Accounting Expertise and Ill-Structured Problems: Cognitive Reasoning Abilities and Performance in Business Valuation Tasks

Wray Bradley
University of Arkansas, Fayetteville
ACCOUNTING EXPERTISE AND ILL-STRUCTURED PROBLEMS: COGNITIVE REASONING ABILITIES AND PERFORMANCE IN BUSINESS VALUATION TASKS
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COGNITIVE REASONING ABILITIES AND PERFORMANCE IN BUSINESS
VALUATION TASKS

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By

WRAY E. BRADLEY, B.B.A., M.B.A., J.D.
Cleveland State University. 1984
Pace University. 1974
The University of Texas at El Paso. 1970

December 1998
University of Arkansas

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Unless the LORD builds the house, they labor in vain who build it...
(Psalms 127:1)

I would like to acknowledge my dependence upon the grace of a loving heavenly father. HIS grace has sustained me through six long years of the Ph.D. process.

A dissertation may not seem like a team project. However, it has been my experience that without the assistance of many people I would not have made it nearly this far. I would like to acknowledge team members. First, my committee has been very supportive and patient with me. They have shown a genuine interest in both my personal and professional growth. The accounting faculty and accounting doctoral students (especially my friend and colleague, Steve Ludwig) have been most supportive of me. My wife, family, and close friends have always prayerfully supported me through the process (good times as well as bad).

I offer heartfelt thanks to my committee, my friends, my colleagues, and especially my family. It really is a team project and it is my feeling that I have been blessed with the very best of teammates.
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Chapter 1
INTRODUCTION

Gibbins and Swieringa (1995) imply that the phrase *judgment research in accounting and auditing* is a misnomer because behavioral accounting researchers have focused largely on the functional area of auditing. The study of auditors and audit tasks is, and will continue to be, very important. However, the accounting profession is undergoing unprecedented change due in part to rapid changes in technology and increasing globalization in the marketplace. Accountants increasingly are providing new services. One of the most rapidly growing areas of new business for the accounting profession is the provision of business valuation services.

This introductory chapter outlines the motivation for the current behavioral accounting research study that focuses on the emerging area of business valuation. In addition, the research contributions of the study are briefly discussed along with an overview of the research design.

**Motivation for the Study**

Cheney (1997) reports that, in the United States, the greatest increase in new business for the 100 largest accounting firms is in the provision of business valuation services. Cheney estimates that at least 25 percent of practicing CPAs will be involved in business valuation during their careers. This emerging area of

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1 "Increasingly complex business transactions have resulted in a growing need for valuation engagements" (AICPA 1998). CPAs are hired to provide business valuations for various reasons such as buy-sell agreements, mergers and acquisitions, estate and gift tax valuation, etc.
accounting practice is important not only to the largest firms but also to smaller practice units.

Departing from the audit focus, the current study uses business valuers as research subjects. The primary focus of investigation is on the linkage between cognitive reasoning abilities and performance in ill-structured business valuation tasks*. The concomitant ability-knowledge interaction or 'substitution effect' suggested by Libby (1995) is also considered.

Libby and Tan (1994) have established that general problem-solving ability is related to performance in certain audit tasks. Libby (1995,180) defines this ability as the "capacity to complete information-processing tasks that contribute to audit problem solving". He goes on to indicate that this composite of cognitive abilities includes verbal, quantitative, reasoning, and memory abilities. Libby hypothesizes that, in some instances, ability(ies) may compensate for lack of knowledge. "For example, some problems can be solved using generic problem-solving algorithms or task-specific heuristics. As a consequence, to the degree that a particular ability allows appropriate algorithms to be employed, ability can serve as a substitute to some degree for knowledge in determining performance effectiveness" (Libby 1995.185). Libby proposes that interactions between ability and knowledge affect performance. He then brings up the fact that most prior research in accounting either has controlled for ability differences and ability-

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*A task may be ill-structured because the problem solver has little or no experience in solving the particular task. Or, a task may be ill-structured because there is little formal guidance or suggested problem solving methodology available. Placing a value on a business is an inherently ill-structured problem. During the course of the valuation engagement the valuator must deal with cognitive sub-tasks such as hypothesis generation, estimation, hypothesis evaluation, choice and design. These sub-tasks may also be ill-structured depending on the valuator's experience, knowledge and ability.
knowledge interactions or has just ignored them. This has created a gap in behavioral accounting research that has been discussed by researchers from the fields of psychology and accounting (Abdolmohammadi and Shanteau 1992; Shanteau 1995; Bouwman and Bradley 1997).

Bouwman and Bradley (1997) suggest that a systematic examination of the impact of specific cognitive abilities, and their interactions with other factors of expertise, on task performance in both accounting and auditing contexts is needed. This view is similar to that of Abdolmohammadi and Shanteau (1992) and Shanteau (1995) who outline the need to explore the role that specific cognitive abilities play in performance of professionals.

There are many known cognitive abilities (e.g., information encoding abilities and knowledge retrieval abilities) that aid an accountant in the information processing necessary to solve problems encountered in the day to day practice of accounting. Accounting expertise researchers have suggested that “Because ill-structured tasks provide little information to decision makers about issues involved, means of solution, and alternatives available, reasoning may also be an important determinant of performance” (Bonner, Davis and Jackson 1992, 5). Reasoning abilities are essential tools for the completion of any accounting problem requiring systematic evaluation of evidence (Bonner and Pennington 1991).

Some cognitive abilities (e.g., learning styles and information processing preferences) are considered to be innate and therefore not generally subject to modification by training. Innate cognitive abilities are certainly of interest to researchers because they impact employee selection and recruitment. However, in
an applied discipline such as accounting those abilities that can be changed through training are the focus of more interest. It has been shown that cognitive reasoning abilities are among the abilities that can be successfully enhanced by training (Fong, Krantz and Nisbett 1986).

To date there is limited research from the field of accounting focusing on the relationship between cognitive reasoning abilities and performance, particularly in ill-structured tasks. There is a definite need for this type of research. Not only has the study of reasoning ability been neglected by accounting researchers but the study of ability in general has received minimal research attention⁴.

Contributions of this Research

In spite of the fact that general problem-solving ability has been shown to be an important determinant of expertise, there is little accounting research that concentrates on the role(s) that ability plays in expert performance. No previous accounting studies have examined an ability-performance link in detail. Additionally, no accounting studies have focused their investigations on an ability-knowledge interaction or substitution effect. Rather, accounting researchers have extensively investigated the roles of experience and knowledge on the expert performance of auditors and tax professionals (Bonner and Lewis 1990; Bonner, Davis and Jackson 1992).

† Reasoning abilities are thought to be one of nine 'true' cognitive abilities (Carroll 1993). This study views reasoning from a cognitive psychology perspective as opposed to a philosophical approach to the study of reasoning.

⁴ For discussion, see (Libby and Tan 1994; Libby 1995).
The current study contributes to behavioral accounting research by focusing on the ability factor. This complements recent accounting expertise studies that have focused primarily on experience and knowledge as determinants of performance (e.g., Bonner and Lewis 1990; Bonner, Davis and Jackson 1992).

Secondly, this study draws from accounting cognitive difference research (Driver and Mock 1975; Awasthi and Pratt 1990; Pincus 1990; Mills 1996). Cognitive difference studies typically use narrowly focused psychometric tests to identify and classify persons into groups that exhibit similar cognitive information processing preferences. It is theorized, by cognitive difference researchers, that decisions are at least in part influenced by the different ways that subjects cognitively process information. Similar to accounting difference studies, the present study uses psychometric techniques to measure the cognitive reasoning abilities of subjects. The use of an accounting cognitive difference methodology in an accounting expertise study serves to draw two accounting research streams closer together. This becomes conceptually and methodologically important if we are to systematically identify and examine the relationship of cognitive abilities and performance of accountants.

A third contribution of this study transcends accounting research. The study of expertise encompasses many different functional research areas across many different tasks and many different subject groups. There are major expertise studies from researchers in the fields of accounting, cognitive science, computer engineering, medicine and psychology to name but a few (Glaser and Chi 1988; Ericsson and Smith 1991; Bolger and Wright 1992; Bedard and Chi 1993). Many
of the findings from other professional fields have proven to be generalizable to
accounting tasks and vice versa. The current study explores the ability-
performance link in the generalizable interdisciplinary context of cognitive
construction and cognitive reduction processes. The subjects for this field
experiment are business valuation specialists. This accounting specialty previously
has not been involved in expertise research.

Research Design

Shanteau (1992) proposes classifying decision makers into three categories: naive
decision makers who have little or no skill in making decisions in a specific
area, novices who possess intermediate skill and knowledge, and experts who
possess extensive skill and knowledge. This study uses trained business valuators
as subjects. Using Shanteau's categories, they are classified as novice or expert
based on experience and knowledge related variables. The cognitive reasoning
ability of subjects is measured by a commercially available psychometric test that
provides an overall reasoning score as well as separate scores for deductive and
inductive reasoning ability.

In this field experiment, subjects are required to complete the valuation of a
medical practice for purposes of sale to another medical practitioner. Valuation
case materials are developed from the valuation literature, a review of medical

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1 Construction processes focus on generating ideas and interpretations. Reduction processes reduce information for evaluation purposes. Both types of processes are important cognitive aspects of problem-solving.
2 The California Critical Thinking Skills Test.
practice valuation legal cases, and consultation with experienced business valuators. Performance measures are related to cognitive tasks that the valuator must execute during a valuation.

Although the overall goals of an auditing engagement may differ somewhat from the goals of a business valuation engagement, both the auditor and the business valuator are faced with similar cognitive tasks. Bonner and Pennington (1991) discuss seven cognitive tasks that an auditor must typically perform: information search and retrieval, comprehension, hypotheses generation, design, hypotheses evaluation, estimation, and choice. This study relates four of these cognitive tasks to performance in a business valuation context.

The next chapter discusses the theoretical background for this study from an accounting research perspective. This is followed, in Chapter 3, by a theoretical discussion that relates cognitive reasoning abilities to ill-structured problems/tasks commonly required of an accountant. In Chapter 4, a task analysis of the business valuation engagement is presented and research hypotheses are developed. Chapter 5 contains a discussion of the research design, the statistical analyses of research variables, and related research hypotheses. A discussion of the results of the statistical analyses are contained in Chapter 6. In Chapter 7, some limitations of the current study and implications for future research are briefly discussed. The Appendices contain a copy of the business valuation case, a copy of the background information form, and a reproduction of the psychometric reasoning ability test.
The study of expertise has attracted the interest of researchers from many different disciplines and many different research approaches. Researchers have looked at expertise from judgment/decision making, psychological, expert systems design, and cognitive science perspectives (Bedard 1989; Ericcson and Smith 1991; Sturdy, Newman and Nicholls 1992; Bedard and Chi 1993; Vasarhelyi 1995).

