensional construct consisted of different types of knowledge that people capitalize on during the course of problem solving. The PII was designed as a measure of maximal performance to assess an individual's all-out effort. The PII was developed based on a theoretical framework that originated from contemporary theories of intelligence, including the triarchic theory of intelligence, the bioecological theory of intelligence, and theories of expertise.

The PII battery consisted of three major parts (see Appendix A). The first part contained general questionnaire items regarding participants' characteristics: demographic, educational, and experiential traits. The sample's characteristics included personal information, gender, and date of birth. The demographic aspects included ethnicity and state of origin. The educational attainment included degree, major, and grade point average (GPA). The experiential aspects were determined by asking participants whether they were students or employees, levels of familiarity with the topic of prejudice in general, and whether or not participants had an introduction to social psychology or studied the topic of prejudice. Also this part included items regarding a participant's interest in learning strategies to minimize prejudice and discrimination.

The second part consisted of a metacognition subscale (items 21-40). This part also included four problem scenarios. These scenarios were followed by several items pertaining to the following: (a) construct validity of the scenarios (items 42-44, 78-80, 110-112, & 135-137); (b) familiarity with the scenarios (items 46-47, 82-83, 114-115, & 139-140); (c) participants' interest in the problems (items 48-49, 84-85, 116-117, & 141-142); (d) self-efficacy— whether participants believe they can suggest solutions for the problems (items 45, 81, 113, & 138); (e) definitions of the problems (items 41, 77, 109, & 134); (f) assessment of metacognition (items 50-54, 86-88, 118-119, & 143-145); (g) ranking different statements of definitions according to how they relate to the problems (items 55, 89, 120, & 146); (h) proposing different solutions for each scenario, (items 56-57, 91-92, 121, & 147); (j) evaluation of proposed solutions (items 71-76, 103-108, 129-133, & 153-158); and (i) tacit knowledge, (items 58-70, 92-102, 122-127, & 148-152). The last item in this part was related to the difficulty level of the four scenarios (item 159).

The third part consisted of two types of knowledge: declarative and structural. The declarative knowledge part consisted of several items related to different facts and concepts about the domain of prejudice (items 160-179). The structural knowledge part consisted of theories and generalizations in the domain of prejudice (items 180-194). In the following, I explain in detail the development of the PII.

Detailed Description of the Development of the PII

Scenarios

Practical intelligence should be measured with ecologically valid problems (Ceci, 1996; Sternberg et al., 2000). Four different scenarios were adopted from the literature to be used in the current study. These problems mimicked real-life situations that people encounter in daily life. My criteria, when selecting these problems, were the following: (a) a problem should be related to the domain of prejudice; (b) problems should have different degrees of difficulty and complexity; (c) problems should come from different aspects of life and different settings; (d) problems should focus on self and focus on others; (e) problems should be deployed using different media; and (f) problems should vary in the degree of certainty. Based on these criteria, four scenarios were selected as problems to be used in the PII and as means of measuring participants' practical intelligence.

Scenario One: The Ice Cream Shop

This scenario was adopted from Civic Participation and Community Action Sourcebook, Prejudice in a Small Town by Griffith (n.d.). The developer of this scenario demonstrated discrimination in public toward minority people. This scenario may occur frequently in any society and may occur in different ways. Theoretically, the author of this scenario described discrimination against minorities. The purpose for including this scenario was to assess how people respond to prejudice in an action situation as a recipient or witness to the situation. In responding to this scenario, participants have to propose effective solutions to the presented problem. Hypothetically, this scenario was considered about average in its difficulty level in comparison with the following scenarios. This scenario was presented in written form and followed by several items.

Scenario Two: David's Case

This scenario was adopted from a Christian Aid Website. The scenario was centered on racism and poverty in Haiti and the Dominican Republic (Christian Aid, 2006). The developer of this scenario focused on the abuse of needy workers in the workplace. Theoretically, David's scenario is a form of racism that workers face in the workplace. The purpose for including this scenario was to assess how participants respond to this dilemma as recipient or witness of such abuse. Participants had to propose practical solutions for David's problem. This scenario presumably has a higher degree of complexity and difficultly than the previous one. The complexity level is related to several stakeholders being included in this scenario as well as the geopolitical situation in that region. This scenario was presented to participants using a video clip that was posted on the Christian Aid organization website (Christian Aid, 2006). Participants were provided with a link to David's video clip. They were instructed to see the clip prior to answering related questions.

Scenario Three: Appearance in the Workplace

This scenario appeared in the Employment Low Alliance website as a recent study conducted by Hirschfeld (2005). This scenario was adopted from Hirschfeld's study on prejudice based on appearance in the workplace. Theoretically, appearance-based prejudice is a prominent problem at the present time. The reason for including this scenario was to assess how participants could respond to a similar situation if they were victims of this type of prejudice in the workplace. Participants had to provide possible solutions for the problem as if they faced it in the workplace. This scenario is less complicated and difficult than “David’s Case” but more difficult than the “Ice Cream Shop” case. The scenario brings a critical issue to all people. This scenario was presented to participants in written form.

Scenario Four: Stereotyping

A stereotyping topic appeared in a video clip on the internet. This video clip was integrated in to the PII. The characters in the clip mainly talked about stereotyping and its influence on behavior. Theoretically, stereotyping is a frame of mind that might influence people’s behaviors. The purpose for including this scenario was to assess the problem solving ability of people when providing solutions for this problem. Participants had to provide effective solutions for solving stereotyping problems in society. In theory, stereotyping is a complicated problem in any society; however, it has less direct impact on people, such as in David’s scenario. This problem also is more difficult, in my opinion, than the appearance in workplace because it impacts more people. This scenario was presented to participants via a video clip posted on the Yahoo Website. Participants were linked to the stereotyping clip. They were instructed to see the clip prior to answering the related questions.

These scenarios had been validated as being real-life problems. The researcher for the current study developed construct validity items. These items were part of the PII. Both reviewers and participants were asked whether they thought that these scenarios were (a) real-life problems, (b) related to prejudice, and (c) whether this situation is common for people.

The scenarios have different difficulty levels. The reviewers and participants in this study were asked to rank the difficulty levels of these scenarios. They were forced to rank the scenarios' difficulty on a four-point Likert scale and not to use the same score for any two cases. That means each scenario had to have a different specific difficulty level than the others. The difficulty level was used to weight participants' answers in the final analyses.

Practical intelligence was assessed in this study by using participants' solutions for the problems presented in the scenarios. Scoring of solutions that were provided by participants for the four scenarios was based on the expert judgments (see Appendix B). Participants provided an enormous number of solution strategies for the four scenarios. After reviewing these strategies, this researcher grouped these strategies in categories for one important reason: to help experts evaluate a minimal number of strategies, thereby enabling them to compare strategies. Solutions for each item were classified into four groups. Many solutions proposed by participants were similar and therefore, these solutions were united in one category. For the first three scenarios, solution strategies were classified into four groups and each group has several categories. For the last scenario, solutions were classified into two groups. Categories were developed as follows. The first group consisted of strategies directed toward the main character who initiated the problem. The second group consisted of strategies directed toward the main character who was a recipient of the problem. The third group consisted of strategies directed toward the other parties. The fourth group of strategies was directed toward one's self. For example, "The Ice Cream Shop Scenario" categories were (a) solution strategies directed toward the salesman, (b) solution strategies directed toward the family, (c) solution strategies directed toward others, and (d) solution strategies directed toward self. The last scenario consisted only of the third and fourth groups.

Table 3.4

Reviewers' Degree, Major, and College Who Evaluated Solution Strategies

Reviewer	Gender	Degree	Major	College
F	Female	Doctoral Student	Social Psychology	Social Science
L	Female	Doctoral Student	Social Psychology	Social Science
M	Female	Doctoral Student	Social Psychology	Social Science

A team of social scientists, consisting of three experts (see Table 3.4), came together and evaluated the strategies. The author and the three experts held a discussion session to review and develop criteria from the literature for evaluating these strategies. These criteria were (a) feasibility, that is whether a solution is possible to carry out—a score of zero was given to any response when the solution cannot be implemented totally and ten points was given when the solution is easily and realistically implemented; (b) effectiveness, that is whether a solution has a potential for success—a score of zero was given when the solution was not at all effective in solving the problem and ten points was given if the solution response to the problem most likely would lead to a positive outcome; (c) problem appreciation, that is whether a solution demonstrates understanding of the problem—a score of zero was given to any participant who did not demonstrate understanding of the problem and ten points was given to any response that showed a strong understanding and awareness of the root of the problem; (d) social appropriateness, that is the manners used in dealing with the problem—a score of zero was given to any response that was not socially appropriate and acceptable with the conventional norm and social context and ten points was given to any response that demonstrated a highly appropriate and acceptable response for the conventional norms and social context. Then experts assigned an importance rating for each criterion on a scale from least important (1) to most important (10) ways to solve the problem. They rated feasibility as 8, effectiveness as 7, problem appreciation as 9, and social appropriateness as 6. After each category was rated, scores on each criterion were multiplied by the weight of that criterion. Then scores on the four criteria were summed for each solution.

Every participant provided at least one solution strategy for each of the six items. Therefore, a participant was given a score for each strategy s/he provided. Then scores within each scenario were summed. The total scores across the six items were summed to quantify the performance on real-life problem solving—practical intelligence. The total score was influenced by the flexibility of thinking score because the total score of performance on real-life problem solving was a function of the number of strategies provided by an individual. Therefore, the researcher of this study decided to use only the score of the best strategy/solution that a participant provided for each of the six items. Then to take the difficulty level for each scenario into consideration, the score for the best strategy across the six items was multiplied by the difficulty level for each scenario as indicated by the ratings of participants (see Table 3.24). In summary, the sum of the weighted best strategies/solutions for the six items was the total score of a participant on performance on real-life problem solving or the score of a participant on practical intelligence items. I used the total score on performance on real-life problem solving as the score on practical intelligence. These two phrases in the following sections are used interchangeably.

The Cognitive Processes Model Battery

Through the analysis of the literature, I found several cognitive processes associated with people's performance on real-life problem solving. These processes were (a) metacognition, (b) defining a problem, (c) flexibility of thinking, and (d) selecting solution strategies. These processes were contained in the cognitive processes model and the researcher intended to determine their contribution to practical intelligence. In the following, the development of each cognitive processes subscale, the rationale, item format, and scoring methods for these items are described.

Metacognition Subscale

The complexity of measuring metacognition came from theoretical and practical sources. The theoretical concern was related to the lack of an acceptable definition among scholars of metacognition and its functions. The practical concern was related to a method of developing items to measure how people think about their thinking.

Several methods are available for assessing metacognition competencies as proposed by many scholars (e.g., Hacker, Dunlosky, Graesser, & NetLibrary Inc., 1998; Nitko, 2004; Perfect & Schwartz, 2002). The simplest way of measuring metacognition is by asking people how many words they may recall and then ask them to recall them. Other methods include self-report questionnaires, interviews, time allocation, inventories, and think aloud strategies. These methods have been used frequently in the measurement of metacognition with different age groups.

In the current study, metacognition was defined as the individual's ability to plan, monitor and formulate strategies in a problem situation, and to be aware of self and cognition in solving a problem. Two different methods were used to measure metacognition. In the first method, the researcher adopted Wells and Cartwright-Hatton's (2004) metacognition scale. The adopted version consisted of 20 questionnaire items (see Appendix A). The first 10 items were focused on *cognitive confidence* and the second 10 items were focused on *cognitive awareness*. In the second method, 13 items were used to measure individuals' awareness of their own cognition and problem solving ability. These items were performance-like items. The 13 items were distributed across the four different scenarios. The assumption of measuring metacognition was that people who are aware of their own thinking would perform better in solving real-life problems than those with less awareness. Further, knowledge about problem solving strategies could facilitate an ability to solve problems. In this study, the researcher used the above two methods for two reasons; first, performance-based items are effective in measuring performance more than questionnaire scales because questionnaire scales as indicated by Shultz and

Whitney are easy to fake (Shultz & Whitney, 2005). Second, the adopted questionnaire subscale was used in this study as a backup plan, in case performance items did not have high reliability.

In the development of the performance items to measure metacognition, two major aspects of this construct were the focus: problem solving competencies and awareness of cognition. In problem solving competencies, items were developed to reveal peoples' perception and understanding of how to approach and solve a problem. For example, one item was related to intervention. In the situation participants were asked to select from many options which ideas and actions they might consider for a particular situation (see item 86, Appendix A). This item was developed to measure planning an action and to select relevant and to exclude irrelevant information. Another item to measure problem solving competencies was to sequence an abstract form of problem solving steps (see item 88, Appendix A). Awareness of problem solving strategies should enable an individual to sequence the steps and put them in the correct order. Additionally, to make these items more difficult, participants were asked to choose only what applies from the options.

Table 3.5

Number and Percent of Metacognition Items in the PII

Metacognition	Number of Items	Percent
General items	20	58
The Ice Cream Shop	5	15
David’s Case	3	9
Appearance in the Workplace	3	9
Stereotyping	3	9
Total	34	100

The metacognition subscale’s items had different formats. First, the 20-item subscale was on a four-point response Likert scale (e.g., 4 = Always, 3 = Most of the time, 2 = Sometimes, and 1 = Rarely), in which participants had to rank how frequently a specific behavior occurred. The 13-item subscale consisted of two types. First, two items were focused on planning an action by selecting appropriate alternatives that fit the situation properly. Second, eleven items were focused on sequencing different action steps, ordering them as they should occur in the mind or in the situation.

Scoring of metacognition subscales was based on different methods. First, scoring the 20-item Likert subscale was based on the sum of scores that participants indicated for each behavior. Some items were on a reverse scale and therefore were subtracted from 5 (items 25, 28, 29, 30, 31, 37, 40). For the 13-item subscale, two different scoring methods were used for the two types of metacognition items. First, for selecting options among many alternatives, if a participant selected the correct option, s/he was given one point. If an individual did not select the wrong option, s/he also got one point. Second, for sequencing items, scoring was based on the multiplication of the correct option order by the participants’ order. For example, suppose that the correct sequence for one item is 1, 2, 5, 4, 3. If a participant provided the correct sequence 1, 2, 5, 4, 3, then the score was calculated as follows; multiplication of the correct sequencing numbers by the participant sequencing numbers. That would be 1, 4, 25, 16, 3, and the sum of these numbers would be 49. For example, if a participant totally reversed the sequence, s/he would get the lowest score, or 35 points.

Defining a Problem Subscale

Scholars believe that problem definition is an important predictor of solution strategies (Berg, 1989; Berg et al., 1998; Klaczynski, 1997; Sternberg et al., 2000). However, not much research has been focused on problem definition. In this study, defining a problem process was defined as the process in which the problem solver had to specify the goal that focused his/her efforts to solve the problem. From a theoretical background, defining a problem results from an interaction between the internal and the external world of an individual. An individual might define the same problem in two contexts differently because not only has the external world changed but also the internal world. Defining a problem is subjective reality possessed by individuals. The purpose of measuring how people define a problem in this study was to investigate the role of this process in practical intelligence.

The researcher developed two methods to measure how people define a problem. First, four open-ended items were developed to assess how in general participants define a problem. For example, a participant was asked: in one statement, define the problem that you read in the scenario. Participants had to write how they perceived the problem in each scenario in one statement. Second, six different problem statements were developed for each scenario and participants were asked to rank them from the most relevant to the least relevant to the problem. That was another way to measure defining a problem. The proposed definitions were developed based on the following theoretical framework: (a) the definition focused on the problem or the interpersonal domain in the problem, (b) the definition was broad or specific, (c) the definition was relevant or irrelevant to a problem, and (d) the problem's existence was recognized or denied. For example, in one item, participants were asked to rank statements as they related to stereotyping problems from the most relevant (1) to the least relevant (6). This stem was followed by six statements: (a) negative attitudes toward other people caused problems (focused on the problem and relatively broad); (b) stereotypes represent cultural conflicts (focused on interpersonal conflict and also broad); (c) prejudice is innate to human beings (a denial of the existence of a problem); (d) discrimination against blonde people is common, (irrelevant to the problem); (e) stereotyping influences our behaviors (problem focused and specific); and (f) not examining negative beliefs leads to stereotyping (focused on an interpersonal domain and specific to the problem).

Table 3.6

Number and Percent of Defining Problem Items in the PII

	Items		
Scenario	Open-ended	Closed-ended	Percent
The Ice Cream Shop	1	1	25
David's Case	1	1	25
Appearance in The Workplace	1	1	25
Stereotyping	1	1	25
Total	4	4	100

Problem definition items had two formats: open-ended and close-ended. In the open-ended formant, participants were allowed to write their own definition for the problem. In the closed-ended items, participants were introduced to six definitions and were asked to rank them from the most relevant to the least relevant.

As mentioned earlier, defining a problem is subjective reality; therefore, no quantitative method was used to inspect the role of problem definition in practical intelligence. Problem definitions, however, were dummy coded as categorical variables in this study (Grimm & Yarnold, 2004b). In the dummy coding method, each variable should be coded as a dichotomous variable. Dichotomous variables are not related to quantitative variables; instead, these variables are related to which one of the two categories is most selected by participants. Participants' rankings of the most relevant definitions were specified across the statements in each item. Other rankings were given a zero score. In effect, each statement was assigned a dichotomous code. For the open ended format, participants provided 446 definitions for the four scenarios. Participants' definitions for each scenario were classified and categorized in groups based on their similarities. Then, these categories were reviewed by an expert from social science who confirmed the grouping and categorizations. Agreement between the two reviewers on the categories for "The Ice Cream Shop" scenario definitions was 100%, for David's Case was 100%, for Appearance in the Workplace scenario was 97%, and for the Stereotyping scenario was 98%. Then, a team of three experts from social science with the researcher developed criteria to rank the definitions. These criteria were (a) specific vs. non-specific definitions, specific definition was coded as 1, and non specific definition as 2; (b) concrete vs. abstract, concrete definition was coded 1 and abstract definition coded as 2; and (c) relevant vs. irrelevant, relevant definition was coded 1 and irrelevant was coded 2. Then these definitions were rated on the dichotomous scale mentioned above by the team of experts (see Table 3.4 and Appendix C).

Flexibility of Thinking Subscale

Flexibility of thinking is one of the best predictors of people's performance on real-life problem solving (Patrick & Strough, 2004). The assumption underlying this process is that an individual who provides more strategies has a higher chance of proposing effective solutions. For example, increasing the number of solutions leads to increasing the possibility of producing various and promising alternatives. The purpose of measuring flexibility of thinking in this research was to test the hypothesis that producing various alternatives is a predictor of high practical intelligence. Flexibility of thinking was defined in this study as an individual's ability to generate a variety of solutions for a particular problem. Each scenario was followed by open-ended items for participants to provide as many as ten possible solutions for each item. In the first two cases, two open-ended items followed the scenarios and the last two scenarios were only followed by one open-ended item. The reason was that the last two scenarios focus only on self and did not include other parties, whereas the first two involved more than two characters. A total of six items was developed for measuring flexibility of thinking and practical solutions. For example, participants were asked the following: "Suppose you recently have been hired in a company where appearance is critical, the person who hired you did not state clearly the requirements for appearance, but you notice discrimination. What could one do to deal with the appearance-based discrimination problem? Please list as many ideas as possible."

Table 3.7

Number and Percent of Flexibility of Thinking Items in the PII

Developing Solution	Number of Items	Percent
The Ice Cream Shop	2	33
David's Case	2	33
Appearance in The Workplace	1	17
Stereotyping	1	17
Total	6	100

Measurement of flexibility of thinking had an open-ended format. A person might provide a total of ten strategies for each item, a total of 60 responses for the six items.

Scoring of flexibility of thinking was based on the number of unique strategies that an individual proposed for the six items. One point was given for each unique strategy. For example, if a person provided seven different strategies for the first item, that person was given seven points for that particular item. If a person proposed only two solutions but they were the same with different wording, that person was given only one point for that item as a score for flexibility. The author analyzed the responses and categorized them based on their similarities (see Appendix C). Then, these categories were reviewed by an expert from social science to confirm the grouping. Scores for flexibility of thinking across the six items were summed; the summation was the score for the flexibility construct.

Selecting a Solution Strategy Subscale

Evaluation and selection of solution strategies also is an important factor that contributes to people's performance on real-life problem solving. Theoretically, the type of strategy an individual uses depends on the context and how s/he defines the problem. The purpose of including the selection of a solution strategy factor was to examine the role of selecting solution strategies in practical intelligence.

Selecting a solution strategy was defined in this study as the individual's ability to select a strategy that fits the problem situation and solves the problem effectively. The author developed 23 items to measure how participants evaluate the effectiveness of each strategy. Participants were provided with possible solutions for each scenario and were asked to rank these solutions according to their appropriateness and effectiveness for solving the problems. The solutions were all correct and developed based on the theoretical framework of Sternberg et al. (2000) and Berg et al. (1998). The contextualists' definition of intelligence was used to develop these solutions. The contextualists define intelligence as the ability to adapt to a problem, shape the environment, or select another environment. Berg et al. (1998) added the ability to plan a solution and seek more information to solve the problem. This framework was used to develop solutions for the scenarios. For example, participants were asked to rank the following strategies from the most effective (1) solution to the least (6) if they wanted to improve David's condition. These strategies were the following: (a) make a donation for David, (b) believe that people in that region should contact human rights organizations for themselves, (c) have a fund raising campaign to support people in that region, (d) encourage David and others to leave their job and find a new one, (e) workers have to accept their life and work harder, (f) life is not pleasant for all of us and everyone has job problems. In Table 3.8, a summary of these strategies is illustrated. The numbers in the table were the numbers of the options in each item. For example, alternative number 105 in David's case above reflected the planning to take an action strategy.

Table 3.8

Summary of Strategies Used in the Current Study (Blanchard-Fields et al., 1997).

Category	Strategy	Scenario			
		1	2	3	4
Problem-Focus Strategy	Adapt to the problem			129	
	Shape or change environment	72	103	131	153/156
	Select another environment	73	106	133	
	Seek more information			130	154/157
	Plan to take an action		105	132	155/158
Cognitive-Analysis	Manage subjective appraisal of a situation	76	108		
	Use a logical approach				
Passive-Dependent Strategy	Do not initiate any behavior				
	Use actions that involve dependence on others	75	104		
Avoidance-Denial Strategy	Change perception or reinterpretation of the problem		107		
	Deny the existence of the problem	74			
	Avoid the problem	71			
	Withdraw from a situation				

1: The Ice Cream Shop, 2: David's Case, 3: Appearance in the Workplace, and 4: Stereotyping

The format of items in the selecting a solution strategy subscale was a stem followed by five to six options for each scenario, and participants were asked to rank these alternatives based on their effectiveness from the most effective (1) to the least effective (6). Five to six items from each scenario were used, with a total of 23 items.

Scoring the evaluation and selection of strategies was based on the difference method. Three social science experts rated these strategies as a team (see Table 3.4). Their ratings were used as criteria to quantify a participant's ability to evaluate solution strategies (see Appendix D). The expert rating for each strategy was subtracted from participants' ratings. Then, scores were converted to absolute values. The low scores reflected high performance on this subscale because the lowest scores indicated closeness to experts' ratings.

The Types of Knowledge Model Battery

Structural and tacit knowledge predict people's performance on real-life problem solving. The second model in this study consisted of several types of knowledge. The purpose was to investigate their role in practical intelligence. The knowledge model included three types. These types were declarative knowledge, structural knowledge, and tacit knowledge. Declarative knowledge included facts and concepts about the domain of prejudice. Structural knowledge included generalizations and theories about the same domain. Tacit knowledge included implicit knowledge that people learned from their experience in the domain of prejudice. In the following, a description of the development of these items—rationale, item formats, and scoring methods—is provided.

Declarative Knowledge Subscale

Declarative knowledge is not among the predictors of practical intelligence; however, this type of knowledge is essential for structural knowledge (Jonassen et al., 1993). The purpose of including declarative knowledge was to investigate the role of domain specific knowledge in problem solving. In other words, I attempted to examine the contribution of declarative knowledge to practical intelligence.

Declarative knowledge was defined in this study as factual knowledge that consisted of facts, concepts, and concrete ideas. A total of 20 items was developed about the domain of prejudice. In the development of these items, the nature and the cause of prejudice, the origin and the source, and strategies for solving such problems (cure strategies) were taken into consideration. For example, “discrimination is an attitude toward members of some social groups” was a wrong statement and this statement was related to the nature and the cause of prejudice. Participants were asked to indicate whether this statement was true or false. In Table 3.9, the distribution of declarative knowledge items on the domain of prejudice is illustrated.

Table 3.9

Number and Percent of Declarative Items across Different Aspects of the Prejudice Domain in the PII

Domain of Prejudice	Number of Items	Percent
Nature and cause	6	30
Origin and source	7	35
Cure strategies	7	35
Total	20	100

True or false items were used for the declarative knowledge subscale. The 20-item subscale consisted of 10 true items and 10 false items.

The scoring of the declarative knowledge part was one point for each correct answer. A total score of 20 points was given to anyone who answered the 20 items correctly.

Structural Knowledge Subscale

Theoretically, structural knowledge is the underlying representation of a domain of knowledge that an individual possesses. Structural knowledge, similar to any psychological concept, is a hypothetical construct. The purpose for measuring structural knowledge was to determine the contribution of this type of knowledge to practical intelligence. This type of knowledge was found in previous studies to be an important factor in practical intelligence.

Methods of assessing structural knowledge of individuals include cognitive mapping, process tracing and regression modeling (Jonassen et al., 1993). However, cognitive mapping is the most common method. Representing knowledge of structures may be carried out through several techniques, including causal interaction maps, cross classification tables, and concept maps. These techniques are perceived as an explicit way to illustrate how knowledge is structured in one's mind.

The literature shows several stages for developing structural knowledge scales. In the first stage, select knowledge, either from respondents or a domain of knowledge. In the second stage, how knowledge is structured must be evoked. In the last stage, to compare structural knowledge, a criterion reference must be obtained. This reference could be an expert's knowledge or a theoretical domain of knowledge that has been supported by empirical research findings. Worth mentioning is that experts' cognitive structures resemble subject-matter structures more than do novices' cognitive structures. The cognitive maps method was used as the approach for assessing structural knowledge.

The cognitive map assessment was used to represent how a person's structural knowledge was connected. These connections were assumed to represent the underlying representation of knowledge about the domain. The process of producing and developing cognitive map tests includes several steps. First, test developers should select a domain-specific area. Second, specify the events, phenomena or the outcome of interest. Third, identify factors that influence the phenomena or the outcome. Fourth, draw direct lines or arrows depicting causal links between the new factors and the variable of interest. Fifth, consider how would-be concepts are interrelated and make links between them (Jonassen et al., 1993; Shin et al., 2003). The same procedure mentioned above was used in this study to develop the structural knowledge items.

180.
Draw arrows below to illustrate how prejudicial people may benefit from using stereotypes:

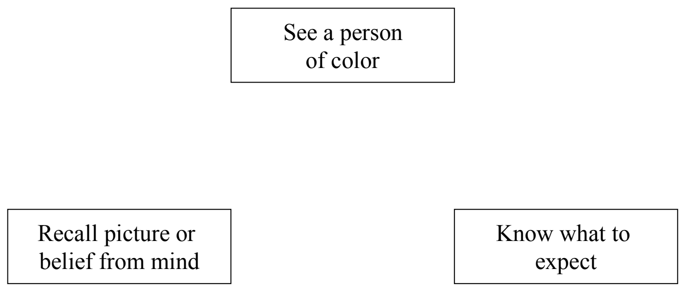


Figure 3.1: An Example of a Structural Knowledge Item

The cognitive map method of developing structural knowledge items was specifically used to convey causal relationships. This type of relationship can be true in different domains and topics, especially when making links between concepts or generalizations. The advantages of this method include depicting the multiple factors that are involved in phenomena and are easy to develop and interpret. The disadvantages of this method include the limitations of causal knowledge and of a particular phenomenon (Jonassen et al., 1993). An example of structural knowledge is the question above (Figure 3.1). In this question, participants were asked to draw arrows to show how prejudicial people may benefit from stereotyping.

Structural knowledge was defined in this study as knowledge about how the domain of prejudice is structured through theories and generalizations. Based on this definition, the author reviewed many theories about prejudice, discrimination, and stereotyping. Eighteen items were developed and each item consisted of 3 to 7 concepts. These items reflect major theories and generalizations in this domain. Table 3.10 shows the distribution of the structural knowledge items across the domain of prejudice.

Table 3.10

Number and Percent of Structural Knowledge Items in the PII

Domain of Prejudice	Number of Items	Percent
Nature and cause	1	6
Origin and source	7	47
Cure strategies	7	47
Total	15	100

The format of structural knowledge items was based on indicating relationships between different concepts (see Figure 3.1). The concepts were presented in boxes and the participants were asked to draw arrows to indicate the relationships between these concepts. The items consisted of at least three boxes and at most seven. By increasing the number of boxes—concepts—the difficulty level theoretically increased.

Scoring the structural knowledge items after consulting with an expert from social science was based on two concepts: correct link and correct direction. When drawing arrows, participants had to indicate the relationship between two concepts correctly and which concept comes before or precedes the other. If a correct link was made, one point was given, if the correct direction was made, another point was given.