Expertise research is motivated by the desire to understand which factors enable professionals to perform domain specific tasks at high levels of competence. For an applied discipline like accounting, findings from expertise research can be used to focus staff training programs on factors that enhance high levels of performance.

Accounting expertise research has used a causal model that relates experience, knowledge, and ability to superior performance (Einhorn and Hogarth 1981; Libby 1983). The refinement of this model is one of the fastest growing areas of behavioral accounting research (Bonner and Lewis 1990; Bonner, Davis and Jackson 1992; Libby and Tan 1994; Libby 1995; Cloyd 1997). However, much of this refinement has focused on the factors of experience and knowledge while ignoring or controlling for the factor of ability.

The Ability Factor in Previous Accounting Studies

The foundational model for the current study is depicted in Libby (1995). This model is shown in Figure 1. The model depicts the relations among
Figure 1
Antecedents and Consequences of Knowledge
(Libby 1995)
experience, knowledge, ability, and performance. It is assumed that motivation, cognitive exertion, and environment are constant for subjects being examined. The model specifies that direct input comes from experience and abilities with knowledge being an intermediate variable. Knowledge and ability then directly impact performance.

The ability factor consists of two separate categories of ability: learning abilities and general problem-solving abilities. Libby indicates that Link 2 represents learning abilities. These learning abilities include encoding abilities, perception abilities, and memory manipulation abilities (Hergenhahn and Olson 1993). For CPAs, these abilities are fairly consistent across the population since entry into the profession requires standardized academic preparation, somewhat standardized employment screening procedures, and passing the CPA exam. These requirements serve to limit the range of individual learning differences. Increasing learning capability is certainly of interest to the accounting profession. However, if the population is fairly uniform as to this ability, it can be expected that empirical measures of this link may not show significant differences among individual accountants.

Link 4 represents a variety of cognitive abilities associated with problem solving. These general problem-solving abilities include verbal abilities, quantitative abilities, cognitive reasoning abilities, memory abilities, and spatial abilities (Sternberg 1985; Libby 1995). Figure 2 represents a model that more fully illustrates Links 2 and 4 of Figure 1.
Figure 2
Ability and Performance

Experience → Link 1 → Knowledge → Link 3 → Performance

Learning Abilities:
- Encoding
- Perception
- Memory

Ability

General Problem-solving Abilities:
- Verbal
- Quantitative
- Cognitive reasoning
- Memory
- Spatial

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Previous accounting studies have made no attempt to look at the individual sub-components contained in the broad construct known as general problem-solving abilities. Rather, accounting researchers have typically measured this composite of abilities by scores obtained on a small subset of GRE questions (Bonner and Lewis 1990; Bonner, Davis and Jackson 1992; Cloyd 1997).

Marchant (1990) takes the position that scores on a test of general ability such as the GRE are not necessarily good predictors of performance in accounting tasks. This perspective is supported by the authors of the GRE. "The Graduate Record Examinations are designed to assess academic knowledge and skills relevant to graduate study" (Educational Testing Service, 1989, 31). Thus, the developers of the GRE have not psychometrically separated measurements of ability and knowledge. Scores on a subset of GRE questions then represent a composite of knowledge and ability. This is a very coarse measure of general problem-solving ability.

In spite of the rather crude measurement, Bonner and Lewis (1990) found that the ability factor had significant explanatory power for those experimental tasks that required forward and backward reasoning. They also showed that knowledge and ability differences accounted for more of the variance in auditor performance than did experience.

Libby and Tan (1994) extended the Bonner and Lewis (1990) study by using the same data to develop structural equation models of auditor expertise for four different tasks. They found that the ability factor had a direct positive impact on performance in unstructured tasks and an indirect effect, through knowledge,
performance in structured tasks.

The ability factor has also been shown to impact tax professionals. Bonner, Davis, and Jackson (1992), using a similar GRE measure of ability, found that high levels of ability increased performance in a tax issue identification task for subjects who exhibited low levels of declarative and procedural tax knowledge.

It is clear from these accounting studies that ability matters. What is not so clear is just what specific ability(ies) matter as far as the accountant is concerned. A problem encountered by all researchers, whether they are accounting researchers or researchers from another discipline, is how to measure narrowly focused cognitive abilities.

**Previous Accounting Cognitive Difference Studies**

A general test such as the GRE does not focus on measuring a specific cognitive ability. Rather the GRE is designed to measure a combination of academic knowledge and cognitive abilities. There are, however, other tests such as the Witkin's Embedded Figures Test (EFT), the Group Embedded Figures Test (GEFT), and the Figural Intersections Test (FIT) that are designed to measure narrowly focused cognitive abilities. Accounting difference studies have typically examined individual cognitive differences by using psychometric tests such as those listed above. These cognitive differences have generally been operationalized as differences in the way that information is processed during problem solving (Awasthi and Pratt 1990; Pincus 1990; Mills 1996).

In an examination of information processing style and its impact on task
performance Awasthi and Pratt (1990) used the EFT to psychometrically measure a construct called 'perceptual differentiation'. In an experimental task related to accounts receivable, which required subjects to evaluate conjunctive probabilities, the group that scored high in perceptual differentiation performed better than the low perceptual differentiation group.

Pincus (1990) used several psychometric tests including the GEFT to measure field-dependence:field-independence and ambiguity-tolerance:intolerance. She found that auditors who scored high as field-independent and ambiguity-intolerant were more likely to detect manipulation of inventory. In addition, field-independence/dependence alone was found to be a significant explanatory variable for performance differences.

Mills (1996) used the GEFT and the FIT to measure field-independence/dependence and mobility-fixity. She found that mobile auditors (those who perceive stimuli either in or out of context) were willing to place greater reliance on prior work of internal auditors than fixed auditors (those who perceive stimuli only in context).

Much can be learned from the accounting difference studies. Although the accounting difference stream of research has not developed a cognitive model of expertise that can be empirically tested, it has certainly established that specially designed psychometric tests can be used to measure specific cognitive abilities. Thus, accounting researchers are able to examine narrow cognitive abilities and their relationship(s) to performance in an expert-novice context.
A Call for Research on Specific Narrowly Focused Cognitive Abilities

Several researchers have cited the need to look more closely at narrow cognitive abilities. Bouwman (1996) specifically indicates that, for the accounting profession, the study of cognitive abilities must necessarily go beyond the broad concept of general problem-solving ability. Carroll (1992), a noted psychometric researcher, calls for increased research in the area of cognitive abilities. He points out that the examination of cognitive abilities using concepts from cognitive psychology is of recent vintage.

Both the accounting difference approach and the accounting general problem-solving approach have given meaningful insights into the nature of cognitive ability and performance. We now need to draw on the strengths of these two heretofore independent streams of accounting research by psychometrically measuring narrow cognitive abilities and relating them to performance in an expert/novice task context. The next chapter discusses why the study of the narrow ability of cognitive reasoning (a sub-component of general problem-solving ability) is likely to provide productive research opportunities in an accounting context.
Chapter 3
COGNITIVE REASONING ABILITIES
AND ILL-STRUCTURED PROBLEMS

In the previous chapter it was established that the study of the role that problem-solving ability plays in expert performance is an important accounting research question. It was argued that the sub-components of general problem-solving ability must be examined narrowly, focusing on specific abilities. Furthermore, some of these specific abilities can be measured by commercially available psychometric tests.

In this chapter it will be argued that cognitive reasoning abilities are one of the most important set of abilities contained in the broad composite of general problem-solving abilities. Furthermore, cognitive reasoning abilities will be linked directly to ill-structured problems and to ill-structured construction and reduction tasks that an accountant routinely faces. The theoretical discussion of this chapter lays the foundation for the research hypotheses developed in the next chapter.

Reasons for Examining Cognitive Reasoning Abilities

Noted researchers from the field of psychology have long held that reasoning abilities are likely to be important determinants of performance in ill-structured problems (Lesgold 1983; Hunter 1986; Greeno and Simon 1988). This perspective is shared by accounting researchers. “Because ill-structured tasks provide little information to decision makers about issues involved, means of solution, and alternatives available, reasoning may also be an important determinant of performance” (Bonner, Davis and Jackson 1992, 5).
Carroll (1993) presents a comprehensive study of the dimensional analysis of cognitive abilities based on a factor analytic study of 460 data sets from psychological research. Carroll hypothesizes nine 'true' domains of cognitive ability. These domains reflect the kinds of cognitive tasks that individuals perform with differing degrees of achievement. Carroll lists the nine domains of cognitive ability in order of importance:

1. General abilities (includes cognitive development, style and learning abilities).
2. Reasoning abilities.
3. Abilities in the domain of language behavior.
4. Memory abilities.
5. Visual perception abilities.
6. Auditory perception abilities.
7. Number facility.
8. Mental speed abilities.
9. Abilities in producing and retrieving words, ideas, and figural creations.

The first domain contains abilities related to learning. In the previous chapter it was noted that learning related abilities are likely to be fairly constant across the CPA population. Accordingly, empirical measures of this ability may not show significant differences among individual CPAs.

Second in importance is a group of abilities that appear in 241 of the 460 studies. These abilities load on a single factor characterized as 'reasoning abilities'. These reasoning abilities can be subdivided into two major categories: deductive (sequential) reasoning abilities and inductive reasoning (induction) abilities. Carroll (1993, 245) defines the operation of these abilities as:

Deductive Reasoning (Sequential Reasoning) “... operates in tasks or tests that require subjects to start from stated premises, rules, or conditions and engage in one or more steps of reasoning to reach a conclusion that properly and logically follows from the given premises.”
Inductive Reasoning (Induction) "... operates in tasks or tests that present subjects with materials that are governed by one or more implicit rules, or that exhibit or illustrate certain similarities or contrasts. The subject’s task is to discover the rules that govern the materials or the similarities and contrasts on which rules can be based, and then to demonstrate that discovery in some way, either by stating rules or relevant stimulus attributes, or by making appropriate choices among alternatives that are presented."

It is evident from Carroll’s hierarchical listing that reasoning abilities are important from his perspective as a psychometric/psychology researcher.

Additionally, cognitive reasoning abilities are candidates for examination by accounting researchers because they are essential to successful performance in ill-structured accounting tasks. Furthermore, it is widely believed that they are subject to modification during one’s lifetime (Clabaugh, Forbes and Clabaugh 1995; Hanley 1995). Innate abilities are certainly important. But, beyond initial employment screening, the CPA firm can do little about them. Finally, another reason for selecting cognitive reasoning abilities for examination is that they can be measured psychometrically by narrowly focused tests (Watson and Glaser 1980; Facione 1991).

**Reasoning and Ill-Structured Problems and Tasks**

There is no such thing, strictly speaking, as a “reasoning task”, independent of the persons who are to solve that task. For one person, a given task may be relatively novel and hence necessarily executed in a highly controlled fashion. For another person, that same task may be highly familiar. ... The task will be more of a reasoning task for the first individual than for the second. (Sternberg 1986, 287)

During any engagement that requires the systematic examination of
evidence, an accountant faces ill-structured problems and tasks. The concept of ill-structured involves two perspectives. One perspective looks at the problem solver while the other perspective looks at the problem itself. A problem or task may be ill-structured because the problem solver has little or no experience in solving a particular type of problem or task. Or, a problem or task may be ill-structured because there is little formal guidance or suggested problem solving methodology available for a particular type of problem. Even familiar problems often require the problem solver to perform ill-structured subtasks.

Reitman (1965) defines ill-structured problems in terms of the number of solution constraints that must be dealt with (closed) in order to arrive at a solution. If a problem contains a large number of unspecified open constraints, it is considered to be ill-structured. Simon (1973) extends Reitman's definition by proposing that many ill-structured problems become more structured during the solution process. This occurs as the problem solver satisfies open constraints related to subtasks and sub-goals. This means that a particular problem will be ill-structured for an individual who has little experience or knowledge concerning the problem. The same problem would be less ill-structured for an individual who has previous knowledge or experience with the same or a similar problem. For the first individual, problem solution will require more reasoning than for the second individual.

Reitman also describes ill-structured problems in respect to the professional community of problem solvers. "To the extent that a problem evokes a highly variable set of responses concerning referents of attributes, permissible operations.
and their consequences, it may be considered ill-defined or ambiguous with respect to that community.” (Reitman 1965. 151). For example, a business valuation engagement is an inherently ill-structured problem for the accountant because there are likely to be a “highly variable set of responses” for a given business valuation. Thus, an ill-structured problem/task is ill-structured because it is either somewhat novel for the individual problem solver or because it is a problem where there exists diversity of opinion, as to solution process and outcome, among the professional problem solving community.

Simon proposes that “much problem solving effort is directed at structuring problems, and only a fraction of it at solving problems once they are structured” (Simon 1973, 187). The cognitive reasoning process provides structure to initially ill-structured problems or tasks.

Simon (1973) points out that the information necessary for the resolution of open constraints (necessary to provide structure) usually comes from long-term memory. This information is often contained in specific problem schemas or templates that are stored in long-term memory (Bouwman, Frishkoff and Frishkoff 1987). These schemas represent experience and knowledge that the problem solver has organized internally and structured in order to provide more problem solving structure to a specific type of problem. These schemas may range from highly detailed to more general in nature. The use of well-developed schemas is one way that an expert gains a problem solving advantage over a novice. For a given problem or task the schemas of experts are more complete than those of novices. Accordingly, the same problem may be less ill-structured for an expert than it is for
Problem or task structure is based on a continuum. An ill-structured problem for some individuals may be more structured for other individuals depending on the knowledge and experience that an individual brings to the problem. This continuum of problem/task structure is depicted in Figure 3.

The solution of an ill-structured problem or task involves a high degree of reasoning which often requires the use of inductive reasoning or deductive reasoning or both. Typically, inductive reasoning is associated with cognitive construction tasks such as information search and retrieval, hypothesis generation, comprehension, and design. Deductive reasoning problems are generally associated with cognitive reduction tasks such as hypothesis evaluation, estimation, and choice (Sternberg 1986; Greeno and Simon 1988). Few ill-structured problems/tasks are purely inductive or purely deductive, thus, these types of problems/tasks are looked at on the basis of a continuum. Nevertheless, cognitive construction tasks tend to require more inductive reasoning. On the other hand, commonly encountered cognitive reduction tasks tend to require more deductive reasoning. These relationships are shown in Figure 4.

Summary

In summary, cognitive reasoning abilities are important specific abilities within the broad construct of general problem-solving ability. They can be measured by narrowly focused psychometric tests. They are essential abilities for

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Figure 3
Continuum of Problem Structure

<table>
<thead>
<tr>
<th>Ill-Structured</th>
<th>Well-Structured</th>
</tr>
</thead>
<tbody>
<tr>
<td>* many open constraints</td>
<td>* few open constraints</td>
</tr>
<tr>
<td>* small amount of problem related information stored in long term memory</td>
<td>* large amount of problem related information stored in long term memory</td>
</tr>
<tr>
<td>* problem must be solved in a controlled manner employing weak methods such as means-end analysis, working backward, generate and test</td>
<td>* problem solver knows exactly how to proceed (strong method); many solution steps are automated</td>
</tr>
<tr>
<td>* low level of agreement among the problem-solving community as to problem attributes, permissible operations, and consequences of operations</td>
<td>* high level of agreement among problem-solving community as to problem attributes, permissible operations, and consequences of operations</td>
</tr>
<tr>
<td>* high degree of reasoning required</td>
<td>* low degree of reasoning required</td>
</tr>
</tbody>
</table>
Figure 4
Continuum of Reasoning Required for Commonly Encountered Ill-structured Problems/Tasks

<table>
<thead>
<tr>
<th>Deductive Reasoning</th>
<th>Inductive Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>I ←-----------------</td>
<td>I</td>
</tr>
</tbody>
</table>

Reduction tasks:
- Hypothesis evaluation
- Estimation
- Choice

Construction Tasks:
- Information search and retrieval
- Comprehension
- Hypothesis generation
- Design

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solving ill-structured problems. For an ill-structured construction task/problem, a large amount of inductive reasoning is required. If the problem involves an ill-structured reduction task, then a large amount of deductive reasoning is required. These relationships between reasoning and ill-structured construction and reduction tasks provide the theoretical background for the task analysis and hypotheses development contained in the next chapter.
This chapter discusses cognitive construction and reduction tasks that are necessary for the completion of a business valuation engagement. These tasks are related to cognitive reasoning ability based on the discussion in the previous chapter. The linkage between cognitive construction and reduction tasks and the cognitive reasoning process provides the theoretical foundation for the research hypotheses.

The general context for this discussion is the ill-structured problem environment of business valuation. The experimental case study requires the subject to value a medical practice for the purpose of sale to another practitioner.

Phases of the Business Valuation Engagement

Similar to Bonner and Pennington (1991), the business valuation engagement is described in terms of phases. Bonner and Pennington use five phases to outline the audit engagement. This study explains the business valuation engagement in seven phases.

Phase 1 - Assignment Definition and Orientation. In the initial phase of the business valuation assignment, the valuator must first determine the specific assets to be valued and the purpose(s) of the valuation. For example, the valuation requirements and methodology for an estate tax valuation may be quite different from the requirements and methodology for a buy-sell valuation.
Once the items to be valued and the purpose of the engagement are established the valuation standard must be discussed with the client. Typical valuation assignments call for the use of standards such as fair market value, investment value, or liquidation value. Since the final valuation may vary according to the standard used, the appropriate standard must be understood by both the client and the valuator.

Finally, in this initial phase the valuator forms an understanding of the form and expected content of the valuation report, determines the time horizon for the engagement, and makes fee arrangements with the client. In most cases the issues covered in the initial phase are reduced to a written engagement contract.

Several cognitive construction and reduction tasks, such as information search and retrieval, comprehension, hypotheses generation/evaluation, and choice, are involved in this initial phase. These tasks are ill-structured for the valuator who has limited knowledge and experience related to a specific type of valuation. The valuator retrieves general information from memory concerning the type of business involved in the valuation, forms an initial mental representation, forms and evaluates hypotheses concerning valuation standards and report contents, and makes initial choices as to valuation standards.

**Phase 2 - Refinement of Initial Impression(s).** After the terms of the engagement have been established, the valuator must refine his/her mental representation of the business and make sure that the valuation standards and methods match the client’s expectations. During this phase hypotheses concerning
potential problems are developed, preliminary procedural choices are made, and estimates of needed quantitative data along with the design of a preliminary plan for gathering that data are advanced.

**Phase 3 - Data Gathering.** In this phase the valuator is concerned with gathering data related to the company, the industry, and any specific assets that may be involved in the valuation. This phase is similar to the technical understanding and data gathering phases of an audit. The valuator gathers items such as company financial statements, income tax returns, budgets, and forecasts. In addition, the qualitative company information is refined by procedures such as examining the company history, determining key personnel, and reviewing contracts. This phase often involves site visits and site interviews. Finally, the valuator gathers information regarding the local economy and, when available, information related to local industry and competitor businesses. Ideally, the valuator identifies information concerning recent sales of similar businesses.

Cognitively, the valuator spends a lot of time searching for new information and comparing it to retrieved information. In addition, the mental representation of the valuation situation is revised and new hypotheses are developed.

**Phase 4 - Preliminary Evaluation of Data.** Once the data have been gathered, they must be evaluated as to amount and content. At this point, an assessment of the reliability of the data (evidence) gathered is made. If the data are deemed insufficient, then a plan must be designed for the collection of additional
data. Sometimes there are no more data available and the valuator is forced to rely on what already has been gathered.

Once the data are considered to be sufficient, a plan is established for formal analyses. This plan design takes into account the data available and the contents of the data. Like the auditor, during this phase, the valuator compares the current situation with previously encountered businesses of the same type. An initial hypothesis concerning the overall comparative value of the business is formed. Since quantitative data have not yet been analyzed, this hypothesis is largely evaluated using previously gathered qualitative information.

Phase 5 - Analysis and Adjustment of Data. In this phase the valuator begins the formal evaluation of the data. Some of the steps used are very similar to the substantive testing phase of an audit. The valuator makes estimates related to adjustments of Balance Sheet and Income Statement items. Typically, the reported values of fixed assets are adjusted upward or downward based on the valuator's assessment or the report of an outside appraiser. Income Statements may be adjusted for items such as depreciation methods, executive compensation plans, pension plans, and administrative costs. Some of these adjustments may have a material impact on the final valuation. Thus, the business valuator is faced with making materiality estimates.

Also at this time, the valuator performs ratio analyses and comparisons. Common size financial statement comparisons are examined and financial ratios are compared to industry and competitor company standards. All of this
information is used to revise the mental picture of the company. Finally, based on the evaluation of the gathered data, the business valuator must make a final choice as to the specific valuation methods that will be used.

**Phase 6 – The Valuation.** There are several different valuation methods available to the valuator. In many cases (if not most) there is little agreement among the professional community as to which method(s) to use in a given type of valuation. There are methods that are based on items such as discounted future earnings, capitalization of earnings, excess earnings, comparative companies, and assets.

In this phase the valuator must arrive at a final choice as to which method(s) will be used. It is common practice to use several different methods and to make an overall valuation based on a judgmental combination of the different results. Also, if a valuation method is going to be used that requires a discount or capitalization rate, the valuator must estimate the appropriate discount or capitalization rate.