Tacit Knowledge Subscale

Tacit knowledge is a relatively new concept that is related to performance on real-life problem solving. Tacit knowledge is the implicit knowledge that people develop through their interaction with their environment. This type of knowledge is among the best predictors of people's performance on real-life problem solving.

Measurements of tacit knowledge should take into account realistic and contextualized information. A realistic response to a real-life problem is an indicator of a degree of practical intelligence. Measurements of tacit knowledge should include realistic problems in which individuals' performances on these problems are compared with experts in the problems' domain. Sternberg et al. (2000) argued that experts are important sources of tacit knowledge because tacit knowledge is experience-based information.

Measurement of tacit knowledge in the field of intelligence testing has been developed based on several approaches to problem solving in real-life situations. Several methods were used to assess real-life competencies, including critical incident techniques, simulations and situational judgments (Sternberg et al., 2000). According to Flanagan (1954) critical incident techniques include a description of behavior, the setting in which the behavior occurred, and the consequences. This technique involves asking an expert in the subject matter about effective and ineffective behaviors. Simulation techniques are used to assess actual performance of individuals. This technique involves observing people in situations that have been created to simulate real-life problems. Responses on these situations are assumed to resemble the real performance of individuals. Situational judgment techniques are used to measure the performance on descriptions of situations. Following each situation is a set of alternatives for solving the problem. Examinees are asked to choose from the options by either selecting the best and possibly worst solutions or by rating the effectiveness of each option.

According to Sternberg et al. (2000), the tacit knowledge approach for assessing practical intelligence is based on aspects of knowledge individuals' possess in a specific domain that is acquired through solving everyday problems. This approach comes from the assumption that experts' amount of knowledge and organization are different from novices' knowledge and organization. The tacit knowledge approach is consistent with the critical incident approach in the way items are developed. The domain of knowledge is specified and then critical incidents from experts in that field are identified. The simulation method includes a detailed description of the incident to resemble the real-life problems that are encountered every day. The assessment of tacit knowledge depends on the situational judgment approach. This method includes a stem followed by options related to the situation. Examinees are asked to assess the quality of the alternatives in each situation.

The situational judgment technique was used in this study to measure tacit knowledge. Tacit knowledge was defined in this research as the knowledge of effective strategies endorsed by expert adults to deal with problems in a particular context. This type of knowledge is implicit knowledge and not verbalized. A total of 35 items distributed across the four scenarios was developed to measure tacit knowledge (see Table 3.11). Experts—two college professors and two Ph.D. graduate students in social science—were asked to propose solutions for the four scenarios. Their solutions were used to develop tacit knowledge items and my criteria for selection were (a) each solution should be indicated by at least two out of four experts, (b) each solution or strategy must be consistent with the contextual definition of intelligence, and (c) the strategy should fit the problem scenarios.

Table 3.11

Number and Percent of Tacit Knowledge Items in the PII

Tacit Knowledge	Number of Items	Percent
The Ice Cream Shop	13	37
David's Case	11	32
Appearance in The Workplace	6	17
Stereotyping	5	14
Total	35	100

The format of items was similar to the selecting strategy items format: a stem followed by several solutions. Participants were asked to rank the strategies based on their effectiveness for solving the proposed dilemmas.

Scoring tacit knowledge, as indicated, was based on experts' ratings. The difference method was used. This method was based on the difference between the expert ratings of these items and participants' ratings. The author asked six experts to rate these strategies according to their effectiveness. Then, the average of their ratings was used as a criterion for evaluating participants' ratings. A higher difference score was an indication of lower acquisition of tacit knowledge. If a participant had a zero score that means that his/her answers were identical to the expert knowledge. Table 3.12 shows the agreement among the six experts when rating tacit knowledge items. In Table 3.12 the highest agreement was between the two educators ($r = .69$, $p < .01$), whereas agreement between other raters ranged from non significant to .45, ($p < .01$). This indicated that even experts disagree about effective strategies for solving real-life problems.

Table 3.12

Agreement between Experts on Tacit Knowledge Items

		Educators		Sociologists			
Reviewer		A	B	C	D	E	F
Educators	A	1.00	.69[d]	.17	.24	.43[d]	.45[d]
	B		1.00	-.13	.13	.12	.39[a]
Sociologist	C			1.00	.27	.08	.50[d]
	D				1.00	.34[a]	.29
	E					1.00	.09
	F						1.00

a: p < .05; b: p < .005; c: p < .0005; d: p < .01; e: p < .001; f: p < .0001

The Domain of the PII: Prejudice

The domain of knowledge specified in this study was prejudice. Prejudice is a social phenomenon that seems to occur in every culture. Prejudice has many forms and has serious consequences for individuals and their societies (Baron et al., 2004; Haggis, 2005). Individuals, as they mature, encounter several types of explicit and implicit forms of prejudice. Prejudice occurs between and within social groups for competition and other reasons. Scholars explain the sources of prejudice and origin by different theories that take into consideration a relationship between several internal and external forces of individuals (Baron et al., 2004). The researcher found this topic of interest because it is common among different cultures and he can use the same topic in research with different cultures.

Summary of Steps Taken in Developing the PII

The researcher developed his knowledge about the topic of "prejudice" through multiple sources. After reviewing extensive materials about the topic and using the theoretical framework of practical intelligence adopted in this study as a guideline, the researcher took the following steps to develop the PII battery:

1. After reviewing empirical research findings, important factors that were associated with people's performance on real-life problem solving—practical intelligence—were verified. My criterion for selecting these factors was that each factor should contribute to practical intelligence or have an effect size of at least .20. These factors were classified into two models: (a) the cognitive processes model, and (b) the types of knowledge model. As indicated in Table 3.13, the effect sizes for these variables ranged from low to high (r^2 = .10 to .52). The effect size of selection strategies was considerably higher than other variables. Also, the effect size of defining a problem had not been revealed by the reviewed literature.

Table 3.13

The Effect Sizes of Variables Associated with Practical Intelligence

Model	Component	r^2	η^2	$p <$
Cognitive Processes	Metacognition		.10, .28	.01, .03
	Defining a problem	—	—	—
	Flexibility of thinking	.22	.30	.0001
	Selection of strategies		.52	.01
Type of Knowledge	Structural knowledge	.19		.001
	Tacit knowledge	.36		.01
Interaction	The interaction between cognitive and knowledge factors		.47	.0001

2. Each construct was defined. Then items based on the definition were developed. The purpose was to develop too many items because omitting items is easier than adding items after experts have reviewed the PII battery.
3. Using thinking aloud strategies, selected items were reviewed with two students. These students were asked to solve the items while telling why they had chosen particular answers. Then the PII items were revised according to the feedback from these individuals.
4. The PII was reviewed for content validity by experts in two phases. In the first phase, the PII was presented to a seminar class at my college. Four graduate students and one professor with a major in educational psychology provided comments about the PII. Then the PII was modified according to their feedback.

In the second phase, I sent the PII to experts in social psychology. A discussion session was held with a social science expert. Then the PII was improved according to their comments. Based on the revisions of the two phases, several items were omitted from the PII. In the following, the validity of each subscale in the PII was illustrated.

5. The final version of the PII consisted of 194 items distributed across several psychological constructs as shown in Tables 3.16, 3.17, and 3.18.

Validity of the PII

Validity of the PII was obtained from three sources: content, face, and construct validity. The content validity was obtained for the PII prior to its administration. The face and construct validity were investigated after the administration of the PII.

Content Validity

Content of the PII was validated by judgment of subject-matter experts from the field of psychology and social psychology. The PII's items were reviewed for content validity based on the following criteria: (a) the scenarios are representative of the domain of prejudice, (b) the scenarios are ecologically valid, (c) scenarios have different degrees of difficulty and complexity, (d) items of the cognitive processes model measure what is intended by their definitions, and (e) items of the types of knowledge models measure what is intended by their definitions. The researcher provided the experts with a definition of each psychological construct as a reference to evaluate the PII items accordingly. In the following section, the procedures for validation of each psychological construct are demonstrated and the reviewers' interrater agreement and comments are provided.

The First Phase

The PII battery was presented to PhD. students and an instructor (see Table 3.14). These experts were given an overview of the instrument and how it was developed. Then, they were asked to review the PII based on the criteria indicated above. Additionally, experts reviewed the PII based on several criteria and directions in the reviewer's letter (Appendix G). Experts also were asked to answer the items in the PII because that would help them to think about the items and judge what was intended to be measured. Also, some experts' answers were used to develop the tacit knowledge part of the instrument.

Table 3.14

Reviewers' Degree, Major, and College in the First Phase

Reviewer	Gender	Degree	Major	College
A	Female	Professor	Educational Psychology	Education
B	Female	Professor	Education	Education
G	Male	Doctoral Student	Early Childhood	Education
H	Female	Doctoral Student	Education of the Gifted	Education
I	Female	Doctoral Student	Education of the Gifted	Education
J	Female	Doctoral Student	Early Childhood	Education

The first phase involved six experts: two university professors and four graduate students. They provided comments regarding content, mechanics, and substantive information about the PII's items and what was intended to be measured. A discussion with them about the PII battery was executed. Based on their comments, the instrument was modified and no items were excluded at this phase.

The Second Phase

Four experts were consulted for the second phase of the revision, two of whom were social psychologists, one who was an expert in measurement, and another who was an expert in psychology. Comments were received from the two social science experts only. Experts provided me with comments about the instruments' content with regard to items in the knowledge model. The Experts' suggestions were to limit the number of items in the PII because it was very long. Finally, after the comments from all experts in both the first and the second phases were received, their comments were integrated. When experts disagreed about an item, area of expertise was taken into consideration. For example, if the disagreement regarded the knowledge part, only the sociologists' comments on that part were considered.

Scenarios' Content Validity

The scenarios used in the PII battery were validated by experts in the revision of the two phases. All experts agreed that the scenarios reflect real-life problems. Furthermore, twelve items regarding the construct validity of the four scenarios were included in the PII. Experts and participants were asked whether the problems presented were types of real-life problems, whether related to prejudice, and whether this problem is common for people. Agreement between experts in the first and the second phases was 100% that these scenarios are types of real-life problems, these cases are related to prejudice, and they occur frequently. In Table 3.15 agreement between experts in the two phases about the PII parts are illustrated.

Table 3.15

Agreement between the Experts on the Content Validity of the PII's Subscales

Parts of the PII Battery	Number of items	Reviewers	
		Ed. Psychologists	Social Psychologists
Scenarios	4	100%	100%
Metacognition	34	100%	50%
Defining A Problem	4	100%	25%
Flexibility of Thinking	6	67%	100%
Solution Strategy	23	75%	100%
Declarative Knowledge	20	100%	55%
Structural knowledge	18	100%	33%
Tacit Knowledge	35	67%	33%

Validity of Scenarios' Difficulty Levels

As was predicted by the author, the four scenarios had different difficulty levels. Experts rated each scenario independently on a four-point Likert Scale (4 = very difficult, 3 = difficult, 2 = somewhat difficult, 1 = easy). Ratings across the four researchers were added and divided by four. The average rating for (a) the first scenario, "The Ice Cream Shop" was 1.75, this scenario was the easiest; (b) the second scenario, "David's Case" was 3.5 and this was the most difficult one; (c) the third scenario, "Appearance in The

Workplace" was 2.5; (d) the forth scenario, "Stereotyping" was 3.25.

Validity of Metacognition Subscale

The first version of the metacognition subscale consisted of two different sets of items: A 20-item set adopted from the literature and 14 performance-based items developed by the author. In the first phase revision, psychologists agreed 100% that the two subscales (34 items), measure metacognition. However, in the second phase, social psychologists only agreed on 17 items that measured metacognition. Notably, the 10 items sociologists disagreed upon were adopted from the literature on metacognition. These items were revised based on comments from experts in the two phases. One item was removed from the performance-based metacognition subscale.

Validity of Defining a Problem Subscale

The first version of the PII included four items regarding the defining problem construct. These items were in the form of a stem followed by several options. This part was designed to measure how participants defined a problem. In the first phase, experts agreed 100% that these items measured how people defined a problem. However, in the second phase, experts indicated that 75% of these items did not measure this process. Based on the comments from the two phases, another four open-ended items were added in addition to the previous ones. The total number of items in the defining a problem subscale was 8 items.

Validity of Flexibility of Thinking Subscale

The flexibility of thinking subscale included six items. These items were open-ended with eight open spaces for participants to write their own solutions for the problems. Experts in the first phase agreed 67% that these items measured flexibility of thinking. The experts' major comment regarding the stem of these items was changing "what would you do?" to "what could you do?" Another comment was to increase the number of open spaces. These items were improved and the spaces were increased to ten for each item. In the second phase revision, the agreement between the two social psychologists increased to 100% that these items measured flexibility of thinking.

Validity of Selecting a Solution Strategy Subscale

This subscale included four items to measure the selecting a solution strategy. Agreement between the two educational psychological experts in the first phase revisions was 50%. The educational psychologists' comments were that these items were similar to tacit knowledge items and some solutions were in fact statements and not actions. The difference between tacit knowledge and selecting solution strategies is methodological. The selecting a solution strategy items were developed by the author and tacit knowledge items were developed from experts' solutions. The second comment was true and the solutions were revised to be actions. In the second phase revision, the agreement was 100% that this subscale measured the selecting a solution strategy process.

Validity of Declarative Knowledge Subscale

The declarative knowledge subscale consisted of 20 items to measure factual knowledge in the domain of prejudice. These items were distributed in two sets. In the first phase revision, agreement between the two reviewers was 100% that these items measured declarative knowledge. In the second phase revision, experts agreed that only ten items could be used to measure declarative knowledge. One expert argued that ten of the items measured structural knowledge instead of declarative knowledge. Both sets were included and after implementation of the PII, statistical information was used to determine a pattern of relationship between these items.

Validity of Structural Knowledge Subscale

The first version of the structural knowledge subscale included 18 items. This subscale was the most controversial between the experts. In the first phase revision, experts agreed 83% about structural knowledge items. These items were revised based on the comments of the first phase experts. In the second phase revision, experts agreed 50% with the items of this subscale indicating that only nine items measured structural knowledge. Some experts suggested that the stem of these items should be changed to be broader and not specific. For example, instead of writing the stem "draw arrows to illustrate how prejudice can be reduced between different groups", they suggested to write it as follows: "draw arrows to illustrate the relationship between these concepts." This was a major revision in the structural knowledge subscale. Experts also suggested excluding three items from this subscale because these items were not consistent with the definition of structural knowledge. The structural knowledge subscale consisted of 15 items.

Validity of Tacit Knowledge Subscale

The tacit knowledge subscale included 35 items distributed across the four scenarios. Experts in the first phase revision agreed 67% with these subscale items. The items were modified according to their comments. In the second phase, the agreement between the two sociology experts dropped to 50%. This disagreement may result from the researcher not including the actual strategies in the first and the second phases. The author used the experts' strategies to develop the tacit knowledge items. Therefore, in the two phases no strategies were developed. This procedure may result in confusion on the part of the experts.

The final revision of the PII consisted of 194 items distributed across the three major parts (a) general items (40), (b) the cognitive processes model (70 items), and (c) the type of knowledge model (70 items). Tables 3.16, 3.17, and 3.18 show the distribution of these items across the PII's components.

Table 3.16

Number of General Items Distributed across the Scenarios

		Scenario				
Cognitive Model	General	1	2	3	4	Total
Metacognition scale	20					20
Construct validity		3	3	3	3	12
Familiarity	2	2	2	2	2	10
Motivation	1	2	2	2	2	9
Self-efficacy		1	1	1	1	4
Difficulty		1	1	1	1	4
email me the results	1					1
Total	24	9	9	9	9	60

1: The Ice Cream Shop; 2: David's Case; 3: Appearance in The Workplace; and 4: Stereotyping

Table 3.17

Number of Items following each Scenario as they were distributed across the Cognitive Processes Model

	Scenario				
Cognitive Model	1	2	3	4	Total
Metacognition items	5	3	2	3	13
Defining the problem	2	2	2	2	8
Flexibility of thinking	2	2	1	1	6
Solution strategy	6	6	6	5	23
Total	10	8	6	7	50

1: The Ice Cream Shop; 2: David's Case; 3: Appearance in The Workplace; and 4: Stereotyping

Table 3.18

Number of Items following each Type of Knowledge across Topics in the Domain of Prejudice

Domain of Prejudice	Declarative	Structural	Tacit	Total
Nature and cause	6	1		7
Origin and source	7	9		16
Cure strategies	7	5	35	47
Total	20	15	35	70

Face Validity

Face validity of the PII was obtained from participants after the administration of the PII battery. Twelve items were included in the PII following each scenario regarding construct validity: (a) the validity of the scenarios as real-life problems, (b) whether the scenarios were related to prejudice, and (c) whether similar problems occur frequently. Participants rated these items on a three-point Likert scale (1 = No, 2 = Not sure, 3 = Yes). In Table 3.19, the means and standard deviations of participants' ratings on these items are listed. The maximum score for each item across the four scenarios was 12 points. As appears in Table 3.19, participants agreed that these scenarios resembled real-life problems, were related to prejudice, and occurred frequently. David's case (Scenario 2) was perceived as least related to prejudice. Perhaps the reason was that this problem occurred in a different country and the participants were not familiar with it.

Table 3.19

The Mean and the Standard Deviation of Participants' Ratings of the Four Scenarios on Face Validity Items

	Scenario				
Item	1	2	3	4	Total
Could this be a real-life problem?	M = 2.98 SD = .13	M = 2.93 SD = .29	M = 2.80 SD = .48	M = 2.96 SD = .39	M = 11.7 SD = .71
Do you think this problem relates to prejudice?	M = 2.92 SD = 2.70	M = 2.22 SD = .72	M = 2.66 SD = .633	M = 2.87 SD = .39	M = 10.8 SD = 1.3
Do you think this problem or similar situations occur frequently?	M = 2.67 SD = .57	M = 2.87 SD = .39	M = 2.83 SD = .44	M = 2.97 SD = .16	M = 11.3 SD = .95

Scenario 1: The Ice Cream Shop; Scenario 2: David's Case; Scenario 3: Appearance in The Workplace; Scenario 4: Stereotyping

Furthermore, after a participant completed the survey, s/he was asked what s/he thought of the PII. Most of the participants indicated that this survey evoked thinking. Also, participants mentioned that these problems occurred frequently. In addition, participants emphasized that the web-based survey was very interesting and well developed. Numerous participants indicated that the structural knowledge part could be answered in different ways. One reason was that in the stem of the items the author did not specify what was required.

Construct Validity

The construct validity of the PII was obtained through examining both convergent and discriminant validity between the variables. Convergent validity is a concept related to a high correlation between two variables that are theoretically correlated. Discriminant validity, on the other hand, is a concept related to a low and not significant correlation between variables that are not distinct in theory (Anastasi & Urbina, 1997). After the administration of the PII and collection of statistical data about the items in each subscale, I removed problematic items from the different subscales. Then, a correlation matrix was developed to show the relationship between the different variables. Table 3.20 shows these correlations. The construct validity for different subscales in this study was described by the inspection of these correlations.

First, the GPA correlated moderately with the subscale of declarative knowledge, $r = .30$. This correlation was expected because declarative knowledge and GPA were types of academic performance. However, the prior knowledge item did not correlate significantly with either GPA or declarative knowledge. Perhaps that was because the prior knowledge part only consisted of one item, whereas the declarative knowledge consisted of eight items and GPA is an index of general academic performance.

Second, I discussed the validation of the cognitive processes model. The cognitive processes subscales included two subscales of metacognition, a scale of flexibility of thinking and a scale of selecting a solution strategy. The metacognition subscales, ironically, did not correlate significantly with each other. The two subscales consisted of items with different formats. The 20-item subscale was on a four-point Likert scale and the 13-item subscale included performance-based items. The low correlation was not expected, however. Interestingly, as predicted, some correlations were found between the 13-item metacognition subscale and the lower-order thinking processes and the types of knowledge. This subscale correlated with lower-order thinking processes and types of knowledge. That was because the 13-item metacognition subscale was assumed to control these types of processes and processes of knowledge acquisition. For example, this subscale correlated with flexibility of thinking .22 ($p < .05$), with declarative knowledge .20 ($p < .05$), with structural knowledge .25 ($p < .01$), and with tacit knowledge -.20 ($p < .05$). These correlations were evidence of the convergent validity of this subscale. The 13-item metacognition subscale did not correlate significantly with selecting a solution strategy, motivation, self-efficacy, performance on real-life problem solving, and most importantly, with age. The non significant correlations were not expected, nor did the 20-item metacognition subscale correlate significantly with any other variables except the performance on real-life problem solving ($r = .18$, $p < .05$). Perhaps both scales measure different aspects of metacognition.

Convergent validity for the flexibility of thinking subscale was revealed by the pattern of relationship with non-cognitive processes. First, flexibility of thinking correlated from low to moderately with motivation ($r = .24$, $p < .01$) and self-efficacy ($r = .28$, $p < .01$). That is, participants who were motivated and possessed high self-efficacy provided more solutions for the problems and those who were not motivated or had low self-efficacy provided fewer solutions for the problems. This relationship was expected logically because less motivated participants were inclined to do the task with its minimum requirement. Furthermore, flexibility of thinking correlated highly with performance on real-life problem solving ($r = .55$, $p < .01$). This high relationship was explained theoretically because people who were able to provide various alternative solutions for the problem had a great chance to provide an effective solution for the problem. These correlations were evidence for the convergent validity of flexibility of thinking. Flexibility of thinking also correlated with selecting a solution strategy moderately ($r = -.30$, $p < .01$). The negative correlation occurred because the selecting a solution strategy process was scored using a reverse scale. Flexibility of thinking as a process of generating several alternatives is theoretically different from selecting a solution strategy because the second construct reflects evaluation and critical thinking processes. This relationship was unexpected. On the other hand, flexibility of thinking did not correlate with age, degree, GPA, pre knowledge, and declarative knowledge. These constructs were different from flexibility of thinking in their theoretical bases.

The selecting a solution strategy process correlated with similar constructs. The selecting a solution strategy is a process of evaluating different solutions and selecting the most effective; this correlated with tacit knowledge moderately ($r = .46$, $p < .01$) and with performance on real-life problem solving ($r = -.49$, $p < .01$). This correlation was explained theoretically because both constructs involve evaluation skills. Furthermore, the selecting a solution strategy correlation with motivation was low ($r = -.20$, $p < .05$). These relationships can be explained, as participants who were motivated spent time to think of the solutions and consider consequences for each one prior to their evaluation. An important correlation exists between age and selecting a solution strategy (r = -.30, p < .01). This moderate relationship indicated that older adults chose more effective solutions than younger people. These patterns of relationships aligned with convergent validity. On the other hand, the selecting a solution strategy subscale did not correlate significantly with the metacognition subscales, degree, GPA, and self-efficacy. This pattern of relationships can be explained as these variables were different constructs from the selecting a solution strategy. Low and negative correlations existed between the selecting solution strategies and declarative (r = -.19, p < .05) and structural (r = -.20, p < .05) knowledge. These relationships were not expected.

Third, I discussed validity of the types of knowledge model. Declarative and structural knowledge correlated moderately; this correlation is theoretically explained. Declarative knowledge consists of the basic facts and concepts in a particular domain that structural knowledge operates on. In other words, declarative knowledge is necessary for structural knowledge to develop. Tacit knowledge and both declarative (r = -.22, p < .05) and structural (r = -.24, p < .05) knowledge correlated negatively. The reason was that tacit knowledge was scored on a reverse scale. The correlation of tacit knowledge and other types of knowledge was around .20. The low correlation indicates that these types of knowledge are somewhat related to each other. Furthermore, tacit knowledge correlated with performance on real-life problem solving moderately (r = -.37, p < .01). Since tacit knowledge is implicit knowledge about acceptable solutions in real-life problems, this correlation is explained theoretically. These correlations were evidence of convergent validity. On the other hand, surprisingly, tacit knowledge and age correlated positively ($r = .22$, $p < .05$). At a theoretical level, this correlation contradicted the literature and what was predicted in this research, that tacit knowledge would correlate with age negatively.

Last, I discussed the validity of the non-cognitive factors. Motivation and self-efficacy were moderately correlated ($r = .44$, $p < .01$). This correlation indicates that the two constructs perhaps measured similar aspects of the non-cognitive factors. Also, in this research, motivation was measured by items that reflected an individual's interests in solving problems. The self-efficacy items were related to the motivation items. The author, in self-efficacy items, asked whether an individual could propose solutions for problems in which s/he has an interest. That was perhaps a possible reason for the moderate correlation. Motivation also was correlated to age positively ($r = .20$, $p < .05$). These correlations were evidence of convergent validity. On the other hand, motivation and self-efficacy did not correlate with many of the knowledge types, and that was evidence of discriminant validity.

Last, performance on real-life problem solving correlated with the several cognitive processes, types of knowledge model, and non-cognitive factors. The correlations between these models and performance on real-life problem solving were expected, as proposed in Chapter II.

Table 3.20

Correlations between Performance on Real-Life Problems and Gender, Age, Educational Attainment, Cognitive Processes Model, and Types of Knowledge Model

				Education			Non-Cognitive	
Correlations	1	2	3	4	5	6	7	8
1- Performance on real-life problem solving	1.00							
2- Gender	0.17	1.00						
3- Age	-0.09	0.09	1.00					
4- Degree	0.07	0.06	0.62[d]	1.00				
5- GPA	0.16	0.11	0.09	0.17	1.00			
6- Prior knowledge	0.00	0.02	0.28[d]	0.17	-0.01	1.00		
7- Motivation subscale	0.38[d]	0.24[a]	0.20[a]	0.16	0.01	0.06	1.00	
8- Self-efficacy subscale	0.24[d]	0.02	0.10	0.06	-0.08	-0.01	0.44[d]	1.00
9- Metacognition 20-item subscale	0.18[a]	-0.06	-0.03	-0.14	-0.04	-0.03	-0.01	0.09

Table 3.20—*Continued*

				Education			Non-Cognitive	
Correlations	1	2	3	4	5	6	7	8
10- Metacognition 13-item subscale	0.13	-0.11	-0.03	0.00	0.12	-0.05	0.06	-0.07
11- Flexibility of thinking subscale	0.55[d]	0.06	-0.04	0.06	0.10	0.04	0.24[d]	0.28[d]
12- Solution strategy subscale	-0.49[d]	-0.09	0.12	-0.06	-0.08	0.16	-0.21[a]	-0.16
13- Declarative knowledge subscale	0.10	-0.01	0.08	0.16	0.31[d]	0.01	0.01	0.06
14- Structural knowledge subscale	0.14	-0.12	-0.23[a]	-0.14	0.15	-0.06	-0.04	0.06
15- Tacit knowledge subscale	-0.37[d]	-0.08	0.22[a]	0.07	-0.04	0.14	-0.13	-0.02

Table 3.20—*Continued*

	Cognitive Processes Model				Types of Knowledge Model		
Correlations	9	10	11	12	13	14	15
9- Metacognition 20-item subscale	1.00						
10- Metacognition 13-item subscale	0.11	1.00					
11- Flexibility of thinking subscale	0.08	0.22[a]	1.00				
12- Solution strategy subscale	-0.04	-0.07	-0.30[d]	1.00			
13- Declarative knowledge subscale	-0.04	0.20[a]	0.13	-0.19[a]	1.00		
14- Structural knowledge subscale	0.16	0.25[d]	0.19[a]	-0.20[a]	0.35[d]	1.00	
15- Tacit knowledge subscale	-0.03	-0.20[a]	-0.18	0.46[d]	-0.22[a]	-0.24[a]	1.00

a: $p < .05$; b: $p < .005$; c: $p < .0005$; d: $p < .01$; e: $p < .001$; f: $p < .0001$

Reliability of the PII

Shultz and Whitney (2005) argued that to answer the reliability question in a test, the test's developer should first determine the source of error in the measurement. A new measurement of intellectual constructs contains several sources of error. These sources are (a) change in the examinee, (b) content sampling, and (c) the inter-rater agreement. Since the instrument was administered once, the reliability of the PII was derived from the internal consistency of items. Anastasi and Urbine (1997) provided precautions for using this method for determining reliability. First, one source of error in using this method is content sampling. That means the sample of items should be representative of the content of the domain. In the current study, subject-matter experts reviewed the content to determine representativeness of the domain's content as stated in the content validity section of this chapter. The second source of error in scores comes from the heterogeneity in the domain sampled. That means the more differences in the domain, the lower the reliability. This concern was addressed by using precise definitions for each homogeneous construct. Furthermore, the reliability was not calculated for the PII as a whole battery. Since the PII was a measurement of multi-dimensional psychological constructs and due to the precautions reviewed above, the researcher determined the reliability of each subscale in the PII battery separately. The criteria for omitting items from the subscales of the PII were (a) an item correlated lower than .20 with the total of the subscale or (b) negatively correlated with the total for that subscale. In the following section, reliability estimates were discussed for each subscale as indicated by the Coefficient Alpha.

Reliability of Metacognition Subscales

In the PII, two subscales were included to measure metacognition. The first subscale consisted of a 20-item subscale to measure two aspects of metacognition: cognitive confidence and self-awareness. The second subscale consisted of 13 items and was considered to be a performance-based subscale. After removing problematic items, reliability of both subscales was sufficient for measuring metacognition as a psychological construct. The reliability was above the acceptable level in psychology, as illustrated below.

The 20-item subscale was on a four-point Likert scale for both constructs. In the reliability analyses, each part of reliability was analyzed separately. The reliability of the cognitive confidence subscale as indicated by the Coefficient Alpha was below the acceptable level, $r = .65$. The item total correlation analyses showed that items number 25 and 26 of the PII on this subscale were correlated negatively with the total. After removing these items, the reliability coefficient increased to above the acceptable level, $r = .75$. The second subscale, self-awareness, consisted of ten items. The reliability analysis of the second set of items was lower than the conventional value, $r = .66$ (Shultz & Whitney, 2005). When examining the item total correlation, item number 39 was found to correlate lower than .20 with the total. After removing this item, the reliability coefficient increased to .68. The correlation between the totals of the two subscales after removing problematic items as presented in Table 3.20 was high and significant, $r = .61$, $p <.01$. Since the two subscales that were assumed to be measuring different aspects of metacognition correlated moderately with each other, to increase the reliability coefficient, the 17 items were used in one major subscale. The reliability of the subscale that consisted of 17 items was higher than each one alone, $r = .80$. Only the 17 items were used in the final analyses.

The performance-based subscale of metacognition consisted of 13 items. Each item contained several options as illustrated above. The reliability coefficient for this subscale was higher than the above subscale, $r = .83$. After examination of item total correlations for the subscale, item number 86, which correlated lower than .20 with the total was removed. When this item was removed, the reliability increased to .84. In the final analysis, only 12 items were used.

The metacognition subscales (cognitive confidence, self-awareness, and performance-based items) were assumed to measure the metacognition construct. However, the pattern of correlations between these subscales did not validate this assumption. Performance-based items did not correlate significantly with cognitive confidence ($r = .08$, $p > .05$) and self-awareness ($r = .12$, $p > .05$). The two subscales, cognitive confidence and self-awareness, were highly correlated ($r = .55$, $p < .01$) whereas the other subscale with a different format did not correlate highly (see Table 3.21). This pattern of relationship was not expected. A possible explanation of the results was that these subscales measured different aspects of metacognition, because the Likert subscales measured perceptions and the performance-based items measured actual potential.

Table 3.21

Correlations between the Metacognition Subscales (N= 116)

Subscale	1	2	3
1. Cognitive confidence subscale	1		
2. Self awareness subscale	$.55^{d}$	1	
3. Metacognition 13 item subscale	.08	.12	1

a: p < .05; b: p < .005; c: p < .0005; d: p < .01; e: p < .001; f: p < .0001

Defining a Problem Subscale

No reliability estimate for defining problems was calculated because definitions were coded as categorical variables. Four closed-ended items were rated by participants from the most relevant to the least relevant to the problems. In Table 3.22, the averages of participants' ratings for each definition across the four scenarios were presented. The lower the average, the more relevant was the definition to the problem. For example, definitions number 5, 5, 1, and 5 were the most relevant to scenario 1, 2, 3, and 4 respectively. For example, participants perceived this definition as the most relevant for the Ice Cream Shop scenarios: "The black family is not treated fairly"; and perceived the following definition as the least relevant to the problem: "The salesman is in a bad mood."

Table 3.22

Average of Participants' Rating of Problem Definitions from the Most Relevant (1) to the Least Relevant (6)

	Definition Statement					
Scenario	1	2	3	4	5	6
The Ice Cream Shop	2.73	2.70	4.95	4.14	2.09	4.23
David's Case	4.24	3.07	3.54	3.60	2.43	4.02
Appearance in the Workplace	2.44	2.48	2.80	3.79	3.85	5.14
Stereotyping	2.77	2.67	4.94	4.13	2.07	4.27

For the open-ended items, participants in this study proposed 464 definitions for problems presented in the four scenarios. These definitions were categorized based on their similarities. A few of these definitions were not considered statements of the problem. Some participants did not see the video clips. Definitions were rated on a dichotomous scale by the team of experts according to the three criteria: specificity versus non-specificity, concrete versus abstract, and relevant versus irrelevant. None of these items correlated with performance on real-life problem solving. None of these definitions were correlated with performance on real-life problem solving.

The closed-ended items were four and every item consisted of six options based on the theoretical framework mentioned earlier. Four options were correlated significantly with performance on real-life problem solving (Table 3.23). However, two options showed high correlations because of some values, as in option F. 120 and D. 146

(see Figure 3.2). For example, the scatter plot depictions in Figure 3.2 showed that performance on real-life problem solving correlated moderately with option D. 146 of the defining a problem subscale. This moderate correlation occurred because only one participant selected this option as the most relevant definition to the Stereotyping scenario ($r = -.32$, $p < .01$). An inference should not be made based on one participant's answer. The same argument is true for option F. 120. In option F. 120, only a few participants viewed this option as the most relevant definition to the David's Case scenario. By contrast, options B. 120 and B. 146 were considered by many participants as statements both relevant and irrelevant to the problems. In other words, options B. 120 and B. 146 offered more discrimination between participants than did options F. 120 and D. 146. Therefore, option B. 120 and option B. 146 were used in the final analyses.

Table 3.23

Correlations between Defining a Problem Items and Performance on Real-Life Problems

Items	1	B. 120	F. 120	B. 146	D. 146
1- Performance on Real-Life Problem Solving (PRP)	1.00				
B. 120	-0.40[d]	1.00			
F. 120	-0.22[a]	0.07	1.00		
B. 146	-0.19[a]	0.07	0.14	1.00	
D. 146	-0.32[d]	0.16	0.44[d]	0.21[d]	1.00

a: $p < .05$; b: $p < .005$; c: $p < .0005$; d: $p < .01$; e: $p < .001$; f: $p < .0001$

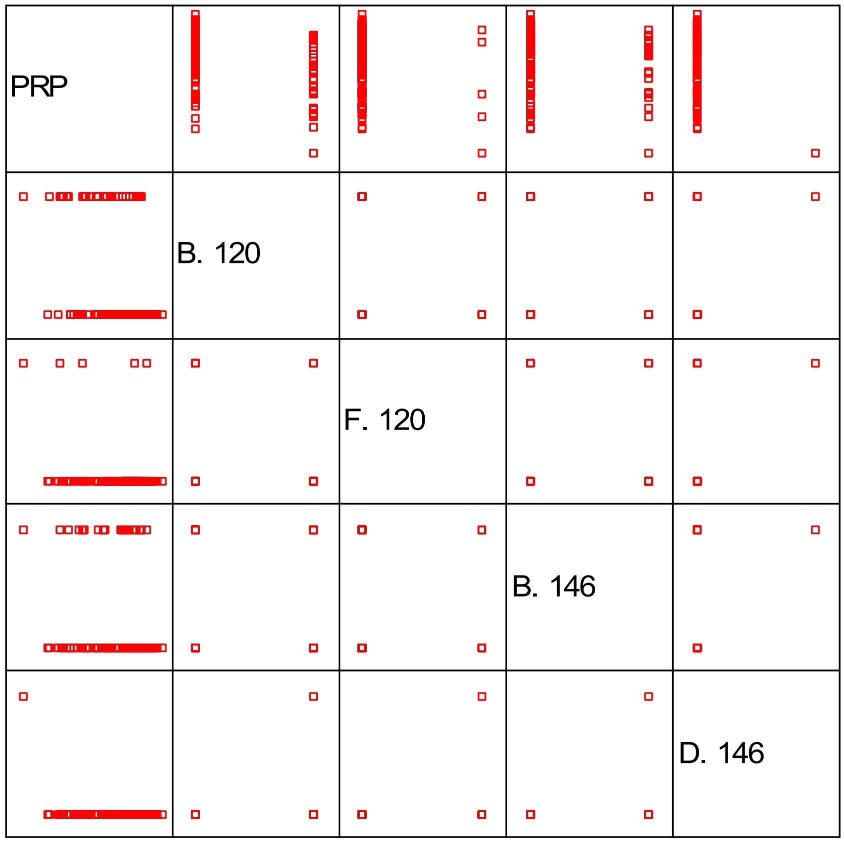


Figure 3.2: Scatter Plots Showing Correlations between Defining a Problem Variables and Performance on Real-Life Problem Solving

Reliability of Flexibility of Thinking Subscale

The flexibility of thinking construct was measured by six open-ended items. Participants proposed possible solutions for each item. They were allowed to propose at most 10 solutions in open spaces for each item, with a total of 60 for this construct. Some participants proposed more than one solution in each space. These solutions were separated into several solutions and included in the analyses. Participants proposed a total number of 2467 solutions for the six items, as shown in Table 3.23. These items were classified into several categories to help evaluators look at these categories and not the total number of answers. The interrater agreement about categories of strategies' classifications between the researcher and a social psychology expert was calculated. The interrater reliability for these items as indicated in Table 3.24 was high for five items and moderate for one item. The items and their categories were further examined based on the feedback from the reviewers. The score of flexibility of thinking was based on the sum of the number of unique solutions that participants provided across the six items. The internal consistency of these items as indicated by the reliability estimate, Coefficient Alpha, was .82 for this part.

Table 3.24

Number of Solutions Proposed for Each Scenario and Interrater Agreement between Two Reviewers about Categories

Scenario	Item	Number of Answers	Percent	Interrater Reliability
The Ice Cream Shop	1	477	20	85.60
	2	483	20	86.70
David's Case	1	337	14	91.20
	2	380	16	68.10
Appearance In the Workplace	1	353	15	88.98
Stereotyping	1	359	15	85.64
Total	6	2389	100.0	—

Reliability of Selecting a Solution Strategy Subscale

A team of three experts in social science (see Table 3.4) rated the 23 solution strategies distributed across the four scenarios. Based on the difference between the experts' rating for each strategy and participants' ratings, every individual was given a score. The reliability Coefficient Alpha estimate for the 23 items was .68. The item total correlation analysis showed that several items correlated lower than .20 with the total (items 132, 153, 154, 156, 158). The five items were omitted from this subscale and the reliability increased to .71 with only two items correlating slightly lower than .20 with the total. Only the 18 items were used in the final analyses.

Reliability of Declarative Knowledge Subscale

The declarative knowledge subscale included 20 items in two sets. One social psychologist indicated that the second set of structural knowledge items measured this construct more than the first set. However, each set separately did not have a sufficient reliability estimate. The reliability for both sets was slightly higher than .40. Therefore, the 20 items were analyzed as one set. The reliability analysis for these items was .44. Many items correlated lower than .20 and some negatively with the total (items 160, 161, 164, 166, 167, 168, 169, 170, 172, 174, 176, &178). These items were found to be relatively difficult and sometimes misleading. Therefore, these items were deleted from the analysis. After removing them, the reliability coefficient increased to .69 but did not reach .70. No further analysis was done on this part due to the low number of items left.

Reliability of Structural Knowledge Subscale

The structural knowledge subscale included 15 items. These items were scored based on the indication of the correct relationship and the correct direction between the concepts. The reliability as measured by the Coefficient Alpha was .72; however, several items correlated negatively with the total score of the structural knowledge subscale (items 181, 182, 183, 187, 188, 190). When these items were removed, the reliability coefficient increased to .79. In the analyses of the results, only nine items were included.

Reliability of Tacit Knowledge Subscale

Tacit knowledge in the PII consisted of 35 items. These items were rated by six experts. The average of experts' ratings of the effectiveness of strategies was employed to evaluate the participants' rating. Table 3.12 consists of ratings between two experts from the field of education and four experts from the social science field on the effectiveness of the strategies. Based on the difference between the average experts' ratings for each strategy and participants' ratings, every individual was given one score for each item. This score was the difference between one's rating and the average experts' ratings. The reliability Coefficient Alpha for this part was .62. Several items correlated negatively and very low with the total. Therefore, I omitted the problematic items (items 61, 62, 64, 67, 92-94, 99, 149-152) to increase the reliability of this subscale. The Coefficient Alpha increased to .72. The total number of items left in this part for the final analyses was 23.

Reliability of Familiarity, Motivation, and Self Efficacy Items

Items that measured participants' experiences with the domain of prejudice and problems presented in the scenarios included nine items. Coefficient Alpha was estimated to determine the reliability of these items. The reliability was .77. The sum of these items was used as a covariate variable. The motivation part included in the PII consisted of 10 items. The same procedure was used to determine the reliability of this scale, and the Coefficient Alpha was .91. The self-efficacy subscale consisted of four items. Reliability of this scale was .63. Perhaps the low reliability for self efficacy may be a result of including only four items in this subscale.

Reliability of Performance on Real-Life Problem Solving

Performance on real-life problem solving was measured by six open-ended items. Responses to these items were rated by three experts based on four criteria as mentioned in the scoring section of problem scenarios (see Page 221). Only the best response of each participant for each item was included in this subscale. The reliability Coefficient Alpha for items that measure performance on real-life problem solving was .93. This reliability was considerably high in comparison with other subscales in the PII.

The Administration of the PII

The administration of the PII was computer-based in the spring semester of the academic year 2005-2006. After the final version of the PII was developed and due to its length, attempts were made to find a computer-based software to deploy the PII using the internet web-based technology. That was for two reasons: first, to effectively and efficiently manage the huge number of variables and data needed for the current study; and second to encourage participants to take the long survey at home, because it is online. After extensive research and review of many computer based software programs, compatible software called Survey *Monkey* was found to administer the PII online (SurveyMonkey.com, 2006). The providers designed the survey to help users to develop many items using different formats. One of the useful specifications included in this survey was that researchers could get the raw data from the participants in their surveys. Furthermore, a useful feature is that the software enables a user to develop an email list and send the survey to particular people. A user also can monitor whether the participants respond. The software was tested for several items. The software was suitable to approximately 90% of the PII's items. The software was not suitable for the structural knowledge part, because this part contained items that required drawing arrows and this feature was not included in this software. The researcher decided to use the software for 90% of the items and developed structural knowledge items to be answered on paper. The PII was named a survey to avoid participants' anxiety about taking an intelligence test.

A plan for recruiting participants was developed. The plan included compensation for the participants: $25 was paid to participants who completed both parts within 24 hours: Part A, the online survey and Part B, the structural knowledge part; $20 was paid if a participant completed the PII within one week; and any participant who invited two friends would receive an extra $5. After I received the approval from the Institutional Review Board, I recruited participants with the help of friends and classroom instructors. Within seven weeks I was able to recruit 140 participants; however, not all of them completed the PII. I had a complete respondent sample of 116 participants.

Comprehensive directions for the PII were included in both parts (see Appendices A & B). Participants who agreed were sent an email with a link to the survey. When they clicked the link, the survey popped up and it could be completed in one or more sittings. Participants were able to complete both parts in about one hour and 20 minutes.

Data Analyses

Data analyses were carried out after the problematic items were deleted from the PII battery as mentioned above. The author did not use all information obtained by the PII in the final analyses (e.g., ethnicity, country of origin, education) because of the limited number of participants and research questions. This information will be used by the author in future research. The number of items remaining in the PII across different subscales is shown in Table 3.25. Several statistical procedures were used to test the hypotheses in this study: (a) a multiple regression model including hierarchal procedure, (b) the Person Product-Moment correlation coefficient, and (c) analysis of variance (ANOVA). Table 3.25 shows the total of final items used in each subscale and the reliability of each subscale. Only these items were used in reporting the results in the next chapter. The following section of this chapter includes procedures for determining sample size, dealing with missing data, and developing covariate variables.

Table 3.25

Total Items in PII across Sections, Number of Items Deleted, and the Reliability after Item Deletion

		Items			
Model	Subscale	Total	Deleted	Reliability	Final
Cognitive Processes	Metacognition				
	20-item subscale	20	2	.81	18
	Performance items	13	2	.85	11
	Defining a problem				
	Flexibility of thinking	6	0	.82	6
	Selecting a solution strategy	23	5	.70	18
Type of Knowledge	Declarative	20	11	.70	9
	Structural knowledge	15	6	.80	9
	Tacit knowledge	35	12	.72	23
Self-Efficacy		4	0	.63	4
Familiarity		9	0	.77	9
Motivation		10	0	.91	10
Performance on Real Life Problems		6	0	.93	0

Sample Size Determination

The sample size for the current study was determined by power analysis. The sample size determination required information about the effect size for the independent variables used, the power needed, and alpha specified. The effect sizes for the variable were determined from the literature review of statistical information as shown in Table 3.13. The power was specified as (1-β) = .80 to control for type II error. Alpha was held at .05. Since the two models consisted of six predictors and one non-cognitive factor, the effect sizes of the seven contributor variables were relatively high, especially tacit knowledge, $r^2 = .36$ and selecting a solution strategy, $r^2 = .52$. Therefore, the minimum effect size for determining the sample size needed for the current study was tacit knowledge effect size ($r^2 = .28$). Therefore, based on the table of sample sizes determinations of Gatsonis and Sampson (1989), the sample required in this study was a total of 105 participants. More participants were included to deal with missing data, if any.

Missing Data

Few data were missing from the surveys. The web-based survey had a function to limit participants from missing data. However, some data were missing from the survey. Two methods to determine the missing data were used (a) multiple regression, and (b) average. The multiple regression procedure was employed for the following variables: (a) construct validity, (b) familiarity with problems, (c) motivation, and (d) self-efficacy. The average for the GPA was replaced for missing data in this variable because the variables in this study were not good predictors for GPA. Also the average was used for the performance on the real-life problem solving variable.

Covariate Variables

Several covariate variables were used in this study. First, scores on familiarity with problems were applied as a covariate variable. Familiarity with problems counts for those who have had experience with similar problems in the past. The second covariate variable was age because participants' ages in this study ranged form 18 to 62 years. The third covariate was gender. When these factors are controlled, participants' performance on real-life problem solving will be freed from the effects of the covariate variables. The covariates were included in the analyses for testing the hypotheses.

Scenarios' Difficulty Levels

Participants also rated the difficulty level of scenarios on a four-point scale. Figure 3.3 shows the mean of participants' ratings of the difficulty level for the four scenarios. The average participants' rating of the difficulty level of each scenario is shown in Table 3.26. David's Case was the most difficult one. The Ice Cream Shop was the least difficult, and Stereotyping was more difficult than Appearance in the Workplace. All the difficulty levels for the scenarios were as predicted. However, the difference between the Ice Cream Shop and Appearance in the Workplace was not very high. The difficulty level for each scenario was used to weigh participants' solutions for each scenario.

Table 3.26

The Average Difficulty Level for the Four Scenarios as Rated by Participants

Scenario	Mean	*SD*
The Ice Cream Shop	2.12	1.00
David's Case	3.25	.90
Appearance In the Workplace	2.16	.99
Stereotyping	2.47	1.19

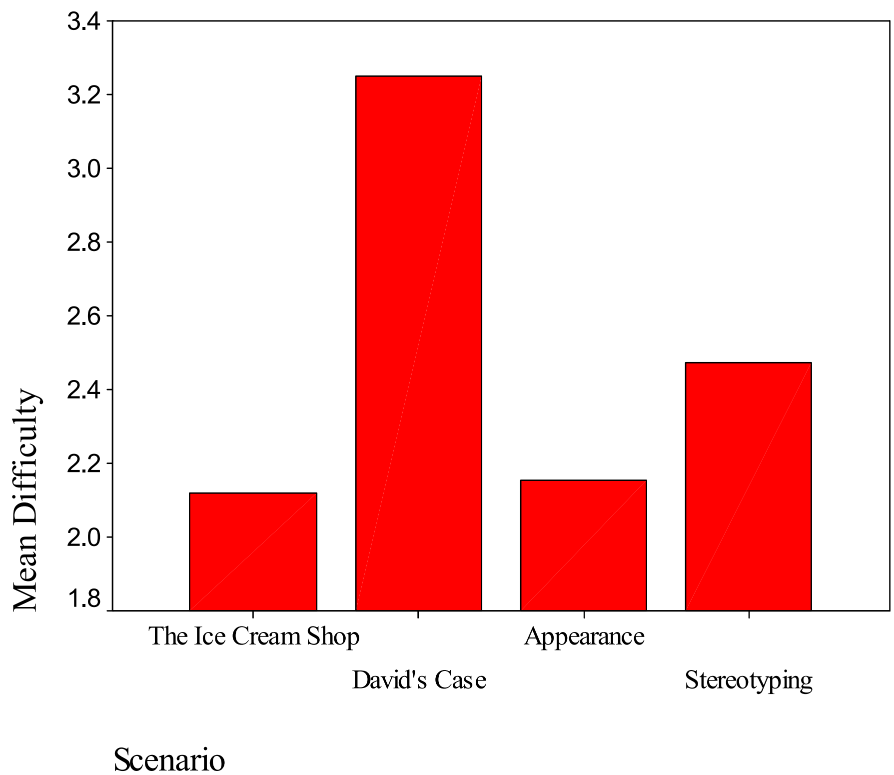


Figure 3.3: Illustration of the Difficulty Level of the Four Scenarios as Perceived by the Participants

Standardized Scores on Subscales

Each subscale had different scoring rubrics. Furthermore, the subscales differed in the score ranges. Therefore, to avoid higher weight for some subscales, the author standardized the scores across all subscales. That ensured that all subscales had the same weight in the final analyses.

Hypotheses and Statistical Tests

First Category: The Cognitive Processes Model

Directional Hypothesis 1: Practical intelligence is predicted significantly by the cognitive processes model.

H1 $_0$: $\beta_{(w)} \leq 0$

To test this hypothesis, a hierarchical multiple regression model was used with cognitive processes as predictors and practical intelligence as a criterion as indicated by the sum of the weighted best solution scores across the six items (see Pages 221-224). Since metacognition was assumed to control lower order cognitive processes, performance on the metacognition subscale was included in the first step. In the second steps, flexibility of thinking, defining a problem, and selecting a solution strategy variables were included.

Null Hypothesis 2: No significant correlation will be found between scores on practical intelligence and general academic performance, as measured by the GPA.

H2 $_0$: $\rho = 0$

To test this hypothesis, a Pearson Product-Moment correlation coefficient was used to investigate the relationship between scores on real-life problem solving and the

GPA index.

Second Category: The Types of Knowledge Model

Directional Hypothesis 3: Practical intelligence is predicted significantly by the knowledge model as measured by structural and tacit knowledge subscales.

$H3_0$: $\beta_{(w)} = 0$

To test this hypothesis, a hierarchical multiple regression model was used, with structural and tacit knowledge as predictors and scores on real-life problem solving as a criterion variable. Since metacognition was assumed to control lower-order processes, performance on metacognition was included in the first step. In the second step, I included structural knowledge and tacit knowledge variables.

Null Hypothesis 4: No significant correlations will be found between scores on practical intelligence and performance on domain specific knowledge as measured by the declarative and structural knowledge subscales in the domain of prejudice.

$H4_0$: $\rho = 0$

To test this hypothesis, a Pearson Product-Moment correlation coefficient was used to illustrate the relationship between scores on real-life problem solving subscale and domain specific knowledge, as measured by the declarative and structural knowledge subscales.

Third Category: Non-Cognitive Factors

Null Hypothesis 5: Non-cognitive factors, including motivation and self-efficacy, are significant predictors of practical intelligence.

$H5_0$: $\beta_{(w)} = 0$

To test this hypothesis, a hierarchical multiple regression model was used with the two non-cognitive factors as predictors and scores on real-life problem solving as a criterion variable. Since metacognition was assumed to control non-cognitive factors, I included performance on the metacognition subscale in the first step. In the second step, I included two predictors, self-efficacy and motivation scores.

Fourth Category: The Contribution of the Two Models and Non-cognitive Factors

Directional Hypothesis 6: Practical intelligence is predicted significantly by the combination of two models and motivation more than either model alone.

H6 $_0$: $\beta_{(w)} \leq 0$

To test this hypothesis, a hierarchical multiple regression model was used with both the cognitive processes model and types of knowledge model as predictors and scores on real-life problem solving as criterion variables. Since metacognition was assumed to control lower order processes, I included performance on the metacognition subscale in the first step. In the second step, I included the sum of the three cognitive process variables and the two types of knowledge variables.

Fifth Category: Familiarity with Problems

Null Hypothesis 7: No significant differences will be found between those who are familiar with problems and those who are not familiar with problems on their performance on real-life problem solving.

H7 $_0$: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

To test this hypothesis, analysis of variance (ANOVA) was used with performance on real-life problem solving as a dependent variable and scores on familiarity with problems as an independent variable. Participants' scores on familiarity with problems were divided into four groups: first, second, third, and fourth quadrants. A Post Hoc procedure was used if the omnibus *F* test was significant.

Sixth Category: Age as a Factor

Null Hypothesis 8: No significant mean difference will be found between scores in performance on real-life problem solving of different age groups.

$H8_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$

To test this hypothesis, participants were divided based on their on age into four groups: first, second, third, and fourth quadrants. Each group consisted of 29 participants. One factor ANOVA was used with performance on real-life problem solving as a dependent variable and age categories as the independent variable. A Post Hoc procedure was used if the omnibus *F* test was significant.

Summary of Chapter III

In this chapter, the author described the method of this study. Participants included 116 volunteers between the ages 18 and 62. Four scenarios consisting of real-life problems were developed to assess people's performance on real-life problem solving. The Practical Intelligence Instrument (PII) contained several subscales to measure four cognitive processes (metacognition, defining a problem, flexibility of thinking, and selecting a solution strategy), three types of knowledge (declarative, structural, and tacit knowledge), and non-cognitive factors (self-efficacy and motivation). The validity of the instrument was obtained from three sources (a) content validity, (b) face validity, and (c) construct validity. The reliability of the subscales included in the PII ranged from .69

to .93. The data were analyzed using correlations, ANOVA and a multiple regression model. The covariate variables were gender, age, and familiarity with problems. Finally, this chapter included the statistical hypotheses and specified procedures to test them.

CHAPTER IV

THE RESULTS

This chapter includes the research questions, hypotheses, statistical tests, and the results. The research questions are presented first, followed by the null hypotheses and statistical hypotheses. Then the statistical procedures to test these hypotheses are presented, followed by the findings.

First Category: The Cognitive Processes Model

Research Question 1

To what extent does the cognitive model contribute to people's performance on real-life problem solving?

The purpose for this research question was to investigate the role of the cognitive processes model including metacognition, defining a problem, and selecting a solution strategy as it relates to performance on real-life problem solving—practical intelligence. A null hypothesis corresponding to this research question was developed as follows:

Directional Hypothesis 1: Practical intelligence is predicted significantly by the cognitive processes model.

H1 $_0$: $\beta_{(w)} \leq 0$

To test this hypothesis, a hierarchical multiple regression model was used with cognitive processes as predictors (independent variables) and performance on real-life problem solving as the criterion variable (dependent variable). In the first step, gender, age, and performance on the familiarity with problems subscale were entered as covariate variables to remove the effects of these variables from the analysis. Performance on the two metacognition subscales was entered in the second step. In the third step, performance on the two options of defining a problem B120 and B146, flexibility of thinking, and selecting a solution strategy variable were entered. In Table 4.1, the results of the analyses are shown.

Table 4.1

Hierarchical Multiple Regression Analyses for Performance on Real-Life Problems as Predicted by the Cognitive Processes Model

Step	Predictor	$R^2_{adj.}$	F_{change}	β	t	r	r_p
1	Age	.019	1.727	.183	1.974	.17	.183
	Gender			-.100	-1.080	-.09	-.101
	Familiarity			.066	.708	.06	.067
2	Metacognition 20-item	.054	3.086[a]	.179[a]	1.959	.18	.184
	Metacognition 13-item			.124	1.318	.13	.125
3	Defining a problem B. 146	.478	23.340[c]	-.146[a]	-2.081	-.19	-.198
	Defining a problem B. 120			-.212[b]	-2.882	-.40	-.270
	Flexibility of thinking			.376[c]	5.011	.56	.438
	Selecting a solution strategy			-.285[c]	-3.883	-.49	-.353

a: $p < .05$; b: $p < .005$; c: $p < .0005$; d: $p < .01$; e: $p < .001$; f: $p < .0001$

As indicated from Table 4.1, the cognitive processes model contributed 48% of the variance in practical intelligence as measured by the PII. Metacognition, defining a problem, flexibility of thinking, and selecting a solution strategy predicted scores on performance on real-life problem solving after controlling for age, gender, and familiarity. The first step of the hierarchical multiple regression model shows that R^2 is not significant, $F(3, 112) = 1.727$, $p = .166$. That indicates that the covariates do not contribute significantly to the performance on real-life problem solving; however, their variance was partialled out from the preceding analyses. The second step analysis showed that metacognition as measured by the two subscales was a significant contributor to practical intelligence. However, the metacognition effect is not large. The increment in $R^2 = .054$ in the second step was significant, $F(2,110)= 3.086$, $p < .05$. In the third step, the three cognitive processes (defining a problem, flexibility of thinking, and selecting a solution strategy) together contributed significantly to performance on real-life problem solving. These processes contributed as a set around 42% of the variance. The increment in $R^2 = .42$ was significant, $F(4,106)= 23.34$, $p < .0005$.