Similar to an audit, the final phases of a business valuation represent how successful the business valuator is at the cognitive design task. Bonner and Pennington (1991) explain that the entire audit is a design task, comprised largely of design sub-tasks that have the goal of assembling information patterns that will assist in overall diagnosis of the client financial condition. Like the design process of an audit, the business valuation design process requires the valuator to put together certain patterns of information that will aid in arriving at an overall
valuation. The expert valuator chooses valuation methods that are most appropriate for the particular engagement, evaluates the strengths and weaknesses of the business, and chooses the most relevant qualitative factors. In the case of the business valuator, the cognitive design skills of the valuator are represented by the final output (e.g. the overall valuation amount). Deductive reasoning has been used to combine some factors during the process of determining the final value. However, the final valuation is largely a product of inductive reasoning. It is an amount that was arrived at by careful comparison of assembled patterns of information. Other values may be logically consistent with the facts of the case but the valuator is forced to decide upon one value or a small range of value. If the valuator does not assemble the best patterns of information (e.g. has low skill in the design process), then the overall value may be significantly different from a valuator who is more skilled at design.

**Phase 7 - Report Preparation.** An audit report is short and uses standardized language. Unlike the audit report, the business valuation report is non-standardized and must be very detailed and specific. After arriving at an overall valuation, the valuator must reduce his/her valuation to documented written form. This final valuation must be justified extensively by indicating the basis for and reasoning behind positions taken during the valuation process. This process is similar to the process that a judge uses when writing his/her opinion at the end of a case.

Throughout the valuation engagement the valuator is required to cognitively
process information necessary to solve the same types of cognitive tasks that Bonner and Pennington (1991) describe in their auditor expertise treatise. For valuators with little domain specific knowledge or experience associated with the valuation of a medical practice, an extensive amount of reasoning is required as they work through the research case. For the valuator with extensive domain knowledge and experience the valuation is less ill-structured. Thus, it is expected that the expert will employ less reasoning. The next section develops hypotheses related to the expected cognitive reasoning demands of experienced (expert) business valuators and less experienced (novice) business valuators.

**Hypotheses Development**

A reasoning problem exists when an ill-structured problem/task requires controlled problem solving that involves deduction and/or induction. In general, more inductive reasoning is required for construction tasks and more deductive reasoning is required for reduction tasks (Sternberg 1986; Greeno and Simon 1988). There are few reasoning tasks that are purely inductive or purely deductive. As previously discussed, reasoning problems are viewed in the context of a continuum.

An expert business valuator, with extensive medical practice valuation knowledge and experience, has developed and in some cases has automated extensive problem solving templates. These individuals have accomplished this by using their extensive domain knowledge and domain specific experience to develop comprehensive inferential rules and schemas that readily are available from long-
term memory. The expert has taken formerly ill-structured tasks and reduced them to more structured tasks. For this person, it is expected that knowledge and experience have effectively substituted for reasoning ability. For the expert, reliance on reasoning ability becomes secondary since a large portion of the overall task is no longer highly ill-structured.

The following research hypothesis describes the expected relationship between performance and reasoning ability for the expert business valuator:

H1: For the ‘expert’ business valuator, reasoning ability is not an important determinant of performance.

Unlike the expert who has automated much of the problem-solving process the novice, who does not have much medical practice valuation experience or knowledge, must treat the valuation problem as ill-structured. This means that the novice must perform each cognitive task in a controlled fashion. For the novice with well-developed reasoning ability, reasoning ability can be expected to compensate for, or substitute for, some of the lack of domain knowledge and experience. Unlike the expert, it can be hypothesized that reasoning ability will be very important in the performance of the novice business valuator.

H2: For the ‘novice’ business valuator, reasoning ability is an important determinant of performance.

When comparing the performance of novice business valuators to expert business valuators, it is expected that cognitive reasoning ability will substitute for some lack of knowledge and/or experience on the part of the novice. Accordingly,
the performance of novices with a high degree of cognitive reasoning ability should approach the performance of experts because reasoning ability effectively takes the place of, or substitutes for, missing knowledge or experience. This is expected to be the case for the overall business valuation, as well as associated sub-tasks.

This expected relationship is expressed in the following hypothesis:

$$H_3: \text{Performance of high reasoning ability novices approaches that of experts on the overall valuation and associated sub-tasks.}$$

The next chapter presents a detailed description of the research design and statistical testing methodology used to evaluate hypotheses $H_1$, $H_2$, and $H_3$. 
This chapter discusses research design issues such as the subjects involved, experimental tasks required of the subjects, data collection, research variables, and the statistical methodology used to evaluate the data and test the hypotheses.

The Experimental Materials

Experimental materials consist of three items. A medical practice case study, a background information form, and Form B of the California Critical Thinking Skills Test (CCTST) (Facione 1991). The self-reported mean completion time for the case study was 1.6 hours. It is estimated that the background information questionnaire took another 10 to 15 minutes to complete. The CCTST requires approximately 45 additional minutes for completion. Thus, the average research subject spent in excess of two and one-half hours working on the experimental materials.

The Case Study. There were three primary concerns in the development of the case materials. First, that the case information contents approximate the information available to a business valuator. Secondly, that the case materials do not lead to a simplistic predetermined valuation. Finally, that the case materials are not too complex to be completed in a reasonable (short) amount of time (Roberts 1990). In consideration of these concerns, the case study requires the valuation of a medical practice for purposes of sale to another practitioner. This type of business
valuation is fairly common especially given the increasing number of retiring senior physicians. It is not a particularly complicated valuation as there are usually limited amounts of fixed assets involved and issues like minority interests are not routinely encountered. Also, there are comparative data available, such as salary information for practice specialties from outside sources like the American Medical Association.

The case was initially developed from an analysis of the literature concerning medical practice valuation (Reilly 1990; Toso 1992; Federa and Ketcham 1993; Pratt 1993; Goldberg 1994; Collins and Simpson 1995; Massad 1995; Rimmer 1995; Nolan and Bober 1997). The case was refined by reviewing legal cases involving valuations of medical practices, by reviewing physician data from the American Medical Association, and by consultation with practitioners and academicians knowledgeable in the area. A pilot study of the case was conducted with business valuators from local CPA firms. The case was revised based on feedback from the pilot study and further scrutiny by practitioners and academicians. Subjects were asked to rate the realism of the case using a five point Likert scale. One on the Likert scale is ‘Very Realistic’, three is ‘Moderately Realistic’, and five ‘Not Realistic’. The overall sample mean Likert value for case realism is 2.3 and the median value is 2.2 (e.g., between ‘moderately realistic’ and ‘very realistic’). Comments from participants indicate that they were satisfied that the case materials are realistic.

The case study requires participants to formulate a valuation of the medical practice of a senior physician for the purpose of sale to a young doctor starting his
own private practice. This particular case was designed in a way that at least three commonly used valuation methods yield results that are very close to each other. A copy of the case materials is contained in Appendix A.

The Background Information Form. The background information form consists of three pages of questions. Basic demographic information is solicited along with specific questions designed to collect information related to experience and knowledge. In addition, participants are asked to assess their ability to value a medical practice on a five point Likert scale. One on the ability Likert scale is 'High Ability', three is 'Moderate Ability', and five is 'Low Ability'. The mean overall ability rating for all subjects is 2.38. A copy of the background information form is contained in Appendix B.

The CCTST. Scores from the California Critical Thinking Skills Test (CCTST) are used to measure cognitive reasoning ability. The test is a standardized psychometric test that provides an overall reasoning ability score and sub-scores for deductive reasoning ability and inductive reasoning ability. There are several commercially available tests which measure reasoning, however, the CCTST is the most recently developed instrument (Facione 1991). The test exhibits a KR-20 reliability score of .70 and has validity characteristics supported by a panel of experts. It is considered to be the best of similar commercially

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8 Mean for the expert group is 1.79. Mean for the novice group is 2.64.
available instruments (Carter-Wells 1992). A copy of Form B of the CCTST is in Appendix C.

The Subjects

An initial inquiry was mailed to a randomly selected group of 3000 business valuators. This group was selected from the membership lists of the American Society of Appraisers, The Institute of Business Appraisers, and The National Association of Certified Valuation Analysts. The experiment and the time requirements were described in this initial mailing. Recipients were asked to return a postage-paid postcard if they were willing to participate in the project.

Postcards were received from 428 business valuators. Packets consisting of a cover letter of explanation and the previously described research materials were mailed to the 428. A deadline of approximately four weeks from receipt of materials was specified. Prior to the deadline, 129 completed research packets were returned. Nine completed packets were returned after the deadline. There does not appear to be any significant difference in the demographic background of early and late responders. No follow-up efforts were employed. Of the 138 responses, 134 contain complete data. This represents a 32 percent return rate based on 428 packets sent.

Population Demographics. Although there are no published demographics concerning the population of business valuators, selected population characteristics can be reasonably estimated. This section discusses the formulation of the
estimated population demographics. A chi-square comparison of the estimated population of business valuators and the research sample demographics is presented in the next section. There are three major national organizations for business valuators. The American Society of Appraisers is a multidisciplinary organization that offers certification in several valuation specialties. According to administrative officials of the organization, approximately 2,400 members belong to the business valuation section of the organization. As of May 1, 1998, 697 of those 2,400 held the Accredited Senior Appraiser (ASA) designation (American Society of Appraisers 1998). In order to receive this designation a member must have five years of full-time valuation experience, pass a written examination, and be approved by the examining committee. Most of the members of the American Society of Appraisers devote the majority of their time to valuation.

The Institute of Business Appraisers (IBA) has about 3,700 members. Approximately 2,400 of these members are CPAs (Hock 1996). After passing a written examination, this organization offers the Certified Business Appraiser (CBA) designation. There is no experience requirement for this designation. As of July 1998, approximately 260 members have earned the CBA designation (Institute of Business Appraisers 1998).

The National Association of Certified Valuation Analysts (NACVA) has about 3,500 members, all of whom are CPAs. After taking a series of training courses and passing a written examination, a member is eligible to be awarded the Certified Valuation Analyst (CVA) designation. There is no experience requirement. As of July 1998, there are approximately 2,900 CVAs (National
Association of Certified Valuation Analysts 1998). It is estimated that at least 20 percent of IBA members also belong to NACVA.

In 1998 the AICPA, for the first time, awarded the designation Accredited in Business Valuation (ABV) to 700 of its members. Thus, within the population of business appraisers there are 700 individuals who hold the new ABV designation. Many of these valuators also hold the ASA, CVA or CBA designation. A summary of business valuator population estimates is presented in Table 1.

**Response Bias.** The primary reason for considering possible response bias is to make an assessment about whether the sample respondents are representative of the population sampled. The certification standards for ASAs, ABVs, CBAs, and CVAs are different. The certification standard for ASAs is the most stringent. ABV certification standards are next in difficulty. CBA and CVA certification standards follow ABV standards in level of difficulty. In order to test for response bias, the proportion of individuals holding various business valuation certifications in the estimated population is compared to the proportion of individuals in the research sample holding the same certifications. The estimated percentage of CPAs in the business valuator population also is compared to the number of CPAs in the research sample. Chi-square Goodness of Fit statistics are listed in Table 2.