The Post Hoc procedure, Holm Bonferroni, was used to control for Type I error and to determine which predictors in the third step contributed to practical intelligence. Because these predictors were assumed to contribute to practical intelligence, a one-tail *t*-test was used as a directional hypothesis. Since four predictors were of interest, Alpha $\alpha_{FW} = .05$ was divided by four, $\alpha_c = .0125$. Therefore, the critical t for the first predictor was $t_{1, 4, 111}(.9875) = 2.27$, for the second predictor was $t_{2, 4, 111}(.9833) = 2.16$, for the third predictor was $t_{3, 4, 111}(.975) = 1.98$, and for the fourth predictor was $t_{4, 4, 111}(.95) = 1.66$. By inspecting the obtained *t*s in Table 4.1, we can infer that all the four predictors contributed significantly to practical intelligence. The first important predictor was flexibility of thinking, which contributed significantly to practical intelligence, $\beta = .376$, $t = 5.011$, $p < .0001$. The second important predictor, selecting a solution strategy, was a significant contributor for practical intelligence, $\beta = .285$, $t = -3.883$, $p < .0001$. The third predictor, option B. 146 of defining a problem (item number 146, see Appendix A), was a significant predictor for practical intelligence, $\beta = -.212$, $t = -2.882$, $p < .005$. The fourth predictor, option B. 120 of defining a problem (item number 120), was a significant predictor for practical intelligence, $\beta = -.146$, $t = -2.081$, $p < .05$.

The contribution of each predictor is illustrated in Figure 4.1 (see also partial correlations in Table 4.1). The pure contribution of each predictor, however, is not attainable because of the influence of the third factor on these factors and the confounding variance between these variables. The contribution of each cognitive process to practical intelligence after removing the effect of other predictors and the criterion is called partial correlation $r_{p.}$ In Figure 4.1, partial correlations are calculated between each cognitive process and performance on real-life problem solving after removing their effects from both the process and performance on real-life problem solving.

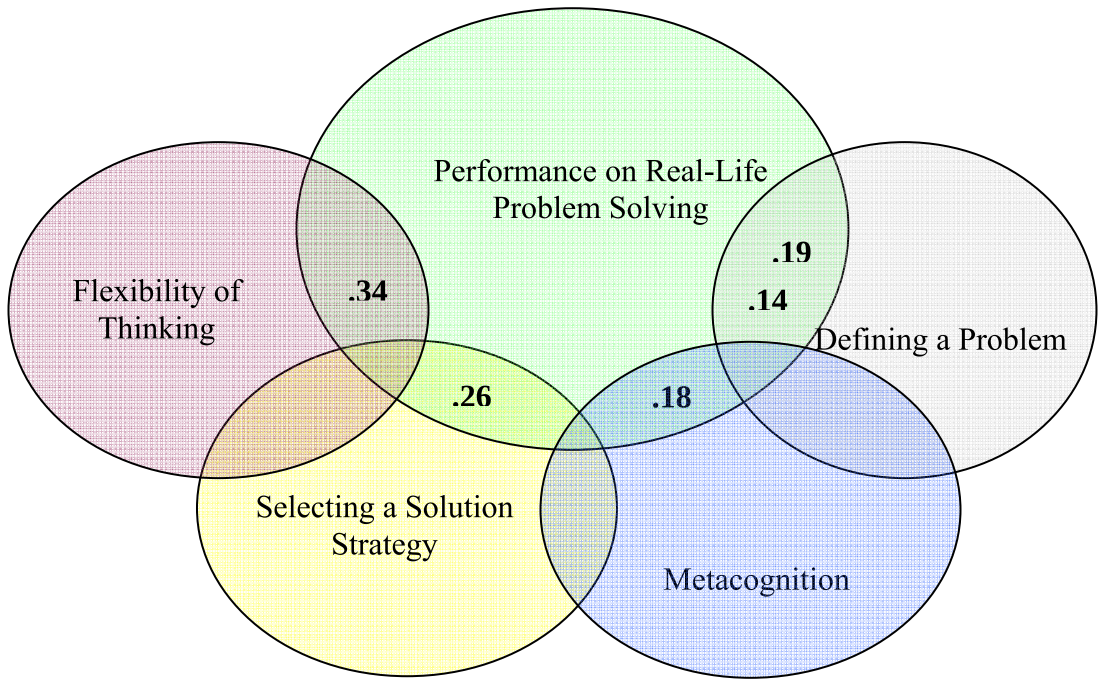


Figure 4. 1: The Partial Correlations between Cognitive Processes and Performance on Real-Life Problems

Flexibility of thinking and selecting solution strategies were the highest contributors to practical intelligence. Two options from defining problem items were the lowest contributors to the performance of participants on real-life problem solving. Metacognition contributed very little to performance on real-life problem solving. The zero-order correlations between the cognitive processes model are illustrated in Table 4.2. As indicated, only the 20-item metacognition subscale correlated with performance with real-life problem solving. The 13-item metacognition subscale correlated at a low level with flexibility of thinking (r^2 = .22). That indicates somewhat that both metacognition subscales correlated with performance on real-life problem solving. Both options of defining a problem correlated from low to moderate levels with performance on real-life problem solving. Performance on flexibility of thinking and selecting a solution strategy correlated moderately with performance on real-life problem solving. All the cognitive processes explain partially some aspects of practical intelligence.

Table 4.2

Correlations between Standardized Scores on the Cognitive Processes Model Subscales

Variable	1	2	3	4	5	6
1. Metacognition, 20 Items	1					
2. Metacognition, 13 Items	0.11	1				
3. B. 146	0.05	-0.08	1			
4. B. 120	-0.05	-0.09	0.07	1		
5. Flexibility of Thinking	0.08	0.22[a]	-0.12	-0.26[d]	1	
6. Solution Strategy	-0.04	-0.07	0.06	0.28[d]	-0.30[d]	1
7. Practical Intelligence	0.18[a]	0.13	-0.19[a]	-0.40[b]	0.55[d]	-0.49[d]

a: $p < .05$; b: $p < .005$; c: $p < .0005$; d: $p < .01$; e: $p < .001$; f: $p < .0001$

Research Question 2

To what extent is practical intelligence associated with general academic knowledge?

The purpose of this question was to investigate the role of academic knowledge in practical intelligence. I predicted that domain general knowledge would not be associated with practical intelligence. To answer this question, a statistical hypothesis was developed as follows:

Null Hypothesis 2: No significant correlation will be found between scores on practical intelligence and general academic performance, as measured by the GPA.

$H2_0$: $\rho = 0$

To test this hypothesis, a Pearson Product-Moment correlation coefficient was used to indicate the relationship between scores on real-life problem solving and GPA. Domain general knowledge, as measured by the GPA, was significantly correlated with performance on real-life problem solving. The correlation coefficient was low and significant, $r = .20$, $p < .05$. This result contradicts the author's prediction that performance on real-life problem solving does not correlate with academic performance.

Second Category: The Types of Knowledge Model

Research Question 3

To what extent does the knowledge model contribute to people's performance on real-life problem solving?

The purpose for this research question was to investigate the role of two types of knowledge including structural and tacit knowledge to people's performance on real-life problem solving—practical intelligence. The hypothesis corresponds to this research question as follows:

Directional Hypothesis 3: Practical intelligence is predicted significantly by the knowledge model as measured by structural and tacit knowledge subscales.

$H3_0$: $\beta_{(w)} = 0$

To test this hypothesis, a hierarchical multiple regression model was used with two types of knowledge (structural and tacit) as predictors (independent variables) and performance on real-life problem solving as a criterion variable (dependent variable). In the first step, gender, age, and performance on the familiarity with problem subscales were entered as covariate variables to remove their effects from the analyses. The two metacognition subscale scores were entered in the second step. The reason for this was that metacognition was assumed to control the lower order processes and acquisition of knowledge skills (Sternberg, 1985a). In the third step, performance on structural knowledge and tacit knowledge variables were entered into the model (see Table 4.3).

Table 4.3

Hierarchical Multiple Regression Analyses for Performance on Real-Life Problems as Predicted by the Knowledge Model

Step	Predictor	$R^2_{adj.}$	F_{change}	β	t	r	r_p
1	Age	.019	1.727	.183	1.974	.17	.180
	Gender			-.100	-1.080	-.09	-.101
	Familiarity			.066	.708	.06	.070
2	Metacognition 20-item	.054	3.086[a]	.179	1.959[a]	.18	.180
	Metacognition 13-item			.124	1.318	.13	.130
3	Structural knowledge	.146	6.946[e]	.034	.360	.136	.035
	Tacit knowledge			-.332	-3.591[d]	-.374	-.327

a: $p < .05$; b: $p < .005$; c: $p < .0005$; d: $p < .01$; e: $p < .001$; f: $p < .0001$

As indicated from the Table 4.3, the types of knowledge model as a whole contributed 15% of the variance in practical intelligence as measured by the PII. The analyses reveal that tacit knowledge predicted scores on performance on real-life problem solving after holding constant age, gender, familiarity, and metacognition. The first step of the hierarchical multiple regression model shows that R^2 is not significant, $F(3, 112) = 1.727$, $p = .166$. That indicates that the covariates do not contribute significantly to performance on real-life problem solving; however, their effects have been partialled out from the preceding variables. The second step analysis showed that metacognition as measured by the two subscales was a significant contributor of practical intelligence. The increment in $R^2 = .054$ in the second step was significant, $F(2,110) = 3.086$, $p < .05$. In the third step, the two types of knowledge, structural knowledge and tacit knowledge, together contributed significantly to performance on real-life problem solving. These types of knowledge explained as a set around 15% of the variance. The increment in $R^2 = .146$ was significant, $F(2,108) = 6.946$, $p < .001$.

The Post Hoc procedure Fisher LSD was used to control for Type I error and to determine which predictors in the third step contributed to practical intelligence. Because these predictors were assumed to contribute to practical intelligence, a one-tail *t*-test was used for the directional hypothesis. The condition required by this procedure is that the overall *F* test is significant. This condition is held. As one can see by inspecting the obtained *t*s in Table 3.3, only one predictor contributes significantly to practical intelligence. This predictor is tacit knowledge, $\beta = -.339$, $t = -3.59$, $p < .0005$. Structural knowledge does not predict performance on real-life problem solving significantly, β

= .034, t = .360, p = .34.

The contributions of two predictors are illustrated in the following figure. The pure contribution of any factor, however, is not attainable because of the influence of the third factor and the variance confounded with other variables. In Figure 4.2, I illustrate partial correlations of type of knowledge to performance on real-life problem solving after removing the effect of other variables from both the type of knowledge and the performance.

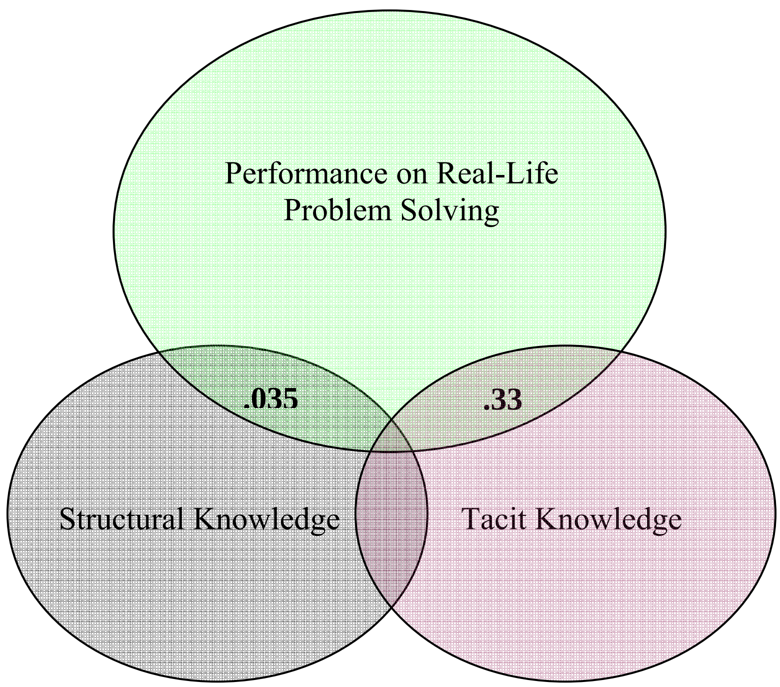


Figure 4.2: The Partial Correlations between the Types of Knowledge Model and Performance on Real-Life Problem Solving

Tacit knowledge was a significant contributor to practical intelligence. Tacit knowledge and structural knowledge had a low correlation, (r = .24, p < .01). The zero-order correlations between the knowledge model and performance on real-life problem solving are illustrated in Table 4.4. Components of the knowledge model are correlated with each other from low to moderate. The knowledge model contributes less to practical intelligence than the cognitive processes model.

Table 4.4

Correlations between Standardized Scores on the Cognitive Processes Model Subscales

Correlations	1	2	3
Declarative knowledge	1		
Structural knowledge	.35[d]	1	
Tacit Knowledge	.23[a]	.24[a]	1

a: $p< .05$; b: $p < .005$; c: $p < .0005$; d: $p< .01$; e: $p < .001$; f: $p < .0001$

Research Question 4

To what extent is practical intelligence associated with domain specific knowledge?

The purpose of this question was to investigate the role of domain specific knowledge in practical intelligence. The author of this research predicted that domain specific knowledge would explain important aspects of practical intelligence. To answer this question, a hypothesis was developed as follows:

Null Hypothesis 4: No significant correlations will be found between scores on practical intelligence and performance on domain specific knowledge as measured by the declarative and structural knowledge subscales in the domain of prejudice.

$H4_0$: $\rho = 0$

To test these hypotheses, a Pearson Product-Moment correlation coefficient was used to indicate the relationship between scores on real-life problem solving and performance on declarative and structural knowledge subscales. In Table 4.5, correlations between these variables are shown.

Domain specific knowledge, as measured by both declarative and structural knowledge, did not correlate with performance on real-life problem solving. As indicated in Table 4.5, scores on performance on real-life problem solving also does not correlate significantly with domain specific knowledge as measured; declarative knowledge, ($r = .10$, $p > .05$); and structural knowledge, ($r = .14$, $p > .05$). These results contradict the author's prediction.

Table 4.5

Correlation Matrix of Domain Specific Knowledge and Performance on Real-Life Problem Solving

Correlations	1	2	3
1- Declarative Knowledge	1.00		
2- Structural Knowledge	0.35^{d}	1.00	
3- Performance on Real-Life Problem Solving	0.10	0.14	1.00

a: $p < .05$; b: $p < .005$; c: $p < .0005$; d: $p < .01$; e: $p < .001$; f: $p < .0001$

Third Category: The Non-Cognitive Factors

Research Question 5

To what extent do the non-cognitive constructs contribute to people's performance on real-life problem solving?

The purpose for this research question was to investigate the role of the non-cognitive constructs, in particular motivation and self-efficacy, in practical intelligence. The null hypothesis corresponds to this research question as follows:

Null Hypothesis 5: Non-cognitive factors, including motivation and self-efficacy, are significant predictors of practical intelligence.

$H5_0$: $\beta_{(w)} = 0$

To test this hypothesis, a hierarchical multiple regression model was used with non-cognitive factors as predictors (independent variables) and performance on real-life problem solving as the criterion variable (dependent variable). In the first step, gender, age, and scores on the familiarity with problems scale were entered as covariate variables to remove the effects of these variables from the analyses. Performance on the two metacognition subscale scores was entered in the second step because metacognition was assumed to control the non-cognitive constructs of personality. In the third step, performance on motivation and self-efficacy variables were entered into the model. In Table 4.6, the results of the analyses are illustrated.

Table 4.6

Hierarchical Multiple Regression Analyses for Performance on Real-Life Problem Solving as Predicted by Motivation and Self-efficacy

Step	Predictor	$R^2_{adj.}$	F_{change}	β	t	r	r_p
1	Age	.019	1.727	.183	1.974	.17	.183
	Gender			-.100	-1.080	-.09	-.101
	Familiarity			.066	.708	.06	.067
2	Metacognition 20-item	.054	3.086[a]	.179[a]	1.959	.18	.184
	Metacognition 13-item			.124	1.318	.13	.125
	Motivation	.195	10.607[c]	.374	3.582[b]	.383	.326
	Self-efficacy			.092	.967	.243	.093

a: $p< .05$; b: $p < .005$; c: $p < .0005$; d: $p< .01$; e: $p < .001$; f: $p < .0001$

Motivation and self-efficacy together contributed 20% of the variance in practical intelligence. The analyses revealed that motivation predicted scores on performance on real-life problem solving after controlling for or partialing out age, gender, and familiarity. The first step of the hierarchical multiple regression model showed that R^2 was not significant, $F(3, 112) = 1.727$, $p = .166$. The second step analysis showed that metacognition as measured by the two subscales was a significant contributor to practical intelligence; however, the metacognition effect was not large. The increment in $R^2 = .054$ in the second step was significant, $F(2,110) = 3.086$, $p < .05$. In the third step, the two non-cognitive constructs, motivation and self-efficacy, together contributed significantly to performance on real-life problem solving. These constructs contributed as a set around 20% of the variance. The increment in $R^2 = .195$ was significant, $F(2,108) = 10.607$, $p < .0001$. Only motivation was a significant predictor of practical intelligence, $\beta = .374$, $t = 3.58$, $p < .005$.

The contributions of each predictor are illustrated in the following figure. The contribution of each non-cognitive factor to practical intelligence, after residualizing the effect of other predictors and the criterion partial correlation, ranged from low to moderate. In Figure 4.3, I illustrate partial correlations of each cognitive process to performance on real-life problem solving after removing the effect of other variables from both the process and the performance. The partial correlation between motivation and performance on real-life problem solving was moderate, $r_p = .33$. Self-efficacy, however, correlated with motivation moderately but low with practical intelligence (see Table 4.7).

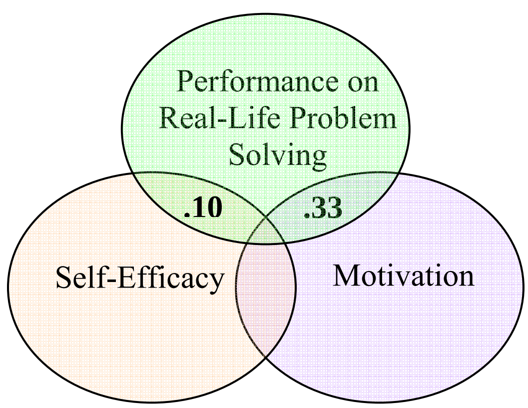


Figure 4.3: The Partial Correlations between Non-Cognitive Factors and Performance on Real-Life Problem Solving

The zero-order correlations between the non-cognitive construct and practical intelligence are illustrated in Table 4.7. As indicated, motivation and self-efficacy were moderately correlated, ($r = .44$, $p < .01$). Performance on real-life problem solving correlated low with self-efficacy, ($r = .24$, $p < .01$). However, self-efficacy was not a predictor as expected by the author. The author suspected that the shared variance between scores on self-efficacy items and scores on performance on real-life problem solving was confounded with motivation because the correlation between scores on self-efficacy and scores on practical intelligence was low and significant. To examine this conjecture, the partial correlation was calculated between scores on self-efficacy items and scores on practical intelligence after controlling for motivation. The partial correlation between scores on self-efficacy and scores on practical intelligence was very low and not significant ($r_p = .08$, $p = .35$). In Figure 4.4, I illustrated the logical relationships between these variables using a Venn diagram.

Table 4.7

Correlations between Standardized Scores of Non-Cognitive Constructs and Practical Intelligence

Correlations	1	2	3
Practical intelligence	1.00		
Motivation	0.38^{d}	1.00	
Self Efficacy	0.24^{d}	0.44^{d}	1.00

a: $p < .05$; b: $p < .005$; c: $p < .0005$; d: $p < .01$; e: $p < .001$; f: $p < .0001$

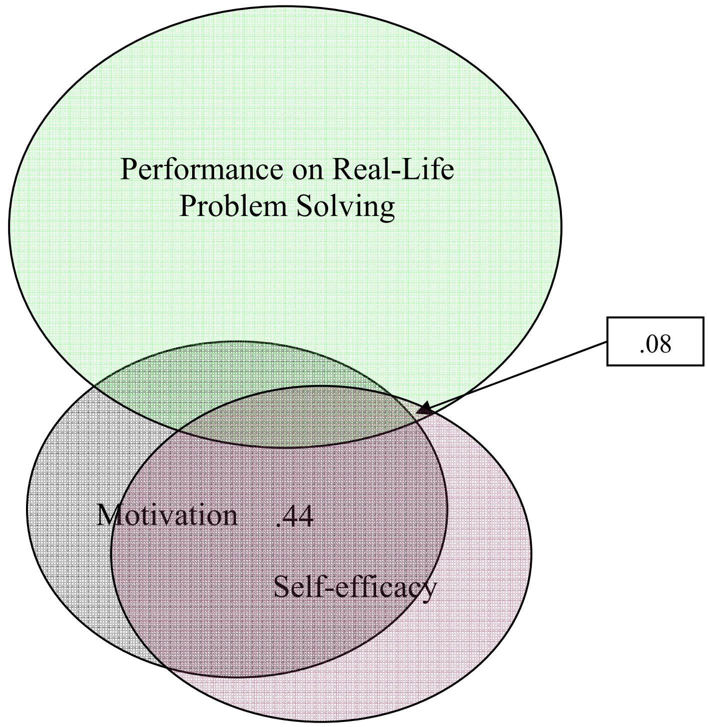


Figure 4.4: The Partial Correlations between the Non-Cognitive Component and Performance on Real-Life Problem Solving

Fourth Category: The Contribution of the Two Models and Non-cognitive Factors

Research Question 6

To what extent do the two models and non-cognitive factors together contribute to practical intelligence?

The purpose of this research question was to investigate the role of both the models and motivation to performance on real-life problem solving. The hypothesis corresponds to this research question as follows:

Directional Hypothesis 6: Practical intelligence is predicted significantly by the combination of two models and motivation more than any model alone.

$H6_0$: $\beta_{(w)} \leq 0$

To test this hypothesis, a hierarchical multiple regression model was used with the cognitive processes model, with types of knowledge and motivation as predictors (independent variables) and performance on real-life problem solving as a criterion variable (dependent variable). In the first step, gender, age, and performance on the familiarity with problems subscale were entered as covariate variables to remove the effects of these variables from the analyses. Performance on the two metacognition subscales was entered in the second step. In the third step, defining problem options, flexibility of thinking, selecting a solution strategy, structural knowledge, tacit knowledge, and motivation were entered into the model. In Table 4.8, the results of the analyses are shown.

As indicated in Table 4.8, all variables together contributed 54% of the variance in practical intelligence as measured by the PII. The first step of the hierarchical multiple regression model showed that R^2 was not significant, $F(3, 112) = 1.727$, $p = .166$. That indicated that the covariates did not contribute significantly to performance on real-life problem solving; however, they partialled out any variance of their effect from the preceding analyses. The second step analysis showed that metacognition was a significant contributor to practical intelligence. The increment in $R^2 = .054$ in the second step was significant, $F(2,110) = 3.086$, $p < .05$. In the third step, the variables (defining a problem, flexibility of thinking, selecting a solution strategy, structural knowledge, tacit knowledge, and motivation) contributed significantly to performance on real-life problem solving. These processes contributed as a set around 54% of the variance. The increment in $R^2 = .493$ was significant, $F(7,103) = 17.582$, $p < .0005$.

The Post Hoc sequential procedure Holm Bonferroni was used to control for Type I error and to determine which predictors in the third step contributed to practical intelligence. Because these predictors were assumed to contribute to practical intelligence, a one-tail t-test was used for the directional hypothesis. Since seven predictors were of interest, Alpha $\alpha_{FW} = .05$ was divided by seven, $\alpha_c = .0036$. Then the critical t for the first predictor was $t_{1, 4, 111}(.9929) = 2.49$, for the second predictor was $t_{1, 4, 111}(.9917) = 2.43$, for the third predictor was $t_{2, 7, 103}(.99) = 2.37$, for the fourth predictor was $t_{2, 7, 103}(.9875) = 2.27$, for the fifth predictor was $t_{2, 7, 103}(.9833) = 2.17$, for the sixth predictor was $t_{2, 7, 103}(.975) = 1.98$, for the seventh was $t_{2, 7, 103}(.95) = 1.66$. By inspecting the obtained ts in Table 4.8, one can see that six predictors contributed significantly to practical intelligence and only structural knowledge did not contribute to practical intelligence, $\beta = -.053$, $t = -.754$, $p = .35$. The first predictor, flexibility of thinking, was significantly associated with practical intelligence, $\beta = .349$, $t = 4.87$, $p < .0001$. Motivation was the second best predictor of practical intelligence $\beta = .259$, $t = 3.51$, $p < .001$. The third predictor, option B. 146 of defining a problem (item number 146, see appendix A), was a significant predictor of practical intelligence, $\beta = -.192$, $t = -2.77$, $p < .001$. The fourth significant predictor was selecting a solution strategy, $\beta = -.183$, $t = 4.87$, $p < .0001$. The fifth predictor, option B. 120 of defining a problem (item number 120), was a significant predictor of practical intelligence, $\beta = -.172$, $t = -2.6$, $p < .01$. The sixth significant predictor was tacit knowledge, $\beta = -.149$, $t = -1.992$, $p < .05$. Consistent with the author's prediction, both the models and the non-cognitive factors contribute to practical intelligence ($R^2_{adjusted}$ = .54) at a higher level than the cognitive processes model ($R^2_{adjusted}$ = .48), and the types of knowledge model ($R^2_{adjusted}$ = .20), separately.

Table 4.8

Hierarchical Multiple Regression Analyses for Performance on Real-Life Problem Solving as Predicted by the Cognitive Processes Model

Step	Predictor	$R^2_{adj.}$	F_{change}	β	t	r	r_p
1	Age	.019	1.727	.183	1.974	.17	.183
	Gender			-.100	-1.080	-.09	-.101
	Familiarity			.066	.708	.06	.067
2	Metacognition 20-item	.054	3.086[a]	.179[a]	1.959	.18	.184
	Metacognition 13-item			.124	1.318	.13	.125
3	Defining a problem B. 146	.540	17.582[c]	-.173	-2.600[a]	-.19	-.250
	Defining a problem B. 120			-.192	-2.774[e]	-.40	-.260
	Flexibility of thinking			.349	4.874[f]	.56	.430
	Selecting a solution strategy			-.183	-2.378[a]	-.49	-.230
	Structural knowledge			-.053	-.754	.14	-.070
	Tacit knowledge			-.149	-1.992[a]	-.37	-.190
	Motivation			.259	3.507[e]	.38	.330

a: $p < .05$; b: $p < .005$; c: $p < .0005$; d: $p < .01$; e: $p < .001$; f: $p < .0001$

Fifth Category: Familiarity with Problems

Research Question 7

To what extent is familiarity with problems associated with performance on a measure of practical intelligence?

The purpose of this question was to investigate the role of familiarity with problems in practical intelligence. The author of this research predicted that participants who were familiar with problems would perform better than those who were not familiar with them. The hypothesis associated with this research question is as follows:

Null Hypothesis 7: No significant differences will be found between those who are familiar with problems and those who are not familiar with problems on their performance on real-life problem solving.

$H7_0$: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

To test these hypotheses, participants' scores on the familiarity subscale were divided into four groups based on the semi-interquartile ranges. Then performance on real-life problem solving was freed from the difficulty weight because the difficulty weight could influence the variance for the different groups (see Table 4.9). The independent variable was the four groups of the level of familiarity with problems and the dependent variable was performance on practical intelligence.

Table 4.9

Means and Standard Deviations of Performance on Real-life Problem Solving for Four Groups Divided Based on their Familiarity with Scenarios from Low to High Familiarity Groups

Groups	Mean	n	SD
Low Familiar Group	6893.93	29	1000.99
Low-Medium Familiar Group	8163.75	29	645.46
Medium-High Familiar Group	8443.13	29	481.33
High Familiar Group	8961.00	29	376.73
Total	8115.25	116	1010.08

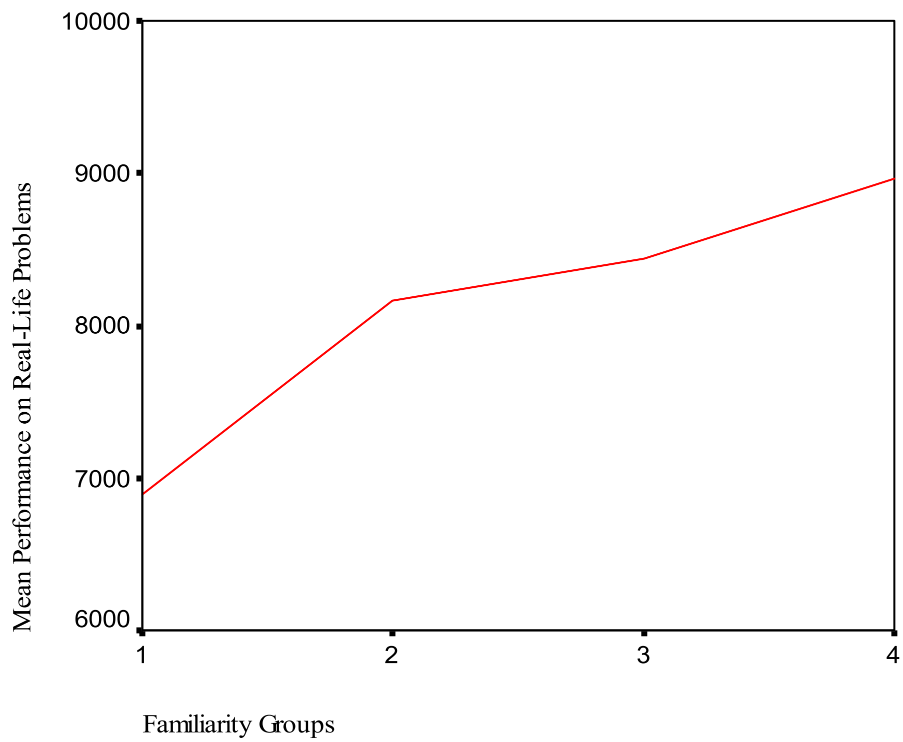


Figure 4.5: Line Chart Illustrating Mean Performance on Real-Life Problem Solving across Four Levels of Familiarity with Problems in the Scenarios

Significant differences were found between the performance of participants who were familiar with problems and those who were not familiar. A one way ANOVA revealed real differences between at least two groups of the four, $F(3, 115) = 49.96$, $p < .0001$. The proportion of variance accounted for by the familiarity factor was moderate, 19%. A Post Hoc analysis was performed to test the differences between groups. The Holm Bonferroni Post Hoc procedure was used to determine the differences between groups.