The results of these statistical tests indicate that the sample proportion of CPAs is similar to the population proportion of CPAs. It is further indicated that the proportion of persons holding the Accredited in Business Valuation (ABV)
### Table 1
**Business Valuation Population Estimates**

<table>
<thead>
<tr>
<th></th>
<th>Members</th>
<th>Number of Members Holding Certification</th>
<th>Percent of the Population Holding Certification</th>
<th>Number of CPAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Society of Appraisers</td>
<td>2,400</td>
<td>700 ASA designation</td>
<td>8.5%</td>
<td>350</td>
</tr>
<tr>
<td>Institute of Business Appraisers</td>
<td>3.700</td>
<td>260 CBA designation</td>
<td>3.2%</td>
<td>2,400</td>
</tr>
<tr>
<td>National Association of Certified Valuation Analysts</td>
<td>3.500</td>
<td>2,900 CVA Designation</td>
<td>35.4%</td>
<td>3,500</td>
</tr>
<tr>
<td>Reduction for estimated 20% overlap of IBA and NACVA</td>
<td>(1,400)</td>
<td></td>
<td></td>
<td>(1,200)</td>
</tr>
<tr>
<td>Estimated population total for persons formally involved in business valuation</td>
<td>8,200</td>
<td>3,860</td>
<td>47.1%</td>
<td>5,050*</td>
</tr>
</tbody>
</table>

*approximately 61.6 percent of the population are CPAs. About 700 CPAs or 8.5 percent of the total business valuator population hold the ABV designation.
Table 2
Chi-Square Goodness of Fit Comparisons

a. \( H_0 \): sample equals population as to proportion of ASAs, CBAs, CVAs, and others.

<table>
<thead>
<tr>
<th></th>
<th>ASA</th>
<th>CBA</th>
<th>CVA</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population percent</td>
<td>8.5%</td>
<td>3.2%</td>
<td>35.4%</td>
<td>52.9%</td>
<td>100%</td>
</tr>
<tr>
<td>Observed sample frequency</td>
<td>19</td>
<td>12</td>
<td>54</td>
<td>53</td>
<td>138</td>
</tr>
</tbody>
</table>

\( df = 3; \) chi-square = 23.55; \( p < .001 \)

b. \( H_0 \): sample equals population as to proportion of ABVs and others.

<table>
<thead>
<tr>
<th></th>
<th>ABV</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population percent</td>
<td>8.5%</td>
<td>91.5%</td>
<td>100%</td>
</tr>
<tr>
<td>Observed sample frequency</td>
<td>18</td>
<td>120</td>
<td>138</td>
</tr>
</tbody>
</table>

\( df = 1; \) chi-square = 3.66; \( p = \) between .05 and .10

c. \( H_0 \): sample equals population as to proportion of CPAs and others.

<table>
<thead>
<tr>
<th></th>
<th>CPA</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population percent</td>
<td>61.6%</td>
<td>38.4%</td>
<td>100%</td>
</tr>
<tr>
<td>Observed sample frequency</td>
<td>91</td>
<td>47</td>
<td>138</td>
</tr>
</tbody>
</table>

\( df = 1; \) chi-square = 1.10; \( p = \) between .20 and .30
designation in the sample and the population is similar. However, when the proportions of persons holding the Accredited Senior Appraiser (ASA), Certified Business Appraiser (CBA), and Certified Valuation Analyst (CVA) are considered, the sample and population appear dissimilar. The results in Table 2a indicate that there are proportionately more ASAs, CBAs, and CVAs in the sample than expected.

If ASAs and CVAs are considered separately while placing CBAs in the 'Other' category, the chi-square value is 3.285 ($p = \text{between } .05 \text{ and } .10$). The inference is that the number of CBAs in the sample relative to the expected number is a reason for rejecting the null hypothesis that the population and sample are proportionately equal. The population and the sample are proportionally similar in respect to the distribution of persons holding the CPA, ASA, CVA, and ABV designations. Although there are proportionally more persons holding the CBA designation in the sample, than one would expect to find in the population, the sample still appears to be representative of the population.

If the number of CBAs in the study is larger than expected, then the knowledge and experience levels of the research sample subjects is potentially greater than the population at large. As previously discussed, the research hypotheses of this study are based on the premise that reasoning will be more important for novices than for experts. Since the sample group potentially has higher experience and knowledge levels, then we have a situation where there are proportionally more experts than one would expect to find in the population. This
means that if any response bias exists it works against finding support for the research hypotheses.

**Performance Measures**

The value of a medical practice is established by comparing the incremental income producing value of an existing practice to the incremental income producing value of a new start-up practice in the same specialty area (Pratt 1993). This valuation is quite different from the valuation of a company whose value depends largely on the income producing capacity of its assets given a certain mix of employees and customers. Due to the difference in valuation approaches, the choice of valuation method(s) is more limited for a medical practice than for a company that makes or sells a product. The case materials were developed such that the market data comparable, the capitalization of income/cashflows, and the asset accumulation methods yield overall valuation results that are very close to each other. This was done in order to minimize the possible confounding effect of judgment decisions associated with combining results from different methods.

There are two types of performance measures used in this study. The first type of performance measures are raw scores. Raw scores are used as dependent variables in 2x2 factorial ANOVAs. The second type of performance measures are benchmarked scores where the responses of subjects are compared to the mean and median scores of a nine member expert panel. The benchmarked scores are used as dependent variables in OLS regression equations. The next section briefly describes the measurement of the performance scores.
Performance Scores Related to Reasoning Ability. As previously discussed, most reasoning tasks require a combination of deductive and inductive reasoning. Since reasoning tasks are based on a continuum of deductive reasoning and inductive reasoning it is difficult to find a performance measure which clearly relates to only deductive reasoning or only inductive reasoning. In general, construction tasks require more inductive reasoning and reduction tasks require more deductive reasoning.

Two tasks that Bonner and Pennington (1991) classify as construction tasks are *design* and *hypothesis generation*. These tasks require significant deductive reasoning, but overall it is expected that more inductive reasoning is required. The expected relationship is that a performance measure associated with *design* and/or *hypothesis generation* is more closely related to inductive reasoning ability.

The *design* performance measures are the most straightforward of all the performance measures. Similar to an audit, the overall valuation of a business is a *design* task. The final output of the design solution is the final valuation amount. In the case materials, subjects are asked to assign a specific overall valuation amount to the medical practice. This amount is the *raw* performance measure for the design task and is a dependent variable in a 2x2 factorial ANOVA. The *benchmarked* performance measure for the design task is the absolute value of the difference between a subject's medical practice valuation amount and the mean medical practice valuation of the expert panel. This value is the dependent variable in OLS regression equations.

The *hypothesis generation* performance measures are also straightforward.
Soon after reviewing the initial qualitative information presented in the case, a subject is asked to assign a preliminary value to the medical practice compared to other medical practices. This task requires the valuator to formulate a hypothesis regarding the practice value. The answer for this preliminary hypothesis is in the form of a five point Likert scale where 1 is ‘low value’ and 5 is ‘high value’. The raw performance measure for the hypothesis generation task is the actual Likert score (e.g., 4.0, 4.2, etc.). The benchmarked performance measure is the absolute value of the difference between the raw score and the mean Likert score of the expert panel.

Bonner and Pennington (1991) discuss hypothesis evaluation tasks in the context of two types of research where auditors evaluate hypotheses based on qualitative information and case histories (Simnett and Trotman 1989) and where auditors have been asked to list and evaluate important cues (Messier and Schneider 1988). Immediately following the Likert scale task, the subject is asked to list the five most relevant items contained in the qualitative case information. This is very similar to a list and evaluate important cues research task. Such a task certainly requires an amount of inductive reasoning. However, in following the Bonner and Pennington classification of hypothesis evaluation, it is expected that performance on this task is a surrogate for reduction task performance. It follows that performance on this type of task is expected to be more closely associated with deductive reasoning ability.

Scores for the relevant item hypothesis evaluation task are based on a content analysis of the expert panel’s responses to this task. A weighting scheme
based on the frequency that the expert panel listed a particular item is used. This scheme generated the following relevant items and their respective weights:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Positive demographics including affluent community, lack of competition, proximity of specialists/hospital facilities.</td>
<td>9</td>
</tr>
<tr>
<td>2. Favorable accounts receivable collection rate.</td>
<td>3</td>
</tr>
<tr>
<td>3. Good records, well-run office, dedicated office staff.</td>
<td>3</td>
</tr>
<tr>
<td>4. Favorable practice mix.</td>
<td>2</td>
</tr>
<tr>
<td>5. Value of fixed assets.</td>
<td>2</td>
</tr>
<tr>
<td>6. Favorable lease.</td>
<td>1</td>
</tr>
</tbody>
</table>

The weighting scheme is such that item one is mentioned in the expert panel content analysis three times more often than item two, and items two and three are mentioned three times more often than item six. If subjects mention one of these items in their relevant item listing, they are assigned the related score. The score from all items mentioned are added and the sum is a subject's final relevant item (hypothesis evaluation) raw score. The benchmarked score is the absolute value of the difference between a subject's raw score and the mean relevant item score for the expert panel.

Separate but similarly derived performance measures are used for the choice task. After reviewing the qualitative and quantitative information contained in the case materials, subjects are asked to list and describe the valuation method(s) that they will use to form an overall valuation. This is a cognitive choice task. It is expected that performance on this task is related more closely to deductive reasoning ability than inductive reasoning ability.

Similar to the hypothesis evaluation task, performance is measured by a weighted score. The weights for scoring this variable are derived from a content
analysis of the frequency of the expert panel's responses to the same question. For example, method 1 is listed by the expert panel approximately twice as often as method 2.

<table>
<thead>
<tr>
<th>METHOD</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Market comparable using a revenue multiplier.</td>
<td>7</td>
</tr>
<tr>
<td>2. Market comparable using FMV(^9) of assets + goodwill.</td>
<td>4</td>
</tr>
<tr>
<td>3. Capitalization of income/cashflows.</td>
<td>4</td>
</tr>
<tr>
<td>4. Asset accumulation method.</td>
<td>3</td>
</tr>
<tr>
<td>5. Excess earnings method.</td>
<td>2</td>
</tr>
</tbody>
</table>

The sum of all the weighted scores of all methods used by subjects is their final \textit{raw} score for the method \textit{choice} task. \textit{Benchmarked} scores for the choice task are determined by the absolute value of the difference between the \textit{raw} score and the mean score of the expert panel. It is noteworthy that the expert panel mean scores for the relevant item task and the method choice task are greater than the mean scores of the expert and novice groups.