The Post Hoc procedure revealed that differences between group one and all other groups were significant at $p < .05$. The same pattern was found between group four and all other groups. However, no significant mean difference was found between groups two and three. In Table 4.10, the highest difference was found between group one and group four. The difference was two standard deviation units. The next highest mean difference was between group one and group three. The difference was 1.5 standard deviation units. The lowest mean difference was found between group one and group two. That difference was 1.26 standard deviation units. That indicates that participants who are familiar with real-life problems perform better than others in solving these problems.

Table 4.10

Table of Mean Differences between Standardized Scores of Four Groups' Performance on Real-Life Problems

	Group			
Group	1	2	3	4
1	0.00	-1.26[a]	-1.53[a]	-2.05[a]
2		0.00	-0.28	-0.79[a]
3			0.00	-0.51[a]
4				0.00

Sixth Category: Age as a Factor

Research Question 8

To what extent do older adults perform better than younger adults?

The purpose of this research question was to determine the role of age in solving real-life problems. The author of this research predicted that older participants would outperform younger participants on real-life problem solving. To answer this research question, the following hypothesis that corresponds to this question was tested.

Null Hypothesis 8: No significant mean difference will be found between scores in performance on real-life problem solving of different age groups.

$H8_0$: $\mu_1 - \mu_2 - \mu_3 - \mu_4 = 0$

To test this hypothesis, I divided participants based on their age into four groups: first, second, third, and fourth quadrants. Each group had 29 participants. Then I used a one factor ANOVA with performance on real-life problem solving as a dependent variable and age categories as an independent variable. Mean age and standard deviations for each age group are illustrated in Table 4.11. As indicated in the table, the age range was from 19.25 to 43.75 years. Groups three and four were more diverse samples than the first two, as shown by the standard deviation.

Groups of different ages did not differ in performance on real-life problem solving. No significant difference was found between the four age groups on practical intelligence, $F(3,112) = .64$, $p = .59$. This result contradicts the author's prediction about performance on real-life problem solving being related to age. Since the omnibus F was not significant, no Post Hoc procedures were used.

Table 4.11

Means and Standard Deviations of Performance on Real-Life Problem Solving for Four Age groups

Age Group	Mean / SD	n	Performance on Real-life Problems	Age	
				Days	Years
1	Mean	29	8137.01	7216.14	19.25
	SD		1017.65	281.03	
2	Mean	29	7976.34	8122.17	22.25
	SD		980.50	276.90	
3	Mean	29	8318.02	9927.24	27.50
	SD		938.70	1033.20	
4	Mean	29	8029.63	15774.41	43.75
	SD		1114.23	3468.39	
Total	Mean	116	8115.25	10259.99	28.00
	SD		1010.08	3796.31	

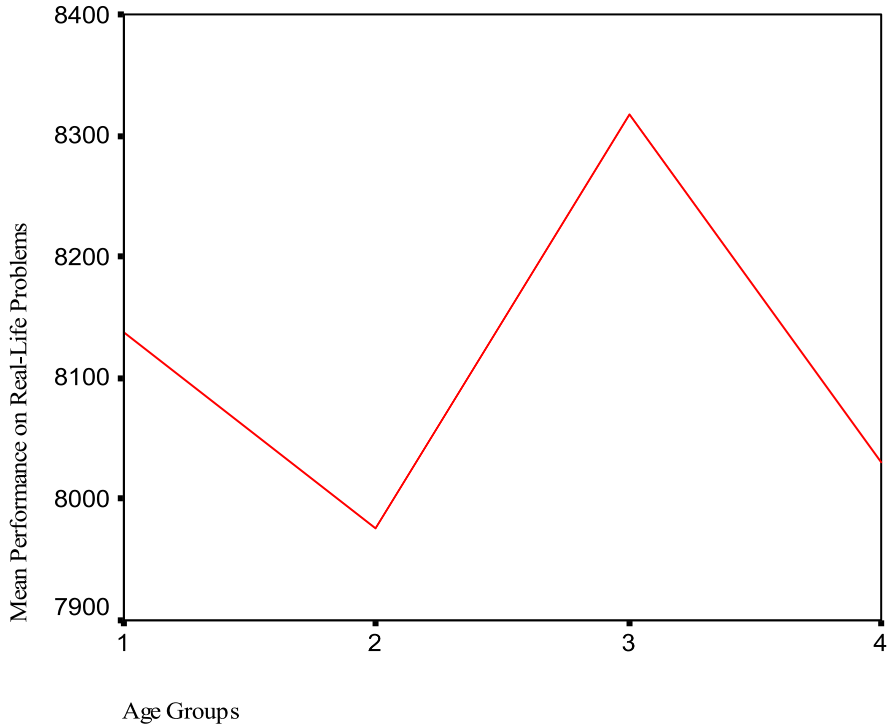


Figure 4.6: Line Graph Illustrating Mean Performance on Real-Life Problem Solving across Four Age Groups

CHAPTER V

DISCUSSION AND CONCLUSION

The primary purpose of this research was to investigate the role of two competing cognitive models in explaining practical intelligence. The secondary purpose of this research was to determine the contribution of some of the non-cognitive factors to practical intelligence. The author developed the Practical Intelligence Instrument (PII)—a multidimensional instrument—to assess people's performance on real-life problem solving and how this performance is related to cognitive and non-cognitive constructs. The PII was administrated to 116 participants. A multiple regression model, ANOVA, and correlational procedures were used to analyze the data.

This chapter includes the discussion of the research findings, suggestions for future research, implications, and study limitations. The author addressed the research findings in the following areas: (a) the role of the cognitive processes model, (b) the role of the types of knowledge model, (c) the role of the non-cognitive constructs, (d) contributions of all models and non-cognitive constructs, (e) the role of familiarity with problems, and (f) the role of age in practical intelligence.

Before starting the discussion, worth mentioning is that several covariate variables were used prior to the analyses of the data. Three variables' effects were isolated prior to the data analyses: gender, age, and familiarity with scenarios. These variables have a potential influence on the results, based on evidence from previous research. First, participants' gender distribution in this study showed that the number of female participants was twice as high as the number of male participants. Second, participants' ages in the sample ranged from 18 to 62. Third, participants who were familiar with problems outperformed those who were not, as indicated by the correlation between performance on real-life problem solving and the familiarity index. Therefore, the influence of these variables needed to be controlled.

First Category: The Cognitive Processes Model

Research Question 1

To what extent does the cognitive model contribute to people's performance on real-life problem solving?

Multiple regression analyses revealed that the cognitive processes model explained 48% of the variance in practical intelligence. The processes included in this model, governed by metacognition, are defining a problem, flexibility of thinking, and selecting a solution strategy. The findings supported the researcher's predictions that these cognitive processes contributed to people's performance on real-life problem solving. Furthermore, the effect sizes or practicality of these processes were relatively consistent with antecedent effect sizes from the literature. In the following section, I discuss each cognitive process and how it relates to practical intelligence.

Metacognition

The contribution of metacognition to practical intelligence was around 5% as revealed by the current study. The ambiguity of real-life problems requires that people organize and regulate their cognition. They must better define the problem, search for effective solutions, predict consequences, and control their emotions (Shin et al., 2003). In this study, two measures of metacognition were employed. The first measure was on a four-point Likert scale. This measure of metacognition correlated low with performance on real-life problem solving (*r* = .18). The second measure of metacognition was a performance-based item type and did not correlate with performance on real-life problem solving; however, this scale correlated with lower order thinking processes and three types of knowledge. The two metacognition subscales were not correlated. Nonetheless, they presumably measured the same construct. A possible explanation of the zero correlation of these two measures is that they measure completely different aspects of the metacognition construct. The Likert scale, as suggested by the author, measures cognitive confidence and self-awareness and the performance based items focus on problem solving skills (see items 53, 86, 87, 119).

Metacognition as measured by the Likert scale and practical intelligence shared some variance. The metacognition subscale was focused on cognitive confidence and self-awareness. This result means that participants who viewed themselves as competent in solving real-life problems and as possessing a higher degree of problem solving competencies performed better on real-life problem solving. In contrast, those who viewed themselves as less competent in solving problems and less confident in their cognitive skills performed somewhat poorly when solving real-life problems. I believe the fact that this relationship was not very high is noteworthy. A possible interpretation of the metacognition role in practical intelligence is that higher knowledge of cognition leads individuals to capitalize on this knowledge in problem solving situations. People who are more confident about their ability to solve problems are in a better position to propose effective solutions than are those who are less confident.

A metacognition component, as measured by the performance-based item, was associated only with lower-order thinking processes and types of knowledge (see Table 3.20). The performance-based items subscale showed a low correlation with flexibility of thinking ($r = .22$, $p < .5$), with the three types of knowledge (declarative, structural, and tacit) ranging from .20 to .25. These results supported the author's position that metacognition related to lower-order thinking processes and acquisition of types of knowledge subscales. Participants who performed well on the metacognition subscales also performed better on flexibility of thinking and the types of knowledge model. However, in contradiction to the author's predictions, no relationship was found between the performance-based items metacognition subscale (the 13-item subscale) and motivation and self-efficacy. Most importantly, no relationship was found between this subscale also and performance on real-life problem solving. A possible interpretation is that items of metacognition in the performance subscale were heavily reliant on problem solving skills in the domain of prejudice. Therefore, the metacognition subscale perhaps measured aspects of metacognition that were related to lower order thinking processes and acquisition of knowledge, but had no direct relationship with practical intelligence.

If the abovementioned explanation is true, the two subscales measure different aspects of metacognition. The low effect size of metacognition in practical intelligence can be referred to as the indirect contribution of the metacognition construct to problem solving. The metacognition construct had some relationship with lower-order thinking processes, as indicated by the correlations shown in Table 3.20 in Chapter III. Another possible explanation for the low effect size of the metacognition subscales, in this study, in comparison with the high effect sizes in the following research findings is related to the type of measure used in these studies.

Similar findings regarding the role of metacognition in solving problems were stated by several researchers. Swanson (1992) found that metacognition accounts for 10% of the variance in the domain of problem solving for different groups, which included gifted and high-average students. From a neuropsychological science point of view, reading a problem and planning a solution, as aspects of metacognition, also account for people's performance on real-life problem solving. Jaušovec (1997) found that the metacognition component, including time allocation during reading of a problem and planning solutions, contributes significantly (28%) to solving ill-structured types of problems. Furthermore, Shin et al. (2003) found that regulation of cognition was a significant predictor of performance on real-life problem solving in unfamiliar contexts. The effect size in the Shin et al. study and this study are similar (around 5%). This effect size is lower than the effect sizes in Swanson and Jaušovec's results. Perhaps the high effect size in the Jaušovec's study was a result of the type of measurement used to determine the metacognition effect. In Jaušovec's study, metacognition was measured by time allocation in reading the problems. This method contradicts the principles of this research; that is, speed of processing cannot be used as a means to measure a psychological construct. In Swanson's study, on the other hand, the effect size was also higher than that in both Shin et al. and the current study. A possible reason was that Swanson used a population different from that of Shin et al. and this author. Swanson investigated the contribution of metacognition to problem solving with gifted and high average-intelligence children (Swanson, 1992). In this population the effect size of metacognition on performance on real-life problem solving may be higher.

In conclusion, high practical intelligence is explained partially by cognitive confidence and self-awareness. The researcher believes that the metacognitive role in problem solving has to be further examined theoretically and empirically. A possible path for studying this construct is to employ several methods and measurements and validate these means by measuring participants' actual performance in real-life problem solving situations.

Defining a Problem

Defining a problem process contributed the least to practical intelligence in this study. The defining a problem process has to be taken with precaution. The author used four open-ended and four closed-ended items in the PII to assess ways people define real-life problems. Responses for the open-ended items were classified dichotomously by a team of three experts on three variables (see Appendix C): (a) specific vs. non-specific, (b) concrete vs. abstract, and (c) relevant vs. irrelevant. Correlations between these variables and performance on real-life problem solving were trivial and not significant. A possible explanation of these results is that performance on real-life problem solving was taken as the sum of the best solutions across six items. Defining problem variables on the three criteria were separated for each criterion and each scenario. The quality of problem definition based on the three criteria was mixed with the total of the performance on real-life problem solving. In other words, if solutions for each scenario were taken separately, possible relationships might emerge. Another possible explanation for the trivial and non significant correlation between dichotomous variables and performance on real-life problem solving results may be related to the order of the open-ended items in the PII. The open-ended items were preceded by the closed-ended items in the PII. The closed-ended items of defining a problem came right before participants provided the solutions for the scenario. The open-ended items were separated by several metacognitive items. This order might influence participants' perceptions of the problems and then their solutions. Their solutions may be based on the closed-ended set of definitions of problems. Therefore, the open-ended definitions' qualities were not taken into consideration by the participants in this study. As a result, the open-ended definitions were not correlated with performance on real-life problem solving. The last explanation may be supported by the following discussion about the closed-ended items of defining a problem.

Two options of the closed-ended items of defining a problem process explained part of the variance in performance on practical intelligence in this study. Participants' selections of the most relevant definitions for the four scenarios were dummy-coded on a dichotomous scale. Two definition statements predicted performance on real-life problem solving. The first statement is B 120: "Appearance of an individual is an important factor for the business culture." This statement is related to the Appearance in the Workplace scenario. Participants who did not select this statement as the most relevant definition to the Appearance in the Workplace scenario performed better on real-life problem solving than those who selected this option. This definition is broad and focused on interpersonal aspects of the problem. This definition is relevant to the scenario and should have been selected as relevant to the scenario. However, the result of defining a problem in this study contradicts this prediction. Perhaps, the performance on this definition accounts for practical intelligence because in comparison with other correct definitions, it is relatively vague and resulted in confusion on the participants' part. Another possible interpretation of not selecting the B 120 statement as relevant to the problem is that this definition is focused on interpersonal aspects of the problem. Nonetheless, the scenario represents a problem that is less relevant to interpersonal conflicts than problem focus. An interesting trend associated with this result is discussed in the following paragraph with a second option.

The second statement that predicted performance on practical intelligence was B 146: "Stereotypes represent cultural conflicts." This statement is a definition of the Stereotyping scenario. Participants who selected this statement as the most relevant to the stereotyping scenario performed worse on real-life problem solving than those who consider this statement irrelevant to the problem. Indeed, this definition is broad and focused on interpersonal aspects of the problem. An interesting trend from both definitions is that they focus on interpersonal aspects of the problems and are unspecific. While both scenarios include real-life problem solving, the two scenarios do not involve direct interpersonal conflict. In the appearance-based prejudice scenario, a problem of a person with a company is presented; it is somewhat related to interpersonal conflict. On the other hand, the second definition (B 146: Stereotypes represent cultural conflicts) is related to a stereotyping problem and how people could solve it. Thus no immediate conflict is described in either scenario.

In this study, the process of defining a problem was measured by an abstract method, including several properties of the definitions. However, in the Berg et al. (1998) study, the method was more direct to problem solving strategies. Berg et al. asked participants to describe problems in different domains and then they used participants' answers as an indicator of how they defined the problems.

Analyzing the defining a problem variable was a unique goal in this study. Needless to say, defining a problem is a subjective process that reflects immediate interaction between the context and the personal world. The defining a problem line of research is relatively new in contrast with research on other cognitive processes. Future research has to be carried out using different qualitative methods to reveal what constitutes people's processes for defining problems they encounter in life.

Flexibility of Thinking

Flexibility of thinking was the highest contributor to variance in practical intelligence in this study. The partial correlation of flexibility of thinking and performance on real-life problem solving was moderate (r_p = .44) after isolating the effects of other variables in this study. This correlation is relatively high and explains important variance in practical intelligence. This finding was consistent with the author's prediction that flexibility of thinking was one of the most important predictors of practical intelligence. Participants who are flexible thinkers perform better on real-life problem solving than those who are less flexible. On the other hand, individuals who see the problem from one angle generate solutions that are not diverse. From a theoretical point of view, people who propose many alternative solutions for a particular problem are in a better position to solve problems.

Consistent results were found by Patrick and Strough (2004) when they examined the role of flexibility of thinking in solving real-life problems. They concluded that flexibility of thinking accounts for 25% to 35% of the total variance in solving real-life problems. In Crawford and Channon's (2002) study, the authors examined the role of fluency of thinking in solving real-life problems. They found that older people produced fewer solutions than younger people. Crawford and Channon's result related to the role of flexibility of thinking in practical intelligence contradicts this study result and Patrick and Strough's result. However, Crawford and Channon defined fluency as the total number of strategies generated by participants whereas flexibility of thinking in both this study and in Patrick and Strough was defined as the number of unique strategies provided by participants. Even though the actual difference between the two definitions is small, flexibility of thinking, theoretically, is an important construct for problem solving. Flexibility of thinking has been used in several problem solving models (Treffinger, 1995; Treffinger et al., 2000). People who generate diverse solutions are better at solving problems.

In conclusion, flexibility of thinking was the cognitive process most associated with practical intelligence. This construct contributed at least 44% of the variance in people's performance on real-life problem solving. This effect size is very high in comparison with other cognitive processes. Perhaps this was a result of taking into consideration only the best solution of what an individual provided as means to measure practical intelligence. After proposing a solution for a problem, a person evaluated her/his resolution. If the solution was effective, s/he might go to the next item and if the solution was not effective, s/he produced more solutions. If this approach had been used by participants, flexibility of thinking should associate highly with practical intelligence. The role of flexibility of thinking in practical intelligence has to be taken cautiously when this result is used by others. Flexibility of thinking also has to be investigated further to determine its contribution to practical intelligence with different populations, ages, and problems.

Selecting a Solution Strategy

Selecting a solution strategy was the second best predictor of performance on real-life problem solving in the cognitive processes model. The partial correlation between selecting a solution strategy and performance on real-life problem solving was moderate, ($r_p = .35$). This correlation is the relationship between evaluation/selection of a solution strategy and performance on real-life problem solving when all other variables in this study are isolated from both. This correlation is relatively high. This result was consistent with the researcher’s prediction that selecting a solution strategy was associated with performance on real-life problem solving. A possible interpretation for this finding is that participants who use evaluation and critical thinking during problem solving are better at producing effective solutions. Theoretically, selecting a solution strategy processes include an individual’s ability to evaluate several solutions and select the best alternative that solves the problem. People who are able to evaluate different alternatives and predict their consequences properly are more effective problem solvers than those who lack this skill.

The effect of selecting strategies on practical intelligence has been articulated in several studies. For example, Blanchard-Fields et al. (1997) examined qualitative age differences in everyday problem solving in different contexts. They found that participants used different solution strategies that fit the domain of the problem. In another study, Klaczynski (1994) investigated selecting a solution strategy in relation to the type of task people encounter. The result showed that context and age influenced the selection of a solution strategy. Berg (1989) investigated perceptions of different age groups in solving real-life problems. The results showed that particular strategies were perceived by participants of a particular age group as more effective than others. The effect size was relatively high in her study ($\eta^2 = .52$) whereas the effect size in this study was low ($r^2 = .12$). A possible explanation for these results is that the selecting a solution strategy process in this study has been evaluated based on experts' ratings. By contrast, in Klaczynski and Berg's studies, the actual participants' ratings were analyzed. Selecting a solution strategy process in both studies was the dependent variable whereas it was used in this study as an independent variable. Therefore, selecting a solution strategy has to be quantified in one variable in order to be used as a predictor. That is, the two research designs previously discussed are different from the current study. Specifically, the author of this study examined participants' evaluation of solutions as possible predictors of variance in performance on practical intelligence.

Research Question 2

To what extent is practical intelligence associated with general academic knowledge?

Academic knowledge was slightly related to practical intelligence. Performance on real-life problem solving and academic performance as measured by grade point average (GPA) had a low relationship ($r = .20$, $p < .05$). The correlation coefficient of determination for this relationship was very low, $r^2 = .04$. This result can be explained as participants who perform well on practical intelligence did not necessarily possess a high GPA. This finding was partially consistent with this author's prediction that practical intelligence and academic intelligence are distinct even though the relationship between both constructs was low.

Two possible interpretations can be made about this finding. First, the low shared variance between performance on real-life problem solving and general academic performance can be regarded as distinguishable features of the two types of intelligences because the common variance between practical and academic intelligence is less than 4%. Thus, the two constructs can be viewed as distinct from each other. Another possible interpretation is that cognitive differences for the two constructs can be observed by studying the difference in the external world of an individual. Many external variables are associated with the unique features of both types of intelligences, including diverse types of problems, contexts, experiences, and environments. People are exposed to a wide range of these factors during different epochs in their lives. These different aspects of contexts lead to the development of different types of cognitive structures that enable some to deal with problems effectively while others are incapable of doing so.

The trivial association between practical and academic intelligences was articulated with other researchers' results. For example, Sternberg et al. (2001) investigated the relationship between practical intelligence and academic achievement with adolescents. Practical intelligence correlated from low to moderate with several achievement scales, including a vocabulary test and the Raven Progressive Matrices. Correlations ranged from -.29 to -.16. Similarly, Heng (2000) found that the correlations between performance on academic subscales and performance on real-life problem solving were very low (.02 to .14). In Heng's study, different ability groups were included. Supporting evidence also emerged from a study conducted by Ceci and Liker (1986) that included participants who were intelligent and average (on IQ tests), and their ability to predict horse race winners. They found that performance of experts was not correlated to the IQ test results (r = -.07).

In conclusion, real-life problems and academic problems are of different types. They have different structures. The contexts of the two types provoke diverse types of problems in that every context shapes its population. Performance on practical intelligence of different age groups has to be further explored, using the same method as in this study in different contexts and different domains of knowledge.

Second Category: The Types of Knowledge Model

Research Question 3

To what extent does the knowledge model contribute to people's performance on real-life problem solving?

Multiple regression analyses revealed that the type of knowledge model explains about 15% of the variance in performance on practical intelligence. Two types of knowledge are included in this model: structural and tacit. These types are assumed to be governed by the metacognition construct, because skills of knowledge acquisition and memory are regulated by metacognition. The findings of this section support the researcher's prediction that the type of knowledge model contributes to people's performance on real-life problem solving. Knowledge is the sphere on which cognitive processes operate. People make use of their knowledge, whether structural or tacit, during the course of problem solving. The effect sizes or practicality of these processes are partially aligned with previous effect sizes from the literature. In the following, I discuss each type of knowledge as it is related to practical intelligence.

Structural Knowledge

Structural knowledge was not a significant predictor of people's performance on real-life problem solving in this study. The partial correlation between structural knowledge and practical intelligence was very low ($r_p = .035$). This minor correlation means that after removing the effect of all other variables involved in the analysis, structural knowledge and performance on real-life problem solving do not correlate. Two possible interpretations for this result are theoretical and methodological. First, a theoretical explanation of this finding is that structural knowledge may contribute to practical intelligence if problems depend heavily on the domain of specific knowledge. For example, structural knowledge may be of use if real-life problems under investigation are related to an ecosystem or technology. In the scenarios presented in this study, the focus was relatively free of domain of knowledge. The participants in this study may lack structural knowledge that is used by specialists. Perhaps, they only capitalized on their contextual knowledge—tacit knowledge—in solving real-life problems.

Second, the methodological concern is related to the structural knowledge items used in this study. The structural knowledge subscale in the PII was the most controversial part for reviewers. Reviewers from the domain of sociology did not agree that these items measured structural knowledge specifically. Perhaps the development of this part would have been more valid if it were done by experts in sociology and not by the author. Another methodological concern is related to the cognitive map used in developing structural knowledge items. Day et al. (2001) argued that it is difficult to reveal how knowledge is organized using this method. If he is correct, this might add to a low correlation between structural knowledge and performance on real-life problem solving. Furthermore, participants had mentioned to me that the structural knowledge items could be solved in many different ways. This was a consistent comment from many. Perhaps the usage of a general stem in these items (as mentioned in the method section) caused the confusion on the participants' part. Today, I believe that these items should have been developed by a team of experts, because superficial or general knowledge in the domain of social science does not necessarily help in developing structural knowledge items.

Research findings supported the position that structural knowledge is important to problem solving if the problem depends vitally on a domain of knowledge. For example, in three studies, researchers used specific domains to assess structural knowledge. Structural knowledge in these studies was significantly correlated with problem solving. For example, Shin et al. (2003) studied structural knowledge in the domain of science. They found that structural knowledge was a significant predictor of skill in solving ill-structured problems. Gobbo and Chi (1986) examined structural knowledge, particularly in concepts related to dinosaurs. They found structural knowledge to be a significant predictor of performance in solving ill-structured problems in that domain. Benner's (1984) study of structural knowledge was in the domain of nursing. The above mentioned studies showed evidence of the role of structural knowledge when the solutions depended heavily on knowledge in the domain. Day et al. (2001), by contrast, did not use real-life problems; instead, they used computer game programs to measure structural knowledge. Solving real-life problems that depend profoundly on domain-specific knowledge requires structural knowledge, whereas real-life problems that are less dependent on domain-specific knowledge may not need structural type of knowledge.

Tacit Knowledge

Tacit knowledge was the only contributor to performance on practical intelligence from the type of knowledge model; that is, practically intelligent people depend on their implicit knowledge to solve real-life problems. This type of knowledge was a significant predictor of problem solving. The partial correlation between tacit knowledge and practical intelligence was moderate ($r_p = .33$). The partial correlation explains only the overlapping variance between these two variables after controlling the effect of all other variables involved. This partial correlation is relatively high in comparison with other variables and, more specifically, higher than structural knowledge in this study. In contrast with structural knowledge, tacit knowledge is a contextual type of knowledge that is not related to scientific knowledge of a domain. Thus, everyday problem-solving ability is developed to respond to contextual dilemmas that people encounter. Through their interactions, people develop experience and learn effective strategies. These experiences are a type of tacit knowledge. Therefore, this type of information is important in the solving of contextual problems. Participants who possess this type of knowledge perform better than those who lack this type.

The concept of measuring tacit knowledge in problem solving is a new concept in problem solving (Sternberg et al., 2000). Tacit knowledge, in comparison with structural knowledge, is acquired though life experience and is necessary for success in daily living. Consistent results have been articulated in several studies regarding the role of tacit knowledge in solving real-life problems. For example, Sternberg et al. (2001) investigated the role of tacit knowledge in practical intelligence for school-age students. Tacit knowledge explained a great deal of variance in practical intelligence. In another study, Wagner and Sternberg (1985) showed that tacit knowledge in the workplace had a positive relationship with employee salaries and levels of the employees in the company. In another study, Wagner (1987) found that tacit knowledge increased with experience. All the above researchers stated explicitly the important role of tacit knowledge in practical intelligence.

The effect sizes in the previous studies were somewhat comparable with those in the current study. For example, around 11% of the variance in practical intelligence in this study was explained by tacit knowledge. Similarly, Wagner and Sternberg (1985) revealed a similar effect size between practical intelligence and rating of professional success. However, Sternberg et al. (2001) and Nevo and Chawarski (1997) found a higher effect size (r^2 = .36). A possible explanation for the low effect size in this study is related to experts' ratings. As mentioned earlier, experts tend to disagree upon the effective strategies as revealed by the low agreement in rating of tacit knowledge items for this study (see Table 3.12 in Chapter III). The disagreement was within experts from the same domain of expertise. The disagreement influences evaluation of participants for each strategy whereby the effect size might be affected.

In conclusion, tacit knowledge and practical intelligence share common aspects. Tacit knowledge is contextual and not learned in schools. An important need for future research is to study how this type of knowledge is acquired. Furthermore, tacit knowledge has to be integrated in school disciplines. A developmental study of how tacit knowledge unfolds at different ages also is an important goal that would contribute to our understanding of this phenomenon.

Research Question 4

To what extent is practical intelligence associated with domain specific knowledge?