All four \textit{raw} scores are dependent variables in 2x2 factorial ANOVAs with levels corresponding to expert/novice and high/low reasoner. The ANOVAs are examined with the expert panel included in the expert category. This gives a more complete expert/novice comparison. The four \textit{benchmarked} performance scores are used as dependent variables in separate OLS regressions. The expert panel members are excluded from the data set(s) used in regression procedures.

\textbf{The Expert Panel.} In order to establish performance benchmarks for regression scores, a nine member expert panel was selected from among the 134

\(^9\) Fair market value.
subjects who returned fully usable research packets\textsuperscript{10}. The expert panel members exhibit characteristics associated with more experience and more knowledge than other members of the research sample. Consensus among a panel of experts is not necessarily expected for an ill-structured task (Bouwman and Bradley 1997) but has often been used as an indicator of expert performance (Keasey and Watson 1989). In this study, the range of valuation that the expert panel placed on the medical practice is quite narrow when compared to the entire sample. The range for the expert panel is $200,000 to $287,500 compared to a range of $80,000 to $850,000 for the entire sample. Additionally, expert panel members are largely in agreement concerning other factors related to the performance measures used in this study.

Members of the expert panel were selected by conducting a sensitivity analysis of the number of medical practice valuations, number of total valuations, years of valuation experience, and valuation certification held. Only 10 subjects out of the sample of 134 have the following minimum qualifications:

- Twenty or more medical practice valuations.
- Sixty or more total valuations.
- Ten years or more of valuation experience.
- Certified in business valuation.

For one of the 10 subjects, the overall valuation amount was more than two standard deviations below the mean valuation for the group. Some of the written responses from this subject indicated a possible lack of understanding of task requirements. Additionally, his/her other performance measure scores are not in general agreement with the other nine. This subject was dropped from the expert panel.

\textsuperscript{10} 138 research packets were returned, however, only 134 contain complete data.
panel but is included in the expert group.

The mean number of medical practice valuations for the nine member expert panel is 55 compared to a mean of 8 for the rest of the sample. The mean number of total valuations for the expert panel is 450 compared to a mean of 140 for the rest of the sample. The mean number of years of valuation experience for the expert panel is 14 compared to 9 for the rest of the sample.

Research Variables

Performance in the four research tasks is hypothesized to be a function of experience, knowledge, and ability. Motivation and environment are considered to be constant for all subjects.

\[ Performance = f(experience, knowledge, ability) \]

The sole ability of interest in this study is cognitive reasoning ability, a sub-component of general problem-solving ability. Important variables related to experience and knowledge have been delineated in prior accounting research. These same types of variables are included in this study.

Variables Related to Experience. Bonner and Lewis (1990) measure general audit experience as well as task specific audit experience. They found that both general audit experience and task specific experience accounted for performance differences.
General Valuation Domain Experience: For this study, the total number of business valuations of any type, previously performed measures general valuation domain experience.

Task Specific Experience: The total number of medical practice valuations performed or taken part in measures task specific experience.

Variables Related to Knowledge. Bonner and Lewis (1990) examine three components of knowledge: general domain knowledge, subspecialty knowledge, and general business knowledge. Bonner and Lewis solicit subject self-reported knowledge measures and experience measures that they use to develop knowledge variables. So, there is research precedent for developing knowledge variables by using factors that may at first seem to be related to experience.

All business valuators who are certified must take continuing professional education courses each year, and it is reasonable to assume that continuing education courses result in knowledge. In the current study, subjects were asked to list the number of hours of business valuation continuing professional education during their career and the number of hours of non-business valuation continuing education. These hours were thought to be reasonable surrogates of general domain and general business knowledge. However, the self-reported measures are highly variable ranging from zero to "thousands".

General Domain Knowledge: Since the self-reported CPE hours are so variable and since business valuators take CPE courses each year, the number of
years that a subject has been involved in business valuation is used as a proxy for
general domain knowledge. Except for one, research subjects who are not certified
indicated that they are working on certification. Thus, subjects not currently
holding a business valuation certification are still acquiring domain knowledge
through course work taken each year.

General Business Knowledge: Similarly, all CPAs are required to take CPE
courses each year. Even though these courses are accounting oriented they almost
always contain general business related content. Accordingly, general business
knowledge is measured by the number of years that a subject has been a practicing
CPA. The mean number of years, for the sample, as a practicing CPA (18) was
assigned to non-CPAs who had at least that number of years of business
experience. For non-CPAs with less than 18 years business experience, the number
of years as a valuator was used.

Subspecialty Knowledge: Subspecialty knowledge is represented by the
valuation certification held. Different values are assigned to the certifications
based on how stringent the written exam requirements are for a particular type of
certification.

<table>
<thead>
<tr>
<th>CERTIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accredited Senior Appraiser (ASA)</td>
<td>4</td>
</tr>
<tr>
<td>Accredited in Business Valuation (ABV)</td>
<td>3</td>
</tr>
<tr>
<td>Certified Business Appraiser (CBA)</td>
<td>2</td>
</tr>
<tr>
<td>Certified Valuation Analyst (CVA)</td>
<td>2</td>
</tr>
<tr>
<td>Working toward certification</td>
<td>1</td>
</tr>
<tr>
<td>None of the above</td>
<td>0</td>
</tr>
</tbody>
</table>

For individuals holding more than one certification, only one score (the highest) is
counted (e.g., ABV/CVA = 3).
The Ability Factor and a Modified Relationship. As previously discussed, prior research has represented the ability factor as a composite factor labeled *general problem-solving ability*. Cognitive reasoning ability is an important sub-component of this composite factor when dealing with ill-structured problems, and especially for novices. Accordingly, a modified relationship of performance, experience, knowledge, and ability is proposed:

$$\text{Performance} = f(\text{general domain experience, task specific experience, general domain knowledge, subspecialty knowledge, general business knowledge, cognitive reasoning ability}^*)$$

*for construction tasks inductive reasoning ability is expected to be a significant determinant; for reduction tasks deductive reasoning ability is expected to be significant.*

For the expert, reasoning ability is not expected to significantly contribute to performance since the expert approaches a problem with a pre-determined schema.

Statistical Analyses

Statistical methods used in this study include descriptive statistics, logistic regression, linear regression, and analysis of variance. Dependent and independent variables used in the statistical analyses are operationalized as follows.
**Dependent Variables.** Dependent variables consist of both raw and benchmarked scores. The raw scores are dependent variables in analysis of variance and benchmarked scores are dependent variables in regression.

VALUE = subject's overall value assigned to the medical practice.

VALUEB = benchmarked value which is the absolute value of a subject’s overall valuation assigned to the medical practice minus the mean value derived by the panel of experts\(^{11}\).

LIKERT = subject’s Likert score for the preliminary value task.

LIKERTB = benchmarked Likert score.

RELEV = subject's weighted score from the relevant item task.

RELEVB = benchmarked relevant item score.

METH = subject's weighted score based on valuation methods chosen.

METHB = benchmarked method choice score.

---

**Independent Variables.** The independent variables account for the factors of experience, knowledge, and reasoning ability. Experience and knowledge variables are control variables. The reasoning ability variable(s) is the test variable.

**EXPERIENCE RELATED VARIABLES:**

VALEXP = total number of business valuations that a subject has performed or participated in (general domain experience).

MEDEXP = total number of medical practice valuations that a subject has performed or participated in (task specific experience).

\(^{11}\) The absolute value is used for all benchmarked scores since the direction of the difference is not being tested. Rather, the magnitude of the difference is being tested.
KNOWLEDGE RELATED VARIABLES:

YRSVAL = number of years that a subject has been involved in business valuation (general domain knowledge).

CERT = a subject’s scale score based on the type of valuation certification held (subspecialty knowledge).

YRSCPA = number of years that a subject has been a practicing CPA, or for non-CPAs mean number of years for the CPA sample (18) or number of years as a valuator if less than the CPA mean number of years (general business knowledge).

ABILITY RELATED VARIABLES:

REAS = a subject’s overall score on the CCTST.

INDUC = a subject’s inductive reasoning score from the CCTST.

DEDUC = a subject’s deductive reasoning score from the CCTST.

**Logistic Regression.** The following logistic regression model is used to verify classification of subjects into expert and novice categories:

\[ Y_{(0,1)} = \alpha + \beta_1 VALEXP + \beta_2 MEDEXP + \beta_3 YRSVAL + \beta_4 CERT + \beta_5 YRSCPA \]

where: \( Y_{(0,1)} = 0 \) for novice; \( 1 \) for expert

Subjects initially are classified based on a sensitivity analysis of MEDEXP, VALEXP, YRSVAL, and CERT. The logistic regression model is used to mathematically test the validity of the initial classification. The model was developed using the stepwise elimination method.

**Linear Regression.** In order to test hypothesis H1 (reasoning ability will not be an important performance determinant for the expert) and hypothesis H2
(reasoning ability will be an important determinant of performance for the novice) the following ordinary least squares regression models are analyzed. All three of the reasoning scores are considered in the stepwise procedure but only one can remain in a final model. Each model is used with the full novice data set and separately with the novice high reasoning ability and the novice low reasoning ability data subsets. Each model also is used with the entire expert data set and separately with the expert high reasoning ability and expert low reasoning ability data subsets.

Model 1: \[ \text{VALUEB} = \alpha + \beta_1 \text{VALEXP} + \beta_2 \text{MEDEXP} + \beta_3 \text{YRSVAL} + \beta_4 \text{CERT} + \beta_5 \text{YRSCPA} + \beta_6 (\text{REAS or INDUC or DEDUC}) \]

Model 2: \[ \text{LIKERTB} = \alpha + \beta_1 \text{VALEXP} + \beta_2 \text{MEDEXP} + \beta_3 \text{YRSVAL} + \beta_4 \text{Cert} + \beta_5 \text{YRSCPA} + \beta_6 (\text{REAS or INDUC or DEDUC}) \]

Model 3: \[ \text{RELEVB} = \alpha + \beta_1 \text{VALEXP} + \beta_2 \text{MEDEXP} + \beta_3 \text{YRSVAL} + \beta_4 \text{CERT} + \beta_5 \text{YRSCPA} + \beta_6 (\text{REAS or INDUC or DEDUC}) \]

Model 4: \[ \text{METHB} = \alpha + \beta \text{VALEXP} + \beta_2 \text{MEDEXP} + \beta_3 \text{YRSVAL} + \beta_4 \text{CERT} + \beta_5 \text{YRSCPA} + \beta_6 (\text{REAS or INDUC or DEDUC}) \]

**ANOVA.** Hypothesis H3 (high reasoning novice performance will approach expert performance) is tested by 2x2 factorial analyses of variance which incorporates high/low reasoning ability and expert/novice classifications.