Practical intelligence did not correlate significantly with domain specific knowledge. Performance on real-life problem solving did not show a strong relationship with domain specific knowledge as indexed by declarative knowledge ($r = .10$, $p > .05$) and structural knowledge ($r = .14$, $p > .05$), a result which contradicts the author's prediction. A possible interpretation of these findings is that no real relationship exists between domain specific knowledge and practical intelligence. Another possible interpretation of this result is that both declarative knowledge and structural knowledge are academic knowledge and therefore these types of knowledge are not related to people's performance on real-life problem solving as indicated in research question 3. Additionally, another possible explanation is that both the declarative and structural knowledge subscales lack sufficient psychometric validity and reliability. As mentioned in Chapter III, the declarative knowledge subscale did not show high reliability; therefore, many problematic items were deleted from this subscale.

The relationship between domain specific knowledge and problem solving has been investigated by Shin et al. (2003). They found that domain specific knowledge is associated with the solving of well-structured problems in the domain of science. However, the domain specific knowledge was not correlated with the solving of ill-structured problems. This result was consistent with the findings in the current study.

In conclusion, no relationship was found between domain specific knowledge and practical intelligence. A study of this relationship was a unique goal of this research. Hence, there is more need to investigate the link between domain specific knowledge and practical intelligence in future research. A relationship might emerge if quality of solutions to the problems presented depends strongly on domain specific knowledge.

Third Category: Non-Cognitive Factors

Research Question 5

To what extent do the non-cognitive constructs contribute to people's performance on real-life problem solving?

Multiple regression analysis revealed that non-cognitive factors explained around 20% of variance in practical intelligence. The non-cognitive factors include two constructs: motivation and self-efficacy. These constructs also are assumed to be managed by metacognitive components. The findings reported in this section support the researcher's prediction that the non-cognitive factors are associated with people's performance on real-life problem solving. The proportion of variance explained by the non-cognitive factors is relatively high. In the following, I illustrate each construct's role in this study.

Motivation

Motivation in this study was the only significant non-cognitive predictor of performance in practical intelligence. The partial correlation between motivation and practical intelligence was moderate ($r_p = .33$). That is, the correlation between motivation and performance on real-life problem solving, when removing the effect of all other variables involved in both, was moderate. Motivation, as predicted by the author, is among the critical contributors to practical intelligence. People with high motivation tend to perform better than those with low motivation on real-life problem solving. Further, real-life problems might be of more interest to individuals than other types of problems. This type of interest is an important factor for experience that leads to effective problem solving. People who are interested in a domain spend more time and effort to interact with that domain.

Several other researchers emphasized the role of motivation in problem solving. For example, Richardson's (2002) meta-analysis indicated that maximal performance in problem solving resulted from high motivation. However, Shin et al. (2003) found contradicting results regarding the role of motivation in solving both well- and ill-structured problems. They did not find motivation to be an important predictor of performance in problem solving. Perhaps, because motivation is measured in the Shin et al. study by a general scale of motivation, the relationship between motivation and solving problems was not revealed. If motivation were measured with the same level of specificity as items in this study, a stronger relationship might have emerged.

Self-Efficacy

Self-efficacy did not predict performance on practical intelligence items in this study. The partial correlation between performance on real-life problem solving and self-efficacy scores was very low (r = .093) after removing the effect of motivation. Contradicting the author's prediction, self-efficacy was not a predictor of performance on real-life problem solving. Noteworthy is that the correlation between performance on real-life problem solving and self-efficacy was low and significant (r = .24, p < .01) and the correlation between motivation and self-efficacy (r = .44, p < .01) was moderate. One possible interpretation of the self-efficacy results was that the variance of scores on the self-efficacy items—that supposedly had to explain practical intelligence—was confounded with motivation and the leftover variance between self-efficacy and performance on real-life problem solving, after factoring out all variables, was very small (see Figure 4.4). In other words, self-efficacy shared its variance with motivation and did not add an important explained variance to practical intelligence. The last interpretation was confirmed by analysis of the partial correlation between self efficacy scores and performance on real-life problem solving. When the effect of motivation was partialled out, the correlation between self-efficacy scores and performance on real-life problem solving was very low and not significant (r_p = .08, p = .35). Another explanation for the absence of self-efficacy's role in practical intelligence was related also to methodological shortcomings. Self-efficacy was measured by only four items and the reliability estimate for the four items was low (*r* = .63). Therefore, no inferences should be drawn about the role of self-efficacy in practical intelligence based on this study.

Contradicting the results related to self-efficacy in this study, many researchers showed that this construct is an important predictor of problem solving. For example, in a meta-analysis of over a hundred studies, scholars found self-efficacy and work performance to be positively and strongly correlated (Cited in Davis & Curtis, 2003). Furthermore, similar results were found by Kanevsky (1990). She found in a qualitative study that high ability groups were more self-confident than low ability groups.

In sum, self-efficacy did not associate with practical intelligence in this study, even though self-efficacy was among the robust predictors as mentioned by scholars (Blanchard-Fields et al., 1997). I suggest that practical intelligence has to be studied with self-efficacy and other non-cognitive factors together. Further investigation of the role of the non-cognitive constructs in practical intelligence is of interest to the author.

Fourth Category: The Contribution of the Two Models and Non-cognitive Factors

Research Question 6

To what extent do the two models and non-cognitive factors together contribute to practical intelligence?

Multiple regression analysis showed that the two models and the non-cognitive factors explained around 54% of the variance in practical intelligence. In other words, around 54% of the variance in performance on real-life problem solving can be explained by the components of the two models and motivation collectively. The partial correlations for these components ranged from .18 to .43. In this discussion, the focus will be on the contribution of each model in comparison to the others.

First, practical intelligence as explained by the cognitive processes model is higher than either explanation of the types of knowledge model and the non-cognitive model. The cognitive processes model alone accounts for 48% of the variance in performance on practical intelligence. A possible explanation of the superiority of the cognitive processes model was that most of the scenarios presented in the PII required immediate responses and they did not necessarily require domain specific knowledge. People who encounter such situations rarely think through their knowledge repository. Therefore, people do not rely on their knowledge in solving real-life problems. Perhaps they use their knowledge with more well-defined problems. Another potential explanation for the high role of cognitive processes in practical intelligence is that the true role of the types of knowledge model was not discovered.

Second, practical intelligence was predicted more by motivation than by the types of knowledge model. Motivation accounted for around 20% of the variance associated with solving real-life problems. Motivation was the second highest component that predicted performance in problem solving. Unquestionably, motivation is the power that energizes an individual to achieve. People with a high level of energy perform better than those with less energy when all other variables are held constant.

Last, structural and tacit knowledge collectively explained less variance in practical intelligence than either the cognitive processes model or non-cognitive model. The types of knowledge model accounted for around 15% of the total variance shared with practical intelligence. As mentioned above, the role of the types of knowledge model was not revealed entirely in this study. Nevertheless, the types of knowledge model shared some variance with performance on real-life problem solving.

In conclusion, practical intelligence includes several cognitive and non-cognitive competencies. In this study all models accounted for higher shared variance with practical intelligence than each model or component alone. The total variance shared was 54%, consistent with the researcher's prediction that collectively all models would contribute more than each factor separately to people's performance on real-life problem solving.

Fifth Category: Familiarity with Problems

Research Question 7

To what extent is familiarity with problems associated with performance on a measure of practical intelligence?

Participants who were familiar with most of the scenarios performed better than those who were not familiar with the scenarios. ANOVA revealed that the four groups that were classified based on their familiarity with the scenarios differed significantly. Participants in group four (this group is highest in familiarity) achieved better than the rest of the groups by two standard deviation units. Group three had the second highest average scores on real-life problem solving. The lowest average score, on real-life problem solving, was earned by group one (see Table 3.9). This finding provides support to the author's prediction that people who are familiar with problems perform better than those who consider these problems to be novel. An interpretation for this result is that participants who were exposed to similar problems in the past have developed different solution strategies and have observed their consequences; they developed a deeper understanding of how to approach similar problems effectively. Another interpretation is that individuals might have observed effective and efficient solution strategies and might have adapted them. Familiarity with problems accounted for at least 19% of the variance in performance on real-life problem solving in this study.

Similar results were found by others. For example, Smith and Baltes (1990) argued that people performed better when problems were more familiar to their age group. However, other researchers did not find that experience and familiarity with problems influenced performance (Berg, 1989). Crawford and Channon (2002) argued that greater life experience with problems resulted in advantages to the people who were exposed to these types of problems.

In conclusion, familiarity with problems leads to better performance. People with high experience and frequent exposure to certain types of problems tend to achieve higher than those with less experience. Prior experiences with real-life problems are types of learning activities. People try different solutions and approaches to solve problems. Based on such experience, effective strategies are retained and poor ones are eliminated.

Sixth Category: Age as a Factor

Research Question 8

To what extent do older adults perform better than younger adults?

ANOVA revealed that the four age groups did not differ significantly in their performance on real-life problem solving. This result was unexpected. The author predicted that adults would outperform younger participants in solving real-life problems.

However, the result did not support this prediction. A potential explanation for this result is that the problems presented were not of interest to older adults and were not ecologically valid for their age. If problem types in this study were isolated, age could have an influence over practical intelligence.

Another possible explanation of this result is related to scoring the solution of real-life problems. The scoring was carried out by three sociologists at an average age of 31 years. This team's age fell into the third age group. This team scoring of solution strategies might be associated with their group's superiority in practical intelligence. They may evaluate solutions as effective only for their age group. In other words, if the evaluation of these solution strategies were done by an older adult, age might emerge as a factor in solving real-life problems. That is an important research question to be investigated in the future.

In addition, age distribution may be a factor contributing to this result. Age groups one and two were less diverse than groups three and four. As indicated by the standard deviations of the last two age groups, these groups were heterogeneous in comparison with the first two (see Table 4.11). This large dispersion from the last two groups is a potential reason for no performance difference between age groups.

Practical intelligence has different patterns of problem solving strategies in different domains. Blanchard-Fields et al. (1997) found that older and middle age adults use action strategies and cognitive analysis when they encounter problems in the consumer and management domain while younger adults and adolescents apply different strategies. Further, no age differences were found in selecting solution strategies. Even though this result supports the findings of this study with regard to age, it contradicts the author's prediction. The author's prediction was based on the assumption that older people are exposed to more problems than younger people.

In closing, age was not associated with practical intelligence in this study. Many potential factors might influence age as a factor, including problem types, experience, and scoring solution strategies. A possible conclusion for age as a factor is that different age groups may differ in selecting strategies qualitatively but not in overall performance in problem solving. Nonetheless, more research is needed to reveal the role of age in practical intelligence.

Implications

The implications of the results of the current research are for educational and psychological use. First I discuss the educational implications with a focus on teachers, schools, developers of educational programs, and policy-makers. Second, the discussion of psychological implications is presented.

Educational Implications

This author in part emphasized the importance of the problem solving abilities that distinguish human beings from other species. This is an important goal for schools to achieve. Problem solving ability seems to be influenced by the context in which problem solving competencies unfold. Thus, the most important implication is that real-life problems need to be included in the school setting. Evidence from the findings of this research and previous research shows that performance on real-life problem solving is not associated highly with academic performance. Furthermore, academic problems may lack the complexity of real-life problems that is important for cognitive development. Relative degrees of complexity of problems that learners are exposed to are essential for individuals' competencies to advance. Practical intelligence as a means of success in life can be at the heart of school objectives. Practical intelligence competencies have to be developed systematically in a school curriculum.

Educators need to optimize educational programs that take into consideration the competencies of students. Today, teachers need to consider the students' strengths and weaknesses when developing an instructional design and eliminate the one-size fits all teaching approach. Students vary in their cognitive and non-cognitive competencies. For example, the results of this study have shown that different competencies explain various aspects of practical intelligence. These competencies need to be assessed in students and then developed to enhance students' competencies and deficiencies.

In addition, at the heart of teachers' work in schools is to teach problem-solving skills for all students. The author of this research suggested that several higher- and lower-order cognitive processes are essential to be developed as competencies for effectively solving problems. These competencies can be integrated in the curriculum and classrooms activities or can be taught separately to all students to enable them to effectively solve problems. Teachers can arrange various instructional designs by modifying four components of the school curriculum: content, process, product, and environment (Maker & Schiever, 2005). The content component can be modified by integrating real-life problems in instructional designs. For example, teachers can use various real-life problems with different degrees of complexity and novelty. The process component can be modified by applying different thinking skills to novel situations, interacting with peers and groups, using how and why questions, and encouraging thinking aloud strategy. The product component can be modified to foster problem solving competencies by allowing students to be creative and develop different types of products and not be limited to paper-and-pencil tests only. Another important way to foster these competencies is to be a role model as a teacher in using different instructional designs, examples, and products. Most importantly for all above is the climate in which these competencies can flourish and be strengthened. Teachers who allow freedom of choice, variety of products, and accept students are in better position to develop a wide range of thinking skills and competencies than those who lack them. These modifications activate both higher- and lower-order cognitive processes in problem-solving. Teachers can target these cognitive competencies and allow students to experience and practice them.

More specifically, teachers can develop particular cognitive processes using direct instructions in a classroom setting. For example, metacognitive components including planning, monitoring, and formulating strategy can be fostered when teachers allow students to participate in planning activities: defining goals, developing steps, executing activities, and monitoring progress to achieve their goals. Defining a problem is among the critical components for problem-solving. Teachers who assign tasks or present problems to students can ask students to redefine the problem and develop the vision of the final outcome. Flexibility of thinking can be developed through a series of activities, such as allowing freedom of choice among many activities, groups, tasks, problems, and products. Selecting a solution strategy involve an evaluation and critical thinking skills. This process can be developed by asking students to define criteria for the final products. A discussion with students can lead to important standards for their work. These recommendations can be used directly by teachers to plan the classroom activities.

Developers of educational programs need to make use of research findings in creating curricula. Developers of educational programs, textbooks, and learning activities should include a wide range of activities to develop problem-solving skills and cognitive processes. Activities that are contextually valid are accepted more by students than those that appear only in textbooks. Furthermore, curriculum developers can use resources in the environment to develop real-life experiences and not be limited to an abstract form of problems. In addition, today the need for self-learning curricula is tremendous. Curriculum developers can focus on this type of learning to help teachers and families access opportunities in which students can learn on their own. This area of learning can be of a great benefit for students, especially with the support of technology in this era.

Policy-makers need to specify cognitive competencies in which schools and teachers have to achieve. Policy-makers can provide measurable goals that focus on problem solving skills for schools and teachers to achieve. These skills have to be systematically developed and measured. Furthermore, policy makers can develop policies and procedures for schools to emphasize contextual learning activities. Encourage teachers to employ contextual learning and provide incentives and grants to serve this purpose. Eliminate barriers in schools to facilitate the work toward contextual learning.

Psychological Implications

The findings of this study also are of use for the development of procedures for identifying people with practical intelligence and the development of programs to enhance these abilities. The PII consists of several important components that explain much of the variance in practical intelligence. This instrument can be used to identify those who are good problem solvers in real-life situations. Also, this instrument can be used as an assessment tool to pinpoint strengths and weaknesses in aspects that the PII measures. However, the PII limitations have to be considered. For example, the PII cannot be used to measure the processes of defining a problem, declarative knowledge, or structural knowledge, because these sections lack sufficient validity and/or reliability as mentioned above. This instrument can be used in conjunction with other assessments to obtain a more comprehensive picture of the examinees' abilities.

Psychologists need to strive to identify factors that explain practical intelligence. The findings of this study showed that there is still unexplained variance in practical intelligence. This variance might be due to other psychological constructs that are not included in this study. Furthermore, the relationship between the cognitive competencies and the types of knowledge has to be revealed to help educators, program developers, and policy-makers provide better educational opportunities.

Developers of tests of intelligence need to employ problems that are contextually valid. Even though psychologists claim to measure intelligence, they use very simple tasks and superficial indications (e.g., speed of processing) to do so. The performance on complex real-life problem solving cannot be paralleled with tasks in tests of intelligence as many researchers claim.

Finally, in both the educational and psychological fields, technology needs to play a wider role. The capacity of technology and its applications in education and psychology today is tremendous. This means it has to be an integral part of educators, program developers, policy-makers, and psychologists' occupation. Appropriate use of technology promotes efficiency and effectiveness.

Limitations

Several limitations are found in this study in both theoretical and methodological aspects. The theoretical shortcomings of the current study are related to the associated constructs that are measured and the psychometric properties of some subscales in the PII. Practical intelligence may be explained by other factors beyond the factors included in this research. The factors involved in this research explain about 54% of the practical intelligence variance. That is, around 46% of the variance is not explained and might be associated with factors outside the scope of this study.

The methodological limitations are related to the sample, reliability of some subscales, the domain of knowledge, hypothetical scenarios, scoring solutions, and demographic factors. First, the results of the current study cannot be generalized because the sampling was not random. Participants were recruited voluntarily. Second, the reliability of several subscales was not sufficient, in particular the declarative knowledge and self-efficacy subscales. The low reliability of some subscales in this study indicates that the obtained scores from these subscales are not accurate. That is, using information from unreliable subscales cannot be trusted because a great source of error encompasses the data (Bryk & Raudenbush, 1987; Grimm & Yarnold, 2004a). Therefore, the conclusion with regard to this information is questionable. Third, the author of this study employed the domain of prejudice as a possible domain for real-life problems. More research is needed in different domains to validate the current study results. Fifth, even though the scenarios/problems used were real-life problems, they were hypothetical problems for participants. Thus, performance on real-life problem solving has to be examined in an actual setting to further validate the findings of the current study. Sixth, demographic factors have not been taken into consideration with regard to practical intelligence, including socioeconomic status and ethnicity of participants. Finally, the researcher did not examine several factors in the current study because of the limited number of participants.

APPENDIX A

PRACTICAL INTELLIGENCE INSTRUMENT (PII)

Practical Intelligence Instrument (PII)

Personal Information

- The information included in this survey will be held confidential by the researcher, No one will be allowed to look at it.
- After the researcher analyzes the results, Personal information will be destroyed.

Name	1.First 2.Last	11. Phone	
3. Gender	□ Female □ Male	12. Email	
4. Date of Birth		13.Major/GPA	(______of 4:00)
5. Status	□ Employee □ Student	Scores on Standardized Tests	
6.Degree	□ Undergraduate □ Graduate		
7. College		14. SAT	Verbal ( ) Quantitative ( ) Analytical ( )
8. Year of College		15. CAT	Verbal ( ) Quantitative ( ) Analytical ( )
9. Ethnicity		16. GRE	Verbal ( ) Quantitative ( ) Analytical ( )
10. Country of Origin		Others	

Directions

Please read through the following materials and answer the questions based on your thinking. You should know that real-life problems included in this instrument do not have right or wrong answers; however, one solution may be more effective than another.

Note that in some coming questions, you need to have a headset ready.

General Questions

(Familiarity) 17. Have you taken SOC 101 -- Introduction to Sociology or an equivalent course ?			
□ Yes, Grade:	□ I am taking it now	□ No	

(Familiarity) 18. How frequently do you face prejudicial situations on a weekly basis as a recipient or a witness?			
□ Always (6-more times)	□ Often (4-5 times)	□ Some Times(2-3 times)	□ Never (0-1 times)

(Motivation) 19. To what extent are you interested in learning strategies to minimize prejudice and discrimination?			
□ Uninterested	□ Somewhat interested	□ Interested	□ Very interested

20. Do you want to receive a summary of how to deal effectively with prejudice problems?			
□ Yes email me	□ No		

Cognitive Confidence Always= 4, Most of the time =3, Some time =2 , Rarely = 1	4	3	2	1
21. I am a good problem solver				
22. I am competent in producing effective solutions for problems				
23. I trust my ability to solve complex real-life problems				
24. My friends take my suggestions when they encounter problems				
25. When I worry, I think irrationally				
26. I consult with others to solve problems				
27. My guesses about what to do in problem situations are correct				
28. I mislead people with my recommendations for their problems				
29. I am overwhelmed by anxiety when exposed to problems				
30. I doubt my ability to solve a complex problem				

Self-Awareness Always= 4, Most of the time =3, Some time =2 , Rarely = 1	4	3	2	1
31. I cannot control the flow of my thoughts in problem situations				
32. I have control over my thoughts				
33. I evaluate my thinking during the problem-solving process				
34. I can tell which cognitive skills I am using during problem-solving				
35. I pay attention to details in my work				
36. I analyze the difficulty of problems				
37. Worrying thoughts disrupt my thinking when I am in a conflict situation				
38. My anxiety increases when solving complex real-life problems				
39. I judge my solution after a problem situation				
40. I lose track of my thoughts when I solve problems				

Cognitive Processes

and

Tacit Knowledge

Scenario 1: The Ice Cream Shop

- Please read the following scenario carefully. The following questions are based on this scenario.

- Sarah was waiting for her turn at the ice cream shop and noticed that it was a little busy. The people in line included a black woman and her young daughter. As Sarah got in line to get ice cream, she noticed how friendly the man serving the ice cream was to his customers. He would serve the ice cream first and then take the money.

  When it came time for the black woman to order, the man serving the ice cream asked her rudely what she wanted. She told him, and he asked her for the money before he would scoop out the ice cream. She paid him, and then he gave her the ice cream. Next, it was the little girl's turn, and he had the same attitude with the young girl. He harshly demanded the money and then gave her the ice cream. The girl was very frightened (Douglas, n.d.).

  Based on this scenario, answer the following questions.

41. In one statement, define the problem you read in Scenario 1: The Ice Cream Shop

____

42: (Construct Validity) Could this be a real-life problem?			
□ No	□ Not sure	□ Yes	

43: (Construct Validity) Do you think this problem relates to prejudice?			
□ No	□ Not sure	□ Yes	

44: (Construct Validity) Do you think this problem or similar situations occur frequently?			
□ Yes	□ No	□ Not sure	

45 : (Self-efficacy) Can you suggest solutions for this situation?			
□ Yes	□ No	□ Not sure	

46: (Familiarity) On a weekly basis, how frequently do you notice people in similar situations?			
□ Never (0-1 time)	□ Sometimes (2-3 times)	□ Often (4-5 times)	□ Always (6-more times)

47: (Familiarity) On a weekly basis, how often do you personally, as a recipient of prejudice, experience a similar problem?			
□ Always (5-more)	□ Often (3-4)	□ Some Times(2-3)	□ Never (0-1)

48: (Motivation) To what extent is this type of problem important to you personally?			
□ Very	□ Impotent	□ Curious	□ Not interested

49: (Motivation) How much are you interested in learning more about how these problems are resolved?			
□ Very	□ Some what	□ Curious	□ Not interested

50.

If you are interested in intervening in the Ice Cream Shop situation, which of the following ideas might you consider?
(Choose all that apply)

- ☐ Plan for how to approach the situation
- ☐ Talk to the salesman when the woman and her daughter leave the shop
- ☐ Wait and observe the situation and how it may develop
- ☐ React immediately to prevent the salesman's action
- ☐ Think of appropriate ways to intervene
- ☐ Express your objection when your turn comes
- ☐ Encourage others to protest the salesman's reaction
- ☐ Leave the place as a sign of objection
- ☐ Gauge the temper levels of the people involved
- ☐ Be neutral, it is none of your business
- ☐ Speak out to condemn such behavior

51.

Suppose that you are planning to take action to comfort the frightened girl. Put the following steps in the sequence you would do before comforting her:

- ☐ Consider many ways to intervene in the situation such as talking, condemning, welcoming
- ☐ Determine the reasons why your action is appropriate
- ☐ Approach the mother and the girl
- ☐ Predict what would happen if… .
- ☐ Watch for behaviors of all involved
- ☐ Take some time to think

52.
Suppose that you are planning to take action to comfort the frightened girl. Put the following steps in the sequence you would do before comforting her:
(Remember that you may use some of the steps or all of them)

- ☐ Determine possible solution(s)
- ☐ Evaluate proposed action(s)
- ☐ Take action(s)
- ☐ Take action(s)
- ☐ Predict consequence(s)
- ☐ Gather information
- ☐ Pause

53.
Suppose that you are The Mother and you want to respond to the situation, sequence the following steps as you think they should be done:
(Remember that you may use some of the steps or all of them)

- ☐ Consider leaving the shop, talking to the salesman, calming the girl,
- ☐ Think to yourself "the salesman should know how to treat people."
- ☐ Control your irritation
- ☐ Calm down the girl
- ☐ Consider what would happen if I immediately speak out, …

54.

Suppose that you are The Mother and you want to respond to the situation, sequence the following steps as you think they should be done:

(Remember that you may use some of the steps or all of them)

- ☐ Determine possible solution(s)
- ☐ Justify action(s)
- ☐ Control emotion
- ☐ Take action(s)
- ☐ Predict consequence(s)
- ☐ Gather information

55.

Rank the following statements as they relate to the problem from the most relevant (1) to the least (6):

- ☐ a.55 The salesman is a racist person
- ☐ B.55 The salesman is engaging in harmful behavior
- ☐ C.55 The salesman is in a bad mood
- ☐ D.55 The situation is common
- ☐ E.55 The black family is not treated fairly
- ☐ F.55 The little girl's situation arouses Sarah's empathy

56.

If you were Sarah, what could you do in this situation? Please list as many ideas as possible.

57.

If you were the Mother, what could you do? Please list as many ideas as possible.

Rank the effectiveness of the following solutions as possible actions for Sarah to take:

- ☐ 58. Write a letter to the editor
- ☐ 59. Organize a boycott
- ☐ 60. Comfort the girl and the mother
- ☐ 61. Talk to the salesman about his inappropriate behavior
- ☐ 62. Be quiet and ignore the situation
- ☐ 63. Apologize to the family
- ☐ 64. Defend the family

Rank the effectiveness of the following solutions as possible actions for the Mother to take:

- ☐ 65. Write a letter to the owner
- ☐ 66. Speak to the customers
- ☐ 67. Report the ice cream shop to the better business bureau
- ☐ 68. Leave the shop
- ☐ 69. Organize a boycott
- ☐ 70. Talk to your own child about the experience

Rank the solutions from the most effective (1) solution to the least effective (6) in the situation:

☐ 71. Ignore the situation totally
☐ 72. As an observer, condemn the salesman’s behavior
☐ 73. Leave the shop without purchasing anything
☐ 74. Tell the family that the salesman is having a bad mood
☐ 75. Ask other customers to condemn the salesman’s act
☐ 76. Control self and do not enter into the situation

Scenario 2: David’s Case

Please listen to the following video clip carefully. The next questions are based on this video clip. Click to see video You can get free RealPlayer from this site http://www.real.com/

Click here to
Play the Video

77. In one statement, define the problem you saw in Scenario 2: David's Case

____

78: (Construct Validity) Could this be a real-life problem?			
□ No	□ Not sure	□ Yes	

79: (Construct Validity) Do you think this problem relates to prejudice?			
□ No	□ Not sure	□ Yes	

80: (Construct Validity) Do you think this problem or similar situations occur frequently?			
□ Yes	□ No	□ Not sure	

81 : (Self-efficacy) Can you suggest solutions for this situation?			
□ Yes	□ No	□ Not sure	

82: (Familiarity) On a weekly basis, how frequently do you notice people in similar situations?			
□ Never (0-1 time)	□ Sometimes (2-3 times)	□ Often (4-5 times)	□ Always (6-more times)

83: (Familiarity) On a weekly basis, how often do you personally, as a recipient of prejudice, experience a similar problem?			
□ Always (5-more)	□ Often (3-4)	□ Some Times(2-3)	□ Never (0-1)

84: (Motivation) To what extent is this type of problem important to you personally?			
□ Very	□ Impotent	□ Curious	□ Not interested

85: (Motivation) How much are you interested in learning more about how these problems are resolved?			
□ Very	□ Some what	□ Curious	□ Not interested

86.

You were assigned by a charitable organization to be a a Research Leader to investigate David's situation. Your role is to provide a report about this problem. Which of the following steps might you consider?
(Choose all that apply)

- ☐ Review historical documents about the region
- ☐ Evaluate the validity of the information from different sources
- ☐ Tryout possible solutions
- ☐ Develop hypotheses and test them
- ☐ Develop a plan to solve the problem
- ☐ Write to human rights organizations
- ☐ Read about similar situations to develop generalizations
- ☐ Integrate media reports to support your argument
- ☐ Interview people who are having this experience
- ☐ Contact the United Nations for political support

87.

Suppose that you have been assigned to solve the problem. Sequence the following steps as you develop The Plan of Action:
(Remember that you may use some of the steps or all of them)

- ☐ Develop justifications for the action you want to take
- ☐ Determine what has to be done
- ☐ Report advantages and disadvantages of different solutions
- ☐ Discuss who might resist and/or help the phases of the solution
- ☐ Form a timetable for events including who, when, what, …for the solution
- ☐ Determine possible ways for workers to improve their conditions

88.

Suppose that you have been assigned to solve the problem, sequence the following steps as you develop The Plan of Action:
(Remember that you may use some of the steps or all of them)

- ☐ Predict consequence(s)
- ☐ Develop a plan for action(s)
- ☐ Gather information
- ☐ Evaluate and select a solution(s)
- ☐ Define the problem
- ☐ Determine possible solution(s)

89.

Rank the following statements as they relate to David's problem from the most relevant (1) to the least relevant (6):

- ☐ A.89 People do not support each other
- ☐ B.89 Unpleasant life circumstances are reality
- ☐ C.89 Abuse of workers in a workplace is related to poverty
- ☐ D.89 David is ignored by Human Rights Organizations
- ☐ E.89 David has to improve his lifestyle
- ☐ F.89 Poverty is a part of the natural order of this world

90.
If you were David, what could you do to solve the problem? Please list as many ideas as possible.

91.
If you, as a person, want to improve David's life, what could you do? Please list as many ideas as possible.

Rank the effectiveness of the following solutions, as proposed actions for David to take:

- ☐ 92. Find educational opportunities
- ☐ 93. Look for another job
- ☐ 94. Move or return to Haiti
- ☐ 95. Get help from a social service agency
- ☐ 96. Find a second job

Rank the effectiveness of the following solutions as proposed actions for a person who wants to improve David's life:

- ☐ 97. Contact a human rights organization
- ☐ 98. Contact the media
- ☐ 99. Pray for David
- ☐ 100. Do fundraising/ make donation
- ☐ 101. Find him another job
- ☐ 102. Organize workers to take action

Rank the following solutions from the most effective (1) solution to the least (6) if you want to improve David's life:

- ☐ 103. Make a donation to David
- ☐ 104. Believe that people in that region should contact human rights organizations for themselves
- ☐ 105. Have a fund raising campaign to support people in that region
- ☐ 106. Encourage David and other workers to leave their jobs and find new ones
- ☐ 107. Believe that David has to accept his own situation and work harder
- ☐ 108. Recognize that life is not pleasant for all of us and everyone has job problems

Scenario 3: Appearance in the Workplace

In a recent study, the US workforce is divided about the regulation of appearance at work: clothing, weight, hairstyles, and body piercing. The Employment Low Alliance (ELA) asked participants about their view on appearance-based discrimination.

The major findings showed:

A.39% said employers should have the right to deny employment based on appearance.

B.33% said that in their workplace, workers who are physically attractive are more likely to be hired and promoted.

C.33% said workers who are unattractive, overweight, or generally look or dress unconventionally, should be given government legal protection like individuals with disabilities.

Around 50% of the nation's employers have absolutely no policy or regulation that addresses this complex issue. Furthermore, 16% in the survey said that they had been a victim of appearance-based discrimination.

109. In one statement, define the problem you saw in **Scenario 2: David's Case**

____

110: (Construct Validity) Could this be a real-life problem?			
□ No	□ Not sure	□ Yes	

111: (Construct Validity) Do you think this problem relates to prejudice?			
□ No	□ Not sure	□ Yes	

112: (Construct Validity) Do you think this problem or similar situations occur frequently?			
□ Yes	□ No	□ Not sure	

113 : (Self-efficacy) Can you suggest solutions for this situation?			
□ Yes	□ No	□ Not sure	

114: (Familiarity) On a weekly basis, how frequently do you notice people in similar situations?			
□ Never (0-1 time)	□ Sometimes (2-3 times)	□ Often (4-5 times)	□ Always (6-more times)

115: (Familiarity) On a weekly basis, how often do you personally, as a recipient of prejudice, experience a similar problem?			
□ Always (5-more)	□ Often (3-4)	□ Some Times(2-3)	□ Never (0-1)

116: (Motivation) To what extent is this type of problem important to you personally?			
□ Very	□ Impotent	□ Curious	□ Not interested

117: (Motivation) How much are you interested in learning more about how these problems are resolved?			
□ Very	□ Some what	□ Curious	□ Not interested

118.

Suppose that you are an Employee who has been suffering from appearance-based discrimination. You are planning to take action against the company for its persistent discrimination. Sequence the following steps in the order you would take them: (Remember that you may use some of the steps or all of them)

- ☐ Discuss possible actions, including filing a lawsuit
- ☐ Specify steps, people, dates …
- ☐ Consider pros and cons of solutions
- ☐ Form an alliance of the targeted group
- ☐ Search for evidence on appearance-based discrimination
- ☐ Discuss potential resources, resisters …

119

Suppose that you are an employee who has been suffering from appearance-based discrimination. You are planning to take an action against the company for its persistent discrimination. Sequence the following events in the order you would take them: (Remember that you may use some of the steps or all of them)

- ☐ Develop alternative action(s)
- ☐ Take action(s)
- ☐ Determine advantages and disadvantages of solutions
- ☐ Determine the problem and its impact
- ☐ Gather evidence about the problem
- ☐ Develop a plan of action

120.

Rank the following statements based on how relevant they are to the appearance-based prejudice problem in the workplace from the most relevant (1) to the least (6):

- ☐ A.120 Appearance of workers is important to the customer
- ☐ B.120 Appearance of an individual is an important factor for the business culture
- ☐ C.120 Appearance counts in hiring and promoting decisions
- ☐ E.120 Lack of regulations and laws results in confusion on the part of workers
- ☐ D.120 Companies only focus on ways to increase their income
- ☐ F.120 Hiring and promoting are not associated with the appearance of individuals

121.

Suppose that you recently have been hired in a company where appearance is critical. The person who hired you did not state clearly the requirements for appearance, but you notice discrimination. What could one do to deal with the appearance-based discrimination problem?

Rank the effectiveness of the following solutions as proposed actions to take for a person who suffers from appearance discrimination in the workplace:

- ☐ 122. Contact other employees who have had the same problem
- ☐ 123. Find another job
- ☐ 124. Change my appearance and wear appropriate clothes
- ☐ 125. Talk to supervisors
- ☐ 126. Suggest new policies
- ☐ 127. Campaign to get workers' appearance policies established

Rank the following solutions from the most effective (1) solution to the least (6) for individuals in responding to appearance discrimination in the workplace:

- ☐ 129. Comply with the company culture
- ☐ 130. Search for another company that has a clear protection-right policy
- ☐ 131. Support a campaign to establish a law to regulate this problem
- ☐ 132. Prove that professional work comes before appearance
- ☐ 133. Select work that accommodates how you want to appear

Problem 4: Stereotyping

Please listen to the video clip carefully. The next questions are based on this video clip.
Click to see video

134. In one statement, define the problem you saw in Scenario 4: Stereotyping

___

135: (Construct Validity) Could this be a real-life problem?			
□ No	□ Not sure	□ Yes	

136: (Construct Validity) Do you think this problem relates to prejudice?			
□ No	□ Not sure	□ Yes	

137: (Construct Validity) Do you think this problem or similar situations occur frequently?			
□ Yes	□ No	□ Not sure	

138 : (Self-efficacy) Can you suggest solutions for this situation?			
□ Yes	□ No	□ Not sure	

139: (Familiarity) On a weekly basis, how frequently do you notice people in similar situations?			
□ Never (0-1 time)	□ Sometimes (2-3 times)	□ Often (4-5 times)	□ Always (6-more times)

140: (Familiarity) On a weekly basis, how often do you personally, as a recipient of prejudice, experience a similar problem?			
□ Always (5-more)	□ Often (3-4)	□ Some Times(2-3)	□ Never (0-1)

141: (Motivation) To what extent is this type of problem important to you personally?			
□ Very	□ Impotent	□ Curious	□ Not interested

142: (Motivation) How much are you interested in learning more about how these problems are resolved?			
□ Very	□ Some what	□ Curious	□ Not interested

143.

People stereotype frequently. This process occurs unconsciously. Put the following steps in their logical order of how people stereotype:

- ☐ Stimulus
- ☐ Categorization
- ☐ Response
- ☐ Recall negative/positive belief
- ☐ Compare and contrast

144.

Every one of us stereotypes to some degree. Suppose that you are planning to Manage your Thinking when you meet a person whom you stereotype frequently. Put the following events in their logical order in which you would take them to decrease stereotyping:
(Remember that you may use some of these events or all of them)

- ☐ Observe an out-group person
- ☐ Activate a negative frame of mind
- ☐ Diminish the validity of stereotyping
- ☐ Decide to oppose your negative thinking
- ☐ Think of contradictory examples

145.

Every one of us stereotypes to some degree. Suppose that you are planning to Manage your Thinking when you meet a person whom you stereotype frequently. Put the following events in the order in which you would take them to decrease stereotyping:
(Remember that you may use some of these events or all of them)

- ☐ Encounter a stimulus
- ☐ Activate a stereotype
- ☐ Break the stereotype
- ☐ Challenge the stereotype
- ☐ Activate opposing information

146.
Rank the following statements as they relate to stereotyping problems from the most relevant (1) to the least relevant (6):

- ☐ A.146 Negative attitudes toward other people cause problems
- ☐ B.146 Stereotypes represent cultural conflicts
- ☐ C.146 Prejudice is innate to human beings
- ☐ D.146 Discrimination against blond people is common
- ☐ E.146 Stereotyping influences our behaviors
- ☐ F.146 Not examining negative beliefs leads to stereotyping

147.
People frequently stereotype different groups of people. Some stereotypes are based on facts and others are not. List some possible ways to eliminate such behavior. Please list as many ideas as possible.

Rank the effectiveness of the following solutions in limiting your stereotypical thoughts:

- ☐ 148. Exposure to other groups
- ☐ 149. Read about stereotyping & prejudice
- ☐ 150. Actively monitor and examine own thoughts
- ☐ 151. Stop and think before acting
- ☐ 152. Travel to other countries

Rank the following strategies from the most effective (1) to the least (6) at eliminating your tendency to stereotype:

- ☐ 153. Say "No" to yourself when stereotyping
- ☐ 154. Discuss the validity of stereotyping beliefs with targeted people
- ☐ 155. Change your beliefs by interacting with other groups
- ☐ 156. Read more about the influence of stereotyping
- ☐ 157. Ignore your stereotypical thoughts until they have been confirmed by experience
- ☐ 158. Have friends form diverse backgrounds

159.

Rate the difficulty level in the previous scenarios?

Scenarios	Not difficult	Somewhat difficult	Difficult	Extremely difficult
Scenario 1: The Ice Cream Shop				
Scenario 2: David's Case				
Scenario 3: Appearance in the Workplace				
Scenario 2: Stereotyping				

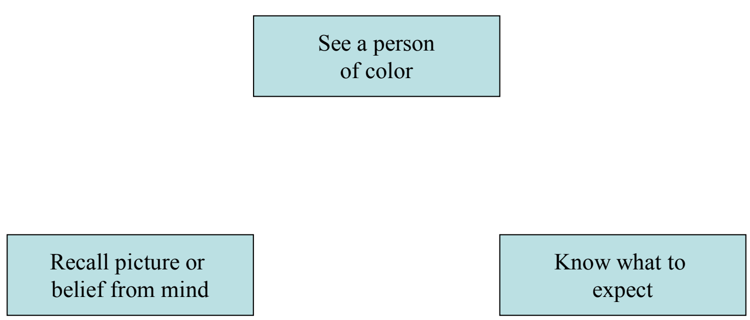
Declarative Knowledge

Statement	True	False
160. Once formed, stereotypes can be changed by a contradicting example		
161. Discrimination is an attitude toward members of some social groups		
162. The competition between two groups has to be real for prejudice to develop between them		
163. Negative attitudes are only acquired through directly rewarded experiences		
164. People tend to be prejudiced even if the differences between groups are small		
165. Concealing negative attitudes in public and expressing them within yourself is not considered prejudice		
166. When people stereotype, they use less cognitive effort to make judgments		
167. Prejudice is a cognitive framework that is highly influenced by processing social information		
168. Friendly interactions with in-group members can reduce prejudice and discrimination		
169. Focusing on achieving common goals instead of competition sometimes eliminates prejudice between groups		

Statement	True	False
170. People's prejudice can be reduced by changing their social environment		
171. Information that is inconsistent with stereotypes fosters stereotyping		
172. The homogeneity of an in-group occurs when we perceive everyone in the out-group as different and the in-group as the same as us		
173. When women behave as aggressively as men, women are perceived as less aggressive than men		
174. We tend to see our in-group as heterogeneous when our identity is threatened		
175. Personal experience, cognitive ability, and motivation can help individuals to limit stereotypes		
176. Today, racism has blatant forms more than subtle ones		
177. Stereotypes function at the same level as conscious thinking		
178. Negative feelings do not necessarily lead to discrimination		
179. Hiring minority individuals based on their lower ethnicity representation in the workplace boosts their self-esteem		

Structural Knowledge

180.
Draw arrows below to illustrate how prejudicial people may benefit from using stereotypes:



181.
Draw arrows below to illustrate the relationship between these concepts, if any:

Experience stimulus

Categorize stimulus

Save cognitive effort

182.
Draw arrows to show how stereotypes function in an individual's mind:

Construct a link

See someone dressed like a gang member

Avoid him

Criminal gangs

183.
Draw arrows below to illustrate how conflict between two social groups leads to discrimination, if any:

184.
Draw arrows below to illustrate how minority people, as targets of prejudice, react in a way to solve prejudice problems:

185.
Draw arrows below to illustrate the relationship between these concepts, if any:

Develop a positive interaction

A majority person

Work on a project of interest

Respect

A person of color

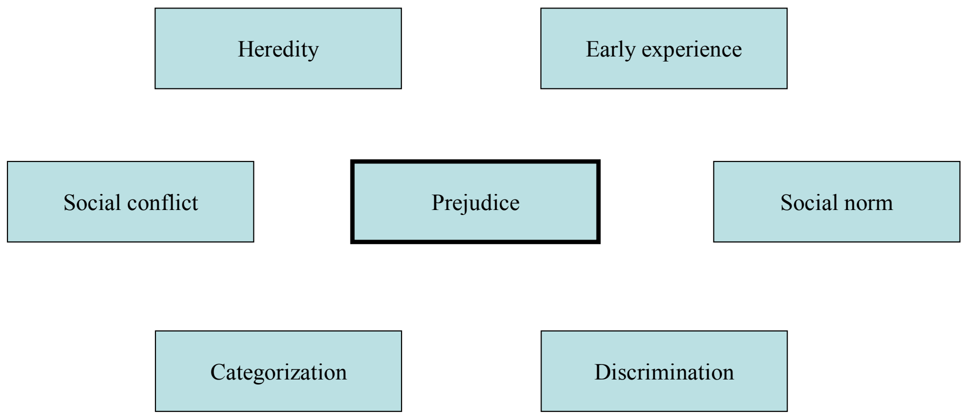
186.
Draw arrows below to illustrate how these concepts are related, if any:

Degrade a group

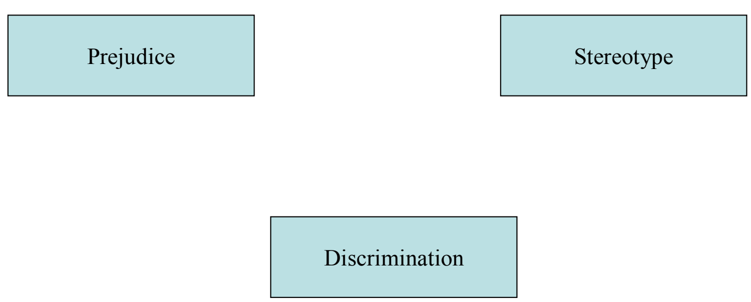
Boost self-image

Feel threat to self-esteem

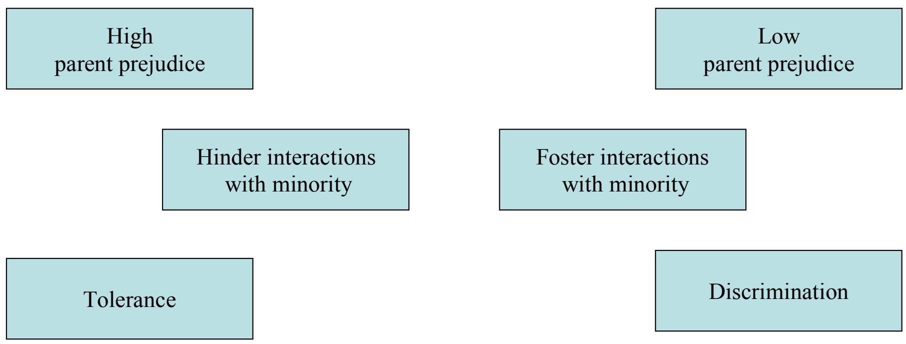
187.
Which of the following causes prejudice? Draw arrows below to illustrate the causes of prejudice:



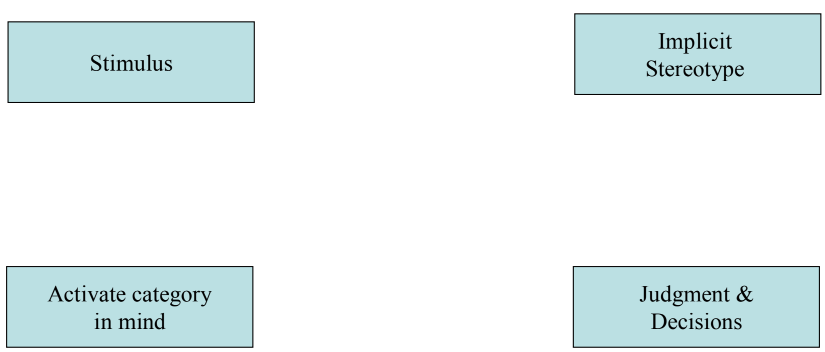
188.
Draw arrows below to show the cause and effect relationships among these concepts, if any:



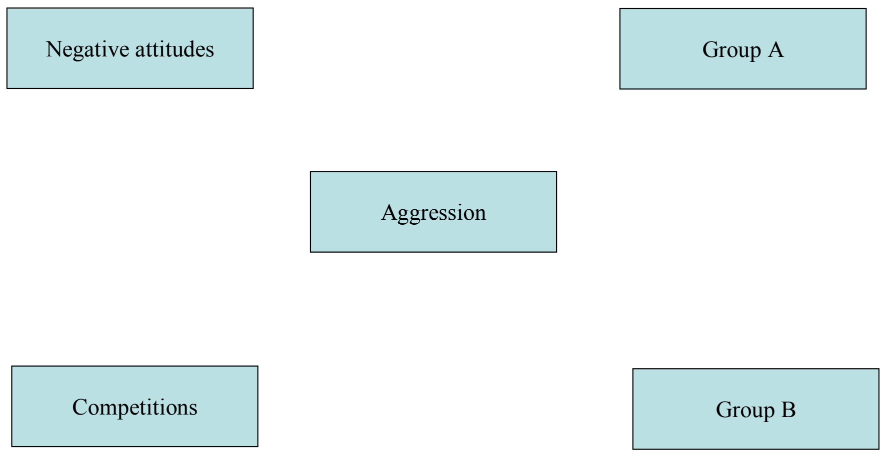
189.
Draw arrows to show the cause and effect between these concepts, if any:



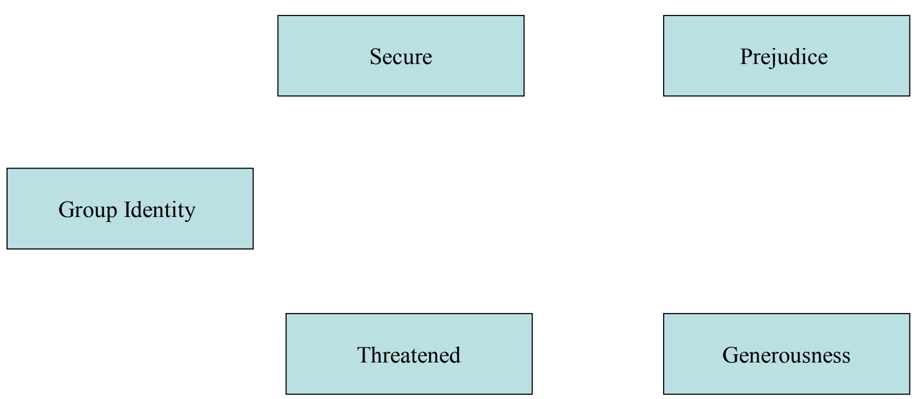
190.
Draw arrows below to illustrate the relationship between these concepts, if any:



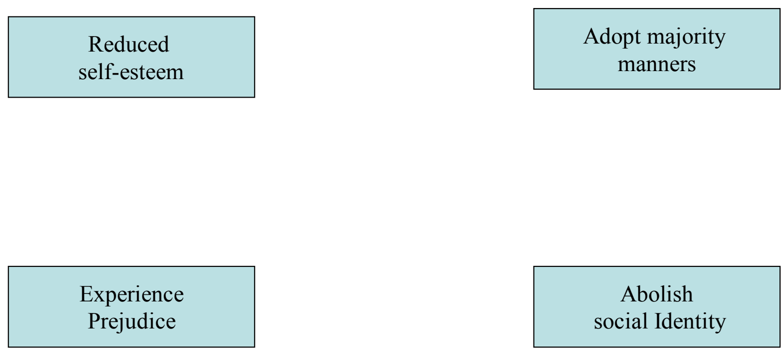
191.
Draw arrows below to illustrate the relationship between these concepts, if any:



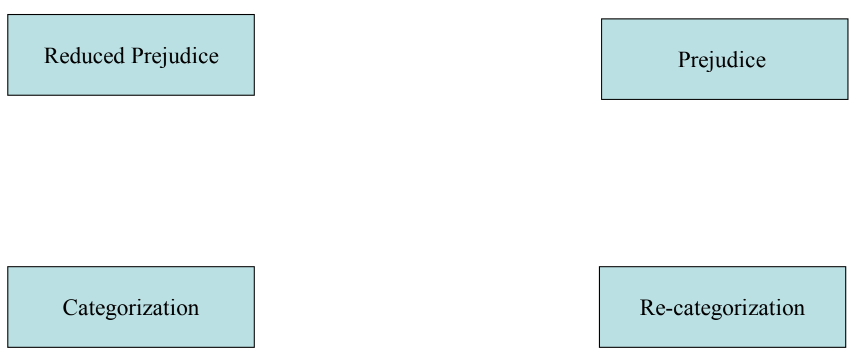
192.
Draw arrows below to illustrate the relationship between these concepts, if any:



193.
Draw arrows below to illustrate the relationship between these concepts, if any:



194.
Draw arrows below to show the cause and effect between these concepts, if any:



APPENDIX B

REVIEWER’S LETTER TO JUDGE THE PII

Dear Reviewer,

At the outset, I would like to thank you for your effort in reviewing the Practical Intelligence Instrument (PII) included in this packet. I think it is helpful for you if I provide you with a brief background about this study and its objectives.

This research is developed in the light of shortcomings of traditional theories of intelligence in explaining how people solve their real-life problems. I propose in this research a new way to assess practical intelligence by integrating two competing theoretical frameworks in the field of intelligence measurement. The first theoretical framework focuses on cognitive processes. The second theoretical framework focuses on different types of knowledge people have about particular domains. In this study the domain is prejudice.

The primary purpose of this research is to investigate the role of two competing cognitive models in explaining practical intelligence. The practical intelligence construct will be assessed by a multidimensional scaling model that includes both cognitive processes and types of knowledge dimensions. The secondary purpose of this research is to determine the contribution of some of the non-cognitive factors to the practical intelligence phenomenon.

Definitions and Terms

Practical intelligence is the ability to solve complex real-life problems effectively.

Real-life Problems are situations, challenges, or dilemmas that people encounter in their daily lives and need to be solved.

Cognitive Model

Metacognition is the ability to plan, monitor, formulate strategy, and be aware of self and cognition in solving a problem.

Problem Definition is a process where the problem solver has to specify the goal that will focus his/her efforts to solve the problem.

Flexibility of Thinking is the ability to generate many solutions for a particular problem.

Solution-Strategy is the ability to select a strategy that fits the problem situation and effectively solves the problem.

Knowledge Model

Declarative Knowledge includes facts, concepts, and concrete ideas in the domain of prejudice.

Structural Knowledge is knowledge about how the domain of prejudice is structured through theories and is validated empirically.

Tacit Knowledge is knowledge of effective strategies endorsed by adults to deal with problems in a particular context.

In the following pages, I include a list of problems/items based on four different scenarios. I intend to assess the aforementioned cognitive processes and types of Knowledge using these items. Your professional review of these items will contribute to the validity of the Practical Intelligence Instrument (PII) as well as will be used to assess participants' abilities to solve problems.

I am looking for your advice in addressing three issues in the PII. *First*, I want your professional judgment as an expert in psychology or social psychology to determine whether a particular item measures the intended competence as defined above. Please check Yes or No to each item. If you check No, please make comments to better revise and improve the item. *Second*, I also want you to answer each item and let me know what do you think of it. *Third*, I would like to have your overall judgment of the PII.

When you finish reviewing the PII, please email me for further arrangements.

Your effort, help, and thinking are truly appreciated.

Sincerely,

The researcher

Omar Muammar

2299 N Silverbell, Apt. 12150

Tucson, AZ 85745

Email: omuammar@email.arizona.edu

Note: I included in this packet a hard copy of the PII and a CD. The hardcopy is identical in text to the CD; however, the CD included two video clips that are related to the case scenarios and integrated in the PII. I suggest that you run the PowerPoint presentation to see the clips in slide 21, 43. If for some reasons the clips do not work, just double-click the video clips in the main file. The hard copy is for your comments and answers.

Reviewer Information

Please fill out the following information

Name		Major	
Degree		Department	
College		University	
Experience	( ) Years	Phone	
Email		Area of Expertise	

☐ I give you the permission to disclose my information for your research only.

APPENDIX C

EXPERTS' RATINGS OF CATEGORIES OF ANSWERS FOR THE DEFINING A PROBLEM ITEMS

Categories of Answers for Item 41

Rank the following statements as they relate to the problem from the most relevant (1) to the least relevant (2) to The Ice Cream Shop Scenario on each criterion:

Statement	A	B	C
1 Rude Behavior	1	1	2
2 Rude behavior because of race	1	1	1
3 Differential treatment because of race	1	1	1
4 Differential treatment	1	1	1
5 Unfairness	2	2	1
6 Racism, (racial) discrimination, (racial) prejudice, (racial) bias	2	2	1
7 Stereotyping (assumptions about behavior based on race)	2	2	1
8 Mental or personality issues	1	1	2
9 Distrust of blacks	1	1	1
10 Ignorance	2	2	1
11 Sadness	2	2	2
12 Customer service issues	1	1	2
13 Uncomfortable around blacks	1	1	1
14 Does not like blacks	1	1	1

A: Specific (1) vs. Less Specific (2); B: Concrete (1) vs. Abstract (2); C: Relevance (1) vs. Irrelevance (2).

Categories of Answers for Item 77

Rank the following statements as they relate to the problem from the most relevant (1) to the least relevant (2) to David's Case on each criterion:

Statement	A	B	C
1 Could not identify problem	0	0	0
2 Poverty	1	2	1
3 Misery/unhappiness	1	2	1
4 Survival	1	2	1
5 Exploitation/oppression/being taken advantage of/abused	2	2	1
6 Working conditions	1	1	1
7 Underpaid/low wages/not a living wage	1	1	1
8 Hard work/hard life	1	1	1
9 Overall bad situation	1	2	2
10 Lack of resources	1	1	1
11 Prejudice, racism, discrimination, unequal treatment	2	2	1
12 A type of segregation	2	2	2
13 No choices, options, opportunities to get out of situation	1	2	1
14 Economy of Haiti	2	1	1
15 Geo-political and economic issues	2	1	1
16 Things should not be this way	0	2	2

A: Specific (1) vs. Less Specific (2); B: Concrete (1) vs. Abstract (2); C: Relevance (1) vs. Irrelevance (2).

Categories of Answers for Item 109

Rank the following statements as they relate to the problem from the most relevant (1) to the least relevant (2) to Appearance in The Workplace Scenario on each criterion:

Statement	A	B	C
1 Importance of appearance (in work issues)	2	1	1
2 Debate/disagree about appearance issues in the workplace	2	1	1
3 No rules about this issue	2	1	1
4 Sexism	2	2	2
5 Employers hiring on appearance, not necessarily qualifications	2	1	1
6 Discrimination, prejudice, judgment, (based on appearance)	2	2	1
7 Racism	2	2	2
8 People are dressing slovenly when they work	1	1	2
9 As a result of most people not thinking about why they think what they think, especially concerning physical appearance, these problems arise. People are animals; instinct takes over at times.	1	2	2
10 I don't see the link between appearance and productivity. However, all workers should dress appropriately based on company policy.	2	1	0
11 Our society is so dependent on stereotypes that we have no choice but to continue feeding into them.	2	2	2
12 Balancing employer right to hire who s/he wants and employee rights	2	1	1
13 Fashion nightmare	1	1	2
14 Complex social problem with facets that are hard to enforce	2	2	2
15 The society as a whole thinks backwards	2	2	2

A: Specific (1) vs. Less Specific (2); B: Concrete (1) vs. Abstract (2); C: Relevance (1) vs. Irrelevance (2).

Answer's Categories of Item 109—*Continued*

16 Misrepresentation	0	0	0
17 Happens	0	0	0
18 As long as you do your job and not wearing ripped up and dirty clothes should not affect your work	1	1	2
19 Something should be done to stop this	2	2	2
20 People blaming others for their shortcomings	1	1	2
21 People want their employees to appear conventional for the comfort of their customers	2	1	2

A: Specific (1) vs. Less Specific (2); B: Concrete (1) vs. Abstract (2); C: Relevance (1) vs. Irrelevance (2).