Dependent variables are VALUE, LIKERT, RELEV, and METH. Separate analyses are conducted using overall reasoning ability, inductive reasoning ability, and deductive reasoning ability.
Summary

Research packets consisting of a medical practice case study, a background information sheet, and Form B of the California Critical Thinking Skills Test were sent to 428 business valuators. One hundred thirty eight of the 428 (32 percent) returned completed packets, of which 134 have usable data. The 134 are believed to be representative of the larger population of business valuators.

Nine of the 10 most experienced and highly qualified valuators in the research sample were selected as an expert panel. Values derived by the expert panel are used as performance benchmarks. There are four dependent performance variable raw scores and four dependent variable benchmarked scores. The dependent variables are related to tasks that are surrogates for the cognitive tasks of design, hypothesis generation, hypothesis evaluation, and choice.

There are six independent variables that are proxies for experience, knowledge and ability. Five of the six independent variables are control variables. There are two control variables related to experience and three control variables related to knowledge. Ability (the test variable) is measured by scores from the CCTST. There are three separate reasoning scores from the CCTST. The overall reasoning score is based on all 34 questions contained in the test while the inductive reasoning score is based on a subset of 14 and the deductive reasoning score is based on a subset of 16.

Experts and novices are classified based on a sensitivity analysis of total number of valuations, total number of medical practice valuations, certification held, and years of valuation experience. This classification was mathematically
validated using a logistic regression model.

Hypotheses H1 (reasoning ability is not as important for the expert) and H2 (reasoning ability is quite important for the novice) are evaluated in the context of four linear regression models that use various combinations of the dependent and independent variables. Hypothesis H3 (high reasoning ability novice performance approaches that of experts) is examined using a 2x2 factorial analysis of variance methodology. A discussion of the results of these statistical analyses is contained in the next chapter.
Chapter 6
RESULTS OF THE STATISTICAL ANALYSES

This chapter discusses the outcome of the research design and statistical analyses described in the preceding chapter. The first section describes the classification of members of the sample into 'Expert' or 'Novice' categories. This is accompanied by descriptive statistics that compare characteristics of the expert panel, the expert sub-sample, and the novice sub-sample. The last section describes the testing of the hypotheses.

The Subjects and Expert/Novice Classification

The subjects are a diverse group of business valuators from 42 states, Canada, and Puerto Rico which exhibit various levels of experience and knowledge. Valuation of a business is a highly judgmental process, and there is an absence of known performance-based outcome measures. It would indeed be rare to have one correct value that could be assigned to a business. This precludes using performance-based measures to identify experts in business valuation. Alternatively, experience-based measures and knowledge-based measures have been used to identify experts (Bouwman and Bradley 1997). For the current study, experts are classified by both experience-based and knowledge-based measures.

Initial Classification of Experts and Novices. A sensitivity analysis of the descriptive statistics for the independent variables was conducted in order to determine criteria for classifying and distinguishing business valuation experts and novices. Based on this examination, subjects were designated as experts if they
met two or more of following criteria:

- 10 or more total medical practice valuations.
- 100 or more total business valuations.
- 10 years of valuation experience.
- Certified in business valuation at least at the CBA/CVA level or above.

The Logistic regression Model. After the initial classification procedure was completed, the logistic regression model discussed in the previous chapter was used to mathematically verify the initial expert/novice classification. The model was developed using the stepwise method. Criteria for stepping variables in and out of the model are p-values < 0.15 and > 0.20 (Hosmer and Lemeshow 1989). Variables meeting the p-value criteria were left in the model if the log likelihood decreased by adding the variable and if the p-value for chi-square of the Hosmer and Lemeshow Goodness of Fit increased. Cook’s distance and possible leverage points were examined for influential cases. Three observations, that were wrongly classified by the final model, have Cook’s D values in excess of 1.012 (two Experts, and one Novice). These observations were eliminated in a revised model. The log likelihood of the revised model decreased. However, the classification accuracy of the revised model was only 96.08 percent, a very modest increase, compared to 94.40 percent for the model with the three cases included. Consequently, all observations are left in the final model. Finally, the Wald statistic for each independent variable in the final model is examined, and the variable coefficients are compared to the coefficient of that variable from a univariate model.

12 Hair, et al. (1995) indicate that observations with Cook's D values in excess of 1.0 are possible influence/leverage points.
summary of the model is presented in Table 3\textsuperscript{13}. The final model was validated with two separate holdout samples. Two separate random samples from the entire sample that approximate one-half of the total sample were computer generated as the holdout samples. The first holdout sample (n = 66) correctly classified 93.75 percent of the sample. The second holdout sample (n = 62) correctly classified 93.55 percent of the sample. The final model wrongly classified three experts and four novices. Interestingly, the holdout samples wrongly classified five of the same seven subjects that were wrongly classified by the final model. The seven wrongly classified subjects included the three with Cook's D in excess of 1.0. All of the data related to the seven wrongly classified subjects was reexamined. Based on this examination two subjects were reclassified from the novice group to the expert group. In the final classification there are 47 experts and 78 novices.

**Descriptive Statistics.** On a comparative basis, the expert group is substantially more experienced in total valuations and medical practice valuations than the novice group. The relationships between expert and novice, when considering the three variables that remain in the logistic regression model -- total number of valuations, total number of medical practice valuations, and certification scale score -- are graphically depicted in Figure 5.

There is some overlap between experts and novices in the total number of valuations performed. This overlap does not occur until 20 total valuations. Thus,

\begin{itemize}
\item \textsuperscript{13} YRSVAL (general domain knowledge) is not a significant variable in the final model.
\end{itemize}
Table 3
Logistic Regression Model

Classification Table for Expert/Novice
Cut Value = 0.50

<table>
<thead>
<tr>
<th></th>
<th>Observed</th>
<th>Correctly Predicted</th>
<th>Incorrectly Predicted</th>
<th>Correct</th>
<th>Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts</td>
<td>45</td>
<td>42</td>
<td>3</td>
<td>93.33%</td>
<td>6.67%</td>
</tr>
<tr>
<td>Novices</td>
<td>80</td>
<td>76</td>
<td>4</td>
<td>95.00%</td>
<td>5.00%</td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
<td>118</td>
<td>7</td>
<td>94.40%</td>
<td>5.60%</td>
</tr>
</tbody>
</table>

Variables in the Equation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Wald Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALEXP = total number of valuations</td>
<td>0.0152</td>
<td>0.0044</td>
<td>11.89</td>
<td>0.0006</td>
</tr>
<tr>
<td>MEDEXP = total number of medical practice valuations</td>
<td>0.9209</td>
<td>0.2470</td>
<td>13.91</td>
<td>0.0002</td>
</tr>
<tr>
<td>CERT = certification score</td>
<td>1.9954</td>
<td>0.7104</td>
<td>7.89</td>
<td>0.0050</td>
</tr>
<tr>
<td>Intercept</td>
<td>-10.8907</td>
<td>2.9381</td>
<td>13.71</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

log likelihood for the model = 30.118
Hosmer and Lemeshow Goodness of Fit chi-square = 0.6997; p > 0.99
Figure 5

Mean Number of Valuations

Mean Number of Medical Practice Valuations

Certification Index

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there are no experts with less than 20 total valuations. There is some overlap between experts and novices in the number of medical practice valuations. However, there are no novices who have more than seven medical practice valuations. Also, there are over 40 novices (more than one half of the novice sample) who have never performed a medical practice valuation. There is some overlap in certification scale score, but there are only two experts who are not working toward some type of certification. A summary of certification held which includes the expert panel is presented in Table 4. A summary of descriptive statistics for the raw score dependent variables and the control independent variables for the entire sample is presented in Table 5. A summary of the reasoning scores for the entire sample is presented in Table 6.

Hypotheses Testing

The study examines expert-novice differences from three perspectives. First, the relationship between performance and reasoning ability is investigated for the expert group. The statistical analyses of the hypothesis related to the expert group is by ordinary least squares regression. Next, the relationship between performance and reasoning ability is examined for the novice group. The statistical analyses for the hypothesis related to the novice group is also by ordinary least squares regression. The third hypothesis examines the relationship between expert/novice performance and high/low reasoning ability. These relationships are tested by 2x2 factorial Analyses of Variance (ANOVA) procedures.
Table 4
Summary of Certification Held
*(subspecialty knowledge)*

<table>
<thead>
<tr>
<th>Certificate</th>
<th>Expert Panel n = 9</th>
<th>Experts n = 47</th>
<th>Novices n = 78</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA</td>
<td>4  44%</td>
<td>15  32%</td>
<td>0  0%</td>
</tr>
<tr>
<td>ABV</td>
<td>1  11%</td>
<td>6   13%</td>
<td>8  10%</td>
</tr>
<tr>
<td>CBA and CVA *</td>
<td>4  44%</td>
<td>15  32%</td>
<td>42  54%</td>
</tr>
<tr>
<td>No certificate</td>
<td>0  0</td>
<td>11** 23%</td>
<td>28  36%</td>
</tr>
<tr>
<td>CPA</td>
<td>5  55%</td>
<td>26  55%</td>
<td>60  77%</td>
</tr>
</tbody>
</table>

*CBA and CVA are combined because the certification standards are similar and several subjects in the sample hold both certifications.

**of the experts not certified all but one is working toward certification. All novices not certified indicate that they are working toward certification.
### Table 5
Comparative Descriptive Statistics
Raw Score Dependent Variables and Control Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Expert Panel n = 9</th>
<th>Experts n = 47</th>
<th>Novices n = 78</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE = value assigned to medical practice</td>
<td>247,099 250,000</td>
<td>262,587 250,000</td>
<td>277,249 262,500</td>
</tr>
<tr>
<td>LIKERT = Likert value assigned to practice</td>
<td>3.98 4.1</td>
<td>3.80 3.90</td>
<td>3.74 4.00</td>
</tr>
<tr>
<td>RELEV = relevant item score</td>
<td>13.33 14.00</td>
<td>12.48 12.00</td>
<td>12.28 14.00</td>
</tr>
<tr>
<td>METH = method choice score</td>
<td>12.00 11.00</td>
<td>11.40 11.00</td>
<td>9.32 10.00</td>
</tr>
<tr>
<td>VALEXP = total number of business valuations (domain experience)</td>
<td>450.55 350.00</td>
<td>275.32 175.00</td>
<td>42.15 20.00</td>
</tr>
<tr>
<td>MEDEXP = number of medical practice valuations (task experience)</td>
<td>55.00 30.00</td>
<td>16.23 10.00</td>
<td>1.43 0</td>
</tr>
<tr>
<td>YRSVAL = years in business Valuation (domain knowledge)</td>
<td>14.00 15.00</td>
<td>12.91 10.00</td>
<td>7.21 5.00</td>
</tr>
<tr>
<td>YRSCPA = years as a CPA (general business knowledge)</td>
<td>18.11 20.00</td>
<td>15.10 16.00</td>
<td>16.20 18.00</td>
</tr>
</tbody>
</table>

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Table 6
Summary of Reasoning Scores
(Independent Variables)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Expert Panel n = 9</th>
<th>Experts n = 47</th>
<th>Novices n = 78</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>REAS = overall reasoning ability score</td>
<td>21.33</td>
<td>20.00</td>
<td>21.34</td>
</tr>
<tr>
<td>INDUC = inductive reasoning ability score</td>
<td>9.22</td>
<td>9.00</td>
<td>9.42</td>
</tr>
<tr>
<td>DEDUC = deductive reasoning ability score</td>
<td>9.67</td>
<td>9.00</td>
<td>9.77</td>
</tr>
</tbody>
</table>
Linear Regression Methodology and Diagnostics. The final regression models for the testing of Hypotheses 1 and 2 are developed in a stepwise manner. Significance level values for stepping variables into and out of the regression are < 0.15 and > 0.25 (Dillon and Goldstein 1984). The first variables to enter the regression model are those with the highest correlation with the dependent variable. A variable remains in the model if the addition of that variable increases the R², lowers the standard error, and the t value for the partial correlation of that variable indicates that the inclusion of the variable enhances the predictive value of the model. Independent variables are assessed for multicollinearity by examining their variance inflation factors (VIFs) and condition indices (CI). Cook’s D values, studentized residuals, and possible leverage points are examined for influential observations. An overall significance level of 0.10 is used because it allows for more power in the regressions when the sample size is small (Cohen 1988). Z scores for independent variables are used in order to account for possible bias in the regression models due to the different scales of the variables.