Answer's Categories of Item 134

Rank the following statements as they relate to the problem from the most relevant (1) to the least relevant (2) to the Stereotyping Scenario on each criterion:

Statement	A	B	C
1 No problem, just discussing issues, even constructive	1	1	1
2 Stereotyping (descriptive, no action)	2	2	1
3 People/everyone stereotype(s), it takes place (involves action)	1	1	1
4 Stereotyping is problematic, dangerous	2	1	1
5 Causes of stereotyping	2	1	1
6 How to solve the problem of stereotyping	2	1	1

A: Specific (1) vs. Less Specific (2); B: Concrete (1) vs. Abstract (2); C: Relevance (1) vs. Irrelevance (2).

Answer’s Categories of Item 134—*Continued*

7 Fear	2	2	1
8 Racism, prejudice, and discrimination	2	2	1
9 Ignorance	2	2	1
10 Stereotypes in the media are influential/role of media in stereotyping	2	1	1
11 Different people have different definitions about stereotyping	1	1	1
12 Mistaken opinion and conclusions	2	2	2
13 Looks	0	0	0
14 Sad	1	2	2
15 Confusion	1	2	2
16 People are unkind when talking about those who are not part of the group	1	1	1
17 True	0	0	0
18 Stereotyping is portrayed as okay and is something that we 'must get used to'	1	1	2
19 The issues discussed truly are prevalent in our society	2	2	2
20 Education	2	2	2
21 Truthful	0	0	0
22 Blame nature for embedding in our brain the need to stereotype as a means of survival from our early ancestors' time. It's innate. Of course, we have a brain to help us not stereotype people.	1	1	1
23 Preoccupation	0	0	0
24 Racial profiling	2	1	1

A: Specific (1) vs. Less Specific (2); B: Concrete (1) vs. Abstract (2); C: Relevance (1) vs. Irrelevance (2).

APPENDIX D

EXPERTS' RATING OF STRATEGIES FOR THE SELECTING A SOLUTION STRATEGY ITEMS

Strategies for Solving the Ice Cream Shop Scenario Problem

Rank the solutions from the most effective (1) solution to the least effective (6) in the situation:

Solution Strategy	Ranking
71 Ignore the situation totally	6
72 As an observer, condemn the salesman's behavior	1
73 Leave the shop without purchasing anything	3
74 Tell the family that the salesman is having a bad mood	5
75 Ask other customers to condemn the salesman's act	2
76 Control self and do not enter into the situation	4

Strategies for Solving the David's Case Scenario Problem

Rank the following solutions from the most effective (1) solution to the least (6) if you want to improve David's life:

Solution Strategy	Ranking
103. Make a donation to David	2
104. Believe that people in that region should contact human rights organizations for themselves	4
105 Have a fund raising campaign to support people in that region	1
106 Encourage David and other workers to leave their jobs and find new ones	3
107 Believe that David has to accept his own situation and work harder	5
108 Recognize that life is not pleasant for all of us and everyone has job problems	6

Strategies for Solving Appearance in the Workplace Scenario Problem

Rank the following solutions from the most effective (1) solution to the least (6) for individuals in responding to appearance discrimination in the workplace:

Solution Strategy	Ranking
129 Comply with the company culture	5
130 Search for another company that has a clear protection-right policy	3
131 Support a campaign to establish a law to regulate this problem	2
132 Prove that professional work comes before appearance	1
133 Select work that accommodates how you want to appear	4

Strategies for Solving Stereotyping Scenario Problem

Rank the following strategies from the most effective (1) to the least (6) at eliminating your tendency to stereotype:

Solution Strategy	Ranking
153 Say "No" to yourself when stereotyping	3
154 Discuss the validity of stereotyping beliefs with targeted people	4
155 Change your beliefs by interacting with other groups	2
156 Read more about the influence of stereotyping	5
157 Ignore your stereotypical thoughts until they have been confirmed by experience	6
158 Have friends from diverse backgrounds	1

APPENDIX E

EXPERTS' RATINGS OF TACIT KNOWLEDGE ITEMS

Ratings of Tacit knowledge Items for the Ice Cream Shop Scenario

	Educators		Sociologists				
Item Number	A	B	C	D	E	F	Absolute Average
58	4	5	6	5	1	7	5
59	7	6	6	4	3	7	6
60	4	4	4	6	1	4	4
61	7	7	2	7	7	4	6
62	1	1	1	1	1	1	1
63	1	3	5	2	1	1	2
64	4	2	5	3	5	3	4
65	7	7	3	3	1	7	5
66	7	6	5	4	1	5	5
67	7	3	5	5	7	7	6
68	1	1	6	7	1	6	4
69	6	5	6	2	1	7	5
70	7	4	7	6	5	6	6

Ratings of Tacit knowledge Items for David's Case Scenario

	Educators		Sociologists				
Item Number	A	B	C	D	E	F	Absolute Average
92	7	4	5	4	7	4	5
93	7	5	4	6	4	3	5
94	1	1	4	3	1	3	2
95	7	6	4	7	4	5	6
96	3	7	3	5	4	3	4
97	6	5	4	3	2	6	4
98	6	7	3	4	2	6	5
99	2	1	3	2	1	1	2
100	3	2	4	6	2	6	4
101	4	4	4	5	4	3	4
102	7	6	4	7	7	6	6

Ratings of Tacit Knowledge Items for the Appearance in the Workplace Scenario

	Educators		Sociologists				
Item Number	A	B	C	D	E	F	Absolute Average
122	3	6	3	5	4	4	4
123	7	5	2	3	1	2	3
124	7	7	2	2	5	4	5
125	7	3	4	7	3	3	5
126	7	1	5	6	4	4	5
127	7	4	6	4	5	4	5

Ratings of Tacit Knowledge Items for the Stereotyping Scenario

	Educators		Sociologists				
Item Number	A	B	C	D	E	F	Absolute Average
148	7	7	6	7	2	6	6
149	4	5	5	6	4	4	5
150	7	4	5	4	7	5	5
151	5	3	5	5	7	5	5
152	7	6	5	3	2	6	5

APPENDIX F

EXPERTS' RATINGS OF SOLUTION STRATEGIES FOR REAL-LIFE PROBLEMS PROPOSED BY PARTICIPANTS

Strategies for Solving the Ice Cream Shop Scenario Problem

56.

If you were Sarah, what could you do in this situation? Please list as many ideas as possible.

First: Strategies directed toward the black family

Please rank the following solution strategies from the least effective (1) to the most effective (10) to solve the problem.

Strategy Category	A	B	C	D
1 Comfort the family	8	6	3	6
2 Talk to the family after they leave	6	6	2	7
3 Apologize to the family	8	7	2	8
4 Consider the possibility of approaching the family	10	1	4	10
5 Try to establish friendship with the family	5	6	3	7
6 Assure the family that they did not do anything wrong	8	6	3	7
7 Show your support for the family	6	5	4	8
8 Be rude to the family too	8	0	2	0
9 Educate the daughter about managing similar situations	3	8	1	3
10 Buy the ice cream for the family	4	2	3	3
11 Show your sympathy for the family	6	6	5	8
12 Give a warm smile to the family	9	2	5	8
13 Direct the family to a friendlier ice cream shop	8	8	7	8

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Strategies of the Ice Cream Shop Scenario—*Continued*

14 Shift the girl's attention from the situation to something else	8	2	4	7
15 Tell the family not to take the man's actions personally	8	0	3	6
16 Ask the family if the man has done offensive behavior previously to the family	8	0	3	4
17 Encourage the family to take action	8	7	8	7
18 Talk to the family to support them	6	5	6	7
19 Leave the family alone	10	0	1	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Second: Strategies directed toward the salesman

Strategy Category	A	B	C	D
1 Comfort the salesman	8	0	0	2
2 Confront the salesman	8	8	10	7
3 Say something after the family leaves	9	7	8	9
4 Tell the salesman that you did not appreciate what he did and leave the shop and never come back	9	9	10	9
5 Seek an apology	8	8	8	8
6 Warn the salesman about discriminatory suits	8	8	9	9
7 In a peaceful manner, tell the salesman that he was unfair to the family	8	8	9	9
8 Talk to the salesman about his action	7	9	8	8
9 Show signs of your objection to his behavior	9	7	7	9
10 Think to yourself that the salesman should change his behavior	10	0	5	10
11 Return the ice cream to the salesman	7	7	9	7
12 Post fliers about the clerk's racist attitude	6	9	10	7
13 Pray for the clerk	10	3	6	10
14 Threaten to convey his behavior to the press in the absence of an apology	8	9	9	7
15 Refuse to pay before getting the ice cream, like the others	7	8	9	7
16 Ask the salesman what the problem is: is he grouchy? Does he know the family personally?	8	6	2	6
17 Give the salesman a dirty look	10	3	6	9

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Third: Strategies directed toward other parties

Strategy Category	A	B	C	D
1 Encourage friends and family to boycott the store	10	8	9	10
2 Tell others about the situation	10	8	8	10
3 Let the media know	7	9	9	8
4 Talk to the manager or the owner	8	10	10	10
5 Involve other customers	3	7	7	7
6 Involve anti-racist groups	6	8	9	6
7 Report the salesman to authorities	5	5	10	3
8 File a lawsuit	1	3	10	8
9 Tell all your ethnic friends to go at the same time	5	3	8	7

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Fourth: Strategies directed toward self

Strategy Category	A	B	C	D
1 Model courtesy and good behavior	9	3	3	10
2 Leave the store and never return to this place	10	8	9	10
3 Protest	7	9	10	8
4 Think about a solution but do not act	10	1	6	10
5 Get upset and frustrated	10	3	7	8
6 Pay for my ice cream first before getting it, to let the man think for a little while	8	4	8	9
7 Get a job there instead of him	0	5	10	10
8 Maintain a peaceful atmosphere	7	3	7	10
9 Gather information about the situation	7	7	7	9
10 Determine the motive	7	7	7	9
11 Make a big scene	9	3	7	3
12 Ignore the situation	10	0	0	10
13 Buy ice cream	10	0	0	10
14 Manage your own emotions	9	2	3	10
15 Steal ice cream	0	0	10	1
16 Make jokes to alleviate the salesman's tension	9	1	4	7
17 Don't make a scene	10	0	3	10
18 Emotional responses toward the family	8	4	8	7

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Now, the previous strategies were grouped into four categories; rate the effectiveness of each category from the most effective (10) to the least effective (1).

Category	Ranking
Daughter-Directed Strategies	5
Salesman-Directed Strategies	5
Other-Directed Strategies	6
Self-Directed Strategies	4

57.

If you were the Mother, what could you do? Please list as many ideas as possible.

Please rank the following solution strategies from the least effective (1) to the most effective (10) to solve the problem.

First: Daughter-directed strategies

Strategy Category	A	B	C	D
1 Comfort my daughter	9	4	10	10
2 Talk and explain to my daughter the salesman's behavior	10	9	10	10
3 Tell my child that the man's behavior is wrong and she did not do anything wrong	10	7	8	9
4 Take my child to a different store	9	6	8	10
5 Hug my child and leave the store	10	1	6	10
6 Teach my daughter a lesson about racism and prejudice	8	8	10	10
7 Encourage my daughter	7	7	6	10
8 Tell the girl the man is in a bad mood	10	0	1	8
9 Be sure to let my daughter know all of the steps that I am taking so that she feels empowered rather than victimized	7	8	10	10
10 Empower my daughter by allowing her to do something positive so she doesn't think she did anything to warrant such behavior from the vendor	6	4	9	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Second: Salesman-directed strategies

Strategy Category	A	B	C	D
1 Seek an explanation from the salesman about his behavior	9	8	9	9
2 Confront the salesman about his behavior	9	8	9	9
3 Seek an apology	9	8	9	9
4 Speak with the salesman in private	7	9	9	10
5 Tell the salesman that I am going to report him	10	9	10	9
6 Inform the salesman that he has lost my business and I will never come back again	10	9	10	10
7 Refuse to pay before I get the ice cream	7	7	10	8
8 Tell the salesman about my feelings and how I perceived his action	8	8	9	9
9 Make a constructive comment in a calm manner	10	8	9	10
10 Make him realize that she is only a child	7	7	9	9
11 I would pray for him	10	2	7	10
12 Bounce the situation back to the man and see how he feels about it	8	88	9	8
13 Say something to the salesman	10	7	7	9
14 Let him know that he has done something wrong	8	8	6	9
15 Don't judge the man	9	2	2	9
16 Demand respect and fair treatment	8	8	8	8

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Salesman-directed strategies–Continued

17 Throw the ice cream	10	0	10	0
18 Give a look to the salesperson	10	1	7	10
19 Calm the salesman	7	7	7	8
20 Comment to the salesperson that he is being rude	10	7	7	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Third: Other-directed strategies

Strategy Category	A	B	C	D
1 Tell other buyers, friends, and family about the salesman's behavior	10	7	8	10
2 Talk to the manager or the owner	9	9	10	10
3 Encourage everyone you know to boycott the ice cream shop	10	8	9	10
4 Talk to the media	6	9	10	6
5 Take action through politics	6	9	10	6
6 Take formal action against the salesman	2	7	10	1
7 Protest and make a big deal of it	7	8	10	3
8 Involve civil rights experts	2	5	10	2
9 Wait for corrective action (apology, etc.)	10	0	5	10
10 Contact the Better Business Bureau	10	10	10	10
11 Talk to or seek help from other customers	8	7	7	7

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Fourth: Self-directed strategies

Strategy Category	A	B	C	D
1 Leave the Place	10	7	6	10
2 Ignore the salesman's behavior	10	0	0	10
3 Remain calm	9	2	6	10
4 Get mad	9	2	6	3
5 Gather information about the situation	8	7	6	9
6 Cause a scene	10	2	6	3
7 Cry	10	2	6	3
8 Life is too short! Don't make his problem my problem. Not everybody is going to like me in this world	9	8	0	10
9 Never be like that	9	10	8	10
10 Do not make a scene	10	0	1	10
11 Boycott/ or do not return	10	8	8	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Now, the previous strategies were grouped into four categories; rate the effectiveness of each category from the most effective (10) to the least effective (1).

Category	Ranking
Daughter-Directed Strategies	4
Salesman-Directed Strategies	5
Other-Directed Strategies	6
Self-Directed Strategies	3

Strategies for Solving David's Case Scenario Problem

90.

If you were David, what could you do to solve the problem? Please list as many ideas as possible.

Please rank the following solution strategies from the least effective (1) to the most effective (10) to solve the problem.

First: Workplace-related strategies

Strategy Category	A	B	C	D
1 Strike	2	7	10	10
2 Demand better conditions	8	6	8	10
3 Discuss the issue with your boss	9	1	7	10
4 Prevent businesses from exploiting workers	0	5	9	8
5 Attack the company and also the government/local governor	1	1	10	3
6 Organize a demonstration	2	7	10	10
7 Continue working there but ask for more benefits	10	1	7	10
8 Boycott	1	7	8	10
9 Become revolutionary	0	10	10	4
10 Do nothing	10	0	0	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Second: Family-related strategies

Strategy Category	A	B	C	D
1 Move my family to another place	1	7	10	10
2 Let my wife work	3	3	8	4
3 Get a Loan	3	2	6	10
4 Leave the family and survive on my own	8	2	10	4
5 Limit the number of children	2	8	8	8
6 Send children to school to get an education	3	6	8	10
7 Take care of myself and my family as best as I can.	5	1	7	10
8 Talk to my family	5	1	7	10
9 Fight to gain civil status for my children	7	2	9	10
10 Stay where I am, but send my children to a more stable environment	3	4	8	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Third: Third-party strategies

Strategy Category	A	B	C	D
1 Get the media involved	6	8	9	10
2 Get the problem noticed	6	7	8	10
3 Seek international assistance	7	8	10	10
4 Contact the government	8	1	10	10
5 Seek legal advice (e.g. lawyer)	8	3	9	10
6 Get help from people	7	7	8	10
7 Contact specialized organizations to seek help	8	8	9	10
8 Organize workers and form a union	9	8	9	10
9 Seek charities	9	9	8	10
10 Use this miserable situation to make a documentary film to show it to the world	10	7	10	10
11 Cooperate with co-workers to find a solution for the problem	9	7	8	10
12 Organize a community of Haitians to gradually pool resources and establish communal living	8	7	8	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Fourth: Self-directed strategies

Strategy Category	A	B	C	D
1 Seek educational or training opportunity	3	7	8	10
2 Go somewhere else	4	9	10	10
3 Find another job	1	4	7	10
4 Control my budget	1	2	7	10
5 Find even more work to do	1	1	7	10
6 Continue to work harder	1	0	7	10
7 Pray	10	2	7	10
8 Attempt to create better conditions in Haiti in order to return	0	0	0	0
9 Do illegal activities to get more money	8	4	10	8
10 Gain self-control	2	1	6	10
11 Maintain a positive attitude	7	2	6	10
12 Suicide...it would stop the problem, depending on religious views	10	5	10	10
13 Build self esteem and self image	7	2	6	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Now, the previous strategies were grouped into four categories; rate the effectiveness of each category from the most effective (10) to the least effective (1).

Category	Ranking
Work Related Strategies	5
Family-Related Strategies	4
Third-Party Strategies	6
Self-Directed Strategies	4

91.

If you, as a person, want to improve David's life, what could you do? Please list as many ideas as possible.

Please rank the following solution strategies from the least effective (1) to the most effective (10) to solve the problem.

First: Strategies directed toward David

Strategy Category	A	B	C	D
1 Teach David job and life related skills	2	7	7	10
2 Educate David and his family	2	7	7	10
3 Help him to find a better job	2	8	8	10
4 Make a donation for David	7	8	8	10
5 Improve David and his co-workers' life conditions	2	10	9	10
6 Try to increase the salary of the profession	3	9	9	10
7 Do research for David and inform him of possible opportunities	4	6	6	10
8 Assist David to immigrate to a different country	9	9	10	10
9 Organize David and other workers	2	8	9	10
10 Start an industry in his country where you could hire him and others in his situation	1	10	10	10
11 Support David	7	4	6	10
12 Develop more efficient machinery for his use	1	7	6	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Strategies directed toward David–Continued

13 Organize demonstrations	8	9	8	10
14 Address the problem in David's home country	7	8	7	10
15 Help him navigate the system so that he can be heard	2	6	8	10
16 Talk to David and other workers	4	1	6	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Second: Strategies directed toward the company

Strategy Category	A	B	C	D
1 Boycott the company	7	4	8	10
2 Support companies that pay livable wages	6	8	8	10
3 Contact the company	8	3	7	10
4 Take legal action against the company	10	4	9	10
5 Start a fund raiser to help support the people with their fight against employers	8	8	9	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Third: Strategies directed toward other authorities

Strategy Category	A	B	C	D
1 Make others aware of the situation	9	7	7	10
2 Contact Human Rights organizations for help	10	7	8	10
3 Involve the media	8	8	9	10
4 Write to authorized people	10	7	8	10
5 Organize a charity fund raiser	8	7	9	10
6 Make sure my government doesn't participate in the exploitation of these workers	1	10	10	10
7 Get ideas from others on how to create better jobs for people like David	6	5	6	10
8 Start a political movement	7	8	8	10
9 Take a court action	2	4	10	10
10 Start a foundation for this cause to provide help	4	8	8	10
11 Contact people who might help	10	7	7	10
12 Present facts to relevant authorities	9	8	8	10
13 Support workers	6	1	6	
14 Seek experts in the area to give lectures to promote awareness	10	7	7	10
15 Ask others to join you in a study to help improve these workers' lifestyles	9	7	7	10
16 Get someone to sponsor research on this	7	6	7	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Strategies directed toward other authorities–Continued

17 Condemn countries publicly	10	3	8	10
18 Speak out against arms proliferation by US government that leads to violence; David should live in a safe country	0	0	0	10
19 Make a donation for others (e.g, aid org., families, etc.)	10	7	8	10
20 Get the United Nations involved	3	9	10	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Fourth: Strategies directed toward self

Strategy Category	A	B	C	D
1 Investigate the problem through research	7	7	6	10
2 Volunteer to help poor people	10	1	6	10
3 Pray for David	10	1	6	10
4 Protest working conditions	8	8	7	10
6 Try to change the social/economical system as well as political system.	1	10	10	10
7 Get involved in aid organizations	8	8	8	10
8 Support legislators who propose initiatives that will bring better conditions to the area	10	8	9	10
9 Consider living a more simple existence and make do with less to encourage a global trend	10	2	8	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Now, the previous strategies were grouped into two categories; rate the effectiveness of each category from the most effective (10) to the least effective (1).

Category	Ranking
Strategies directed toward David	4
Strategies directed toward the company	5
Strategies directed toward other authorities	6
Strategies directed toward self	5

Strategies for Solving Appearance in the Workplace Scenario Problem

121.

Suppose that you recently have been hired in a company where appearance is critical. The person who hired you did not state clearly the requirements for appearance, but you notice discrimination. What could one do to deal with the appearance-based discrimination problem?

Please rank the following solution strategies from the least effective (1) to the most effective (10) to solve the problem.

First: Strategies directed toward the company

Strategy Category	A	B	C	D
1 Discuss the issue with my supervisor	10	7	7	10
2 Find out about the dress code or appropriate dress	10	6	5	10
3 Ask to develop a policy regarding dress	8	7	6	7
4 Confront the manager	7	1	8	5
5 Write a letter to the company	9	7	7	10
6 Talk about advantages of less attractive employees	7	8	7	8
7 Provide the employers with documented federal code indicating that discrimination is illegal	10	10	10	10
8 Wear something to cause reaction from your employer; then explain that it was not stated in hiring that you had to dress a certain way	7	1	7	1

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Strategies directed toward the company–Continued

9 Review the job description	10	1	5	10
10 Discuss possible solutions with your employer	10	7	7	10
11 Make the company fund your facelift!	0	0	0	0
12 Talk to "fat acceptance" organizations and their lawyers to see how they have dealt with this	10	9	10	10
13 Threaten to take more action	7	2	8	1

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Second: Strategies directed toward co-workers

Strategy Category	A	B	C	D
1 Talk to other workers about the issue	8	7	7	8
2 Discuss the issue with anyone who has been discriminated against	9	8	8	10
3 Form alliance groups to develop an action plan	9	9	10	10
4 Ask people to dress nicely and follow the rules	10	1	0	7
5 Educate others	8	8	8	10
6 Organize people to wear something outrageous to work one day	3	1	6	4
7 Provide dressing services	1	1	5	2

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Third: Strategies directed toward authority

Strategy Category	A	B	C	D
1 Sue the company	9	10	10	10
2 Contact the media	9	9	9	10
3 Contact employment office/bureau and report the incident	10	9	9	10
4 Organize a boycott	9	9	9	10
5 Seek legal advice	10	7	7	10
6 Report the company to the BBB if consumers can buy from them	10	8	8	10
7 Alert consumer groups	10	8	8	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Fourth: Strategies directed toward self

Strategy Category	A	B	C	D
1 Ignore the problem	10	0	0	10
2 Quit the job	2	2	10	10
3 Dress nicely and improve self	2	1	0	10
4 Gather information about the problem	8	1	7	10
5 Avoid discrimination	1	2	0	10
6 Show that your work is valuable	10	1	8	10
7 Break the rules	4	2	8	2
8 Blame the victim	10	0	0	1

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Now, the previous strategies were grouped into four categories; rate the effectiveness of each category from the most effective (10) to the least effective (1).

Category	Ranking
Strategies directed toward the company	6
Strategies directed toward co-workers	5
Strategies directed toward authority	6
Strategies directed toward self	3

Strategies for Solving the Stereotyping Scenario Problem

147.

People frequently stereotype different groups of people. Some stereotypes are based on facts and others are not. List some possible ways to eliminate such behavior. Please list as many ideas as possible.

Please rank the following solution strategies from the least effective (1) to the most effective (10) to solve the problem.

First: Strategies directed toward the company

Strategy Category	A	B	C	D
1 Listen to other people before you make a judgment	8	8	7	10
2 Educate others about stereotyping	9	9	8	10
3 Discuss stereotyping with other people	10	9	8	10
4 Do not rely on the media	9	9	9	10
5 Get to know diverse people through interaction before you make a judgment	8	10	8	10
6 Look at the actual person and not the group	9	9	8	10
7 Accept people for who they are and treat them with respect	9	9	7	10
8 Don't dwell on the actions of those who are the cause of prejudice	9	1	1	10
9 Identify stereotypes of your own group	10	8	7	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Strategies directed toward the company–Continued

10 People need to make sure the way they dress does not portray an image that is not them (don't look like a dangerous person walking through an alley if you are not)	5	1	1	4
11 The few people who make the stereotypes need to stop doing those actions	0	10	5	10
12 Teach that we are different, but we are all human	8	8	8	10
13 Raise and support awareness about stereotyping at the national level	9	10	9	10
14 Create organizations to deal with stereotyping	7	10	9	10
15 Bring larger groups of people together	8	9	8	10
16 Get yourself mingled with different groups	9	9	8	10
17 Speak out against any stereotypical statement	4	8	8	10
18 Challenge stereotypical thoughts	10	8	8	10
19 Look at the positive aspects of people	10	7	7	10
20 Focus on similarities not differences	10	8	7	10
21 Attract the media to talk about the topic	8	10	10	10
22 Talk to government agencies to solve this problem	8	10	10	10
23 Try to encourage people to recognize the stages in which stereotyping develops, so that they are able to examine their own behaviors	8	8	8	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Second: Strategies directed toward self

Strategy Category	A	B	C	D
1 Respond neutrally	10	1	1	10
2 Reflect on one's own behavior	10	8	7	10
3 Find counter examples of stereotypical thoughts	10	8	7	10
4 Put yourself in another person's shoes	10	8	7	10
5 Examine facts and reasons about stereotypical thoughts and prejudice	10	8	8	10
6 Educate yourself about stereotyping	9	8	8	10
7 Be open minded and do not believe everything you hear	9	8	7	10
8 Do not categorize and generalize	9	8	7	10
9 Do not judge based on looks	9	8	7	10
10 Think before you act	10	8	7	10
11 Practice making yourself comfortable with other races	10	8	7	10
12 Model and live equality for all	8	8	7	10
13 Stereotypes are not always true	0	0	0	0
14 See others as equal	9	7	7	10
15 Realize that everyone is different	9	8	7	10
16 Ignore stereotypical thoughts	9	1	5	10
17 Change your thinking about people	8	8	8	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Strategies directed toward self–Continued

18 Become conscious of your thinking processes	9	8	8	10
19 Admit stereotyping behavior	10	8	9	8
20 Establish a mind set that is based on inclusively rather than exclusivity	8	8	8	10
21 Make a conscious decision to reduce your stereotyping	10	8	9	10
22 Acknowledge that categorization is for efficiency	10	3	5	7
23 Pray for less stereotyping	10	3	6	10
24 Gather information about other groups and their struggles	10	8	7	10
25 See the differences even within a given category of people.	9	8	8	10
26 Make more jokes about stereotypes, lose the formality of them	10	2	5	1
27 Build self confidence so people don't stereotype to make themselves feel better	7	1	5	10
28 Think how people might stereotype me	10	8	6	10

Criteria- A: Feasibility; B: Effectiveness; C: Problem Appreciation; D: Social Appropriateness.

Now, the previous strategies were grouped into two categories; rate the effectiveness of each category from the most effective (10) to the least effective (1).

Category	Ranking
Strategies directed toward other people	6
Strategies directed toward self	5

APPENDIX G

DIRECTIONS FOR PARTICIPANTS TO FILL OUT THE SURVEY

Dear Participant,

Welcome. Thank you for your interest in participating in my research. I appreciate your time, effort, and thinking. Please give me a few minutes to help you understand and know better how to respond to the following materials. The goal of this research is to understand how people solve their real-life problems. I use an instrument to achieve this goal. The instrument includes two major parts: Part A, which consists of the following pages and questions and Part B, which you will receive via your University of Arizona email. In the email message, you will find a hyperlink. When you click on that link, it will take you to a web-based survey. DO NOT Click on that link until you read the following directions.

Very Important Directions for the Web Survey

DO NOT HIT THAT LINK UNTIL YOU TOTALLY UNDERSTAND THE FOLLOWING DIRECTIONS:

1- The web based survey requires at least 1 hour and 30 minutes for completion.
2- You have to do the web survey in one session; you cannot work on the survey on several occasions. Therefore, do not hit that link unless you are ready and have the time to do it.
3- When you close the survey for any reason, this link will not be activated again.

4- The survey includes video clips. Please make sure that you have speakers or a headset ready and test them before you hit that link.

5- When you hit the video clip link, the video will open in a new window. You can also right click on the "click to see video" link and save the clip to review as many times as you want. Or just do not close the video window until you finish answering the related questions. <u>Remember, if you close the window or do not save the video, you will not be able to see it again.</u>

6- When you hit "Next Question," you will not be able to revise your previous answer.

7- Some questions are required to be answered; you will receive a message if you ignore them. Please, do your best to answer all the questions. If you do not know an appropriate answer, just answer it in the best way you can. Remember that there are no right or wrong answers.

If you have any questions or need immediate assistance, please call me at (520) 891-3536. Sometimes I may not be able to answer the phone because I have classes. I will return your call ASAP. If you want to reach me at any time you can email me at omuammar@email.arizona.edu.

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