Experts and Reasoning Ability. The first hypothesis addresses research questions concerning the importance of reasoning ability in expert performance. “Does reasoning ability significantly contribute to the performance of an expert business valuator?” This hypothesis is expressed and evaluated in the context of the four benchmarked dependent variables:

14 Traditionally, α-values for stepwise procedures are set at 0.05 or 0.10. However, Dillon and Goldstein (1984) indicate that values between 0.15 and 0.25 perform better in terms of mean squared error.
H1: For the 'expert' business valuator, reasoning ability is not an important determinant of performance.

Additionally, regressions are developed for the entire expert sample (n = 47) and two sub-samples. The first sub-sample is comprised of high reasoning ability experts (n = 26). The second sub-sample is comprised of low reasoning ability experts (n = 21). Classification into high and low reasoning ability categories is based on a subject's overall reasoning ability scores from the CCTST. Subjects who scored at or above the standardized normal 92 percentile are classified as having high reasoning ability (Facione 1991). All other experts are classified as having low reasoning ability.

Case materials for subjects with dependent variable observations with studentized residuals in excess of 2.0 are examined. If it appears from the case materials that an individual did not understand the task then that subject was removed and another regression conducted. For the expert sample (n = 47) three subjects were removed in the VALUEB (benchmarked overall medical practice valuation) regressions and one subject was removed in the LIKERTB (benchmarked Likert valuation) regressions. Removal of these outliers from the entire expert sample (n = 47) and the low reasoning expert sample (n=21) does not change the results (no significant models were developed). A summary of the results from the regressions related to H1 appears below. The table number for the only significant model is shown. NSM means that no significant models was developed at $\alpha = .10$. Overall, these results suggest that reasoning ability is not an important determinant of performance for experts.
For hypothesis H1, only one significant model is obtained (Table 7). Thus, reasoning ability as measured by a subject’s inductive reasoning score is a determinant of benchmarked overall valuation only for the high reasoning ability expert group. The sign of the regression coefficient is negative as expected. This model can be interpreted to mean that the higher an expert subject’s inductive reasoning score the lower the absolute value of his/her benchmarked overall valuation score. Thus, an expert with high inductive reasoning has an overall practice valuation that is close to the expert panel mean. The overall valuation task is a proxy for a cognitive design task where inductive reasoning is expected to be important.
### Table 7
Final Regression Model for Hypothesis H1
**Dependent Variable = VALUEB**
(benchmarked overall medical practice valuation)
High Reasoning Ability Experts Data Set
n = 26

<table>
<thead>
<tr>
<th>Model Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>0.381</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis of Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables in the Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>INDUC = inductive reasoning score</td>
</tr>
</tbody>
</table>

*statistically significant at α = .10
Post hoc power = .30 (Cohen 1988)
Novices and Reasoning Ability. Hypothesis H2 deals with the relationship between reasoning and performance for the novice group.

H2: For the 'novice' business valuator, reasoning ability is an important determinant of performance.

Again, the regression models are evaluated for three data sets: the entire novice data set (n = 78), a high reasoning ability novice data set (n = 40), and a low reasoning ability novice data set (n = 30). Classification into high or low reasoning groups is based on the same 92 percentile procedure that was used for the expert data set.

There are seven observations in the novice data set (n = 78) with studentized residual values in excess of 2.0 in respect to the dependent variable VALUEB benchmarked overall medical practice valuation). All of these subjects are in the low reasoning sub-group (n = 30). The case materials for each of these subjects was examined. In two cases it can be argued that the subjects apparently did not fully understand the case material requirements. When these two outliers are eliminated from the sample (n = 78) there is a slight increase in the $R^2$ (from 0.050 to 0.059) value for the regression (Table 8). When all seven statistical outliers are removed from the entire novice sample the $R^2$ increases significantly (from 0.050 to 0.149) and the variable MEDEXP (number of medical practice valuations; task specific experience) is a significant independent variable. However, there is no behavioral accounting theory to support the removal of all seven outliers. Accordingly, all outliers remain in the full novice sample regression reported in Table 8 (n = 78). Removal of the seven outliers in the novice low reasoning ability subset (n = 30) did not change the regression result (i.e. the model...
remains statistically insignificant). A summary of the results of the stepwise
development of the regression models is presented below. The table number for
the significant models is shown. NSM means no significant model was developed
at $\alpha = .10$.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Novices $n = 78$</th>
<th>High Reasoning Ability Novices $n = 48$</th>
<th>Low Reasoning Ability Novices $N = 30$</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUEB (benchmarked overall valuation)</td>
<td>Table 8</td>
<td>Table 9</td>
<td>NSM</td>
</tr>
<tr>
<td>LIKERTB (benchmarked Likert valuation)</td>
<td>NSM</td>
<td>NSM</td>
<td>NSM</td>
</tr>
<tr>
<td>RELEVB (benchmarked relevant item score)</td>
<td>NSM</td>
<td>NSM</td>
<td>NSM</td>
</tr>
<tr>
<td>METHB (benchmarked method choice score)</td>
<td>NSM</td>
<td>NSM</td>
<td>NSM</td>
</tr>
</tbody>
</table>

Hypothesis H2 indicates that reasoning ability is important in novice performance. There are two significant models in support of this hypothesis both for the benchmarked overall valuation. Moreover, for the entire novice group and for the high reasoning ability novice group inductive reasoning ability is a statistically significant determinant of performance as hypothesized. It is expected that inductive reasoning ability is associated with the benchmarked overall medical
practice valuation (design) task. For high reasoning ability novices, the number of medical practice valuations (task specific experience) also is a determinant of performance. The signs of the regression coefficients are negative as expected. The negative coefficients indicate that the higher the inductive reasoning score and the higher the amount of medical practice valuation experience the closer a novice's valuation is to the expert panel mean overall valuation. The model for the entire novice data set is reported in Table 8. The model for the high reasoning novice data set is reported in Table 9.

Analysis of Variance—Novices and Experts. This section describes the testing of hypothesis H3 which compares the performance of high reasoning novices with the performance of the experts.

H3: Performance of high reasoning ability novices approaches that of experts on the overall valuation and associated sub-tasks.

The ANOVAs data set is categorized according to the inductive and deductive reasoning scores. Subjects scoring above the 92 percentile standardized normal scores are classified as high reasoners. All other subjects are classified as low reasoners. Both experts and novices are classified into the high/low categories. In addition, the expert panel is included.

As previously discussed, it is expected that inductive reasoning is associated more closely with performance on the design (overall medical practice valuation) and hypothesis generation (Likert valuation) tasks. It is expected that deductive reasoning will be associated more closely with performance on the hypothesis
Table 8
Final Regression Model for Hypothesis H2
Dependent Variable = VALUEB
(benchmarked overall medical practice valuation)
Entire Novice Data Set
n = 78

<table>
<thead>
<tr>
<th>Model Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
</tr>
<tr>
<td>0.223</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis of Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables in the Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>INDUC = inductive reasoning score</td>
</tr>
</tbody>
</table>

*statistically significant at α = 0.10
Post hoc power = .35

74
Table 9  
Final Regression Model for Hypothesis H2  
Dependent Variable = VALUEB  
(benchmarked medical practice valuation)  
High Reasoning Ability Novice Data Set  
n = 48

<table>
<thead>
<tr>
<th>Model Summary</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R²</td>
<td>Standard Error of the Estimate</td>
<td></td>
</tr>
<tr>
<td>0.359</td>
<td>0.129</td>
<td>51735.442</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis of Variance</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Sum Of Squares</td>
<td>df</td>
<td>Mean Square</td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
<td>----</td>
<td>-------------</td>
</tr>
<tr>
<td>Regression</td>
<td>1.707E+10</td>
<td>2</td>
<td>8.535E+09</td>
</tr>
<tr>
<td>Residual</td>
<td>1.54E+11</td>
<td>45</td>
<td>2.565E+09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables in the Equation</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Standardized Beta</td>
<td>t</td>
<td>p-value</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.134</td>
<td>0.263</td>
<td></td>
</tr>
<tr>
<td>MEDEXP = number of medical practice Valuations</td>
<td>-0.416</td>
<td>-2.539</td>
<td>0.015*</td>
</tr>
<tr>
<td>INDUC = inductive reasoning score</td>
<td>-0.284</td>
<td>-1.730</td>
<td>0.091*</td>
</tr>
</tbody>
</table>

*statistically significant at α = 0.10  
Post hoc power = .53  
VIF for the second independent variable entered into equation = 1.389  
Condition Index for the second independent variable entered = 6.464  
(both VIF and CI values indicate no multicollinearity problems)
evaluation (relevant item identification) and choice (valuation method choice) tasks. Accordingly, the dependent variables VALUE (overall valuation amount) LIKERT (Likert valuation score) are tested against the entire data set classified by inductive reasoning ability and the dependent variables RELEV (relevant item score) and METH (method choice score) are tested when the data set is classified according to deductive reasoning scores. Recall that these dependent variables are raw scores. That is they have not been benchmarked against the expert panel. Because the dependent variables are raw scores, the expert panel is included in the data set (n = 134).

A 2x2 factorial ANOVA design is employed using expert/novice classification and high/low reasoning ability classification. The sample sizes for the analyses are:

<table>
<thead>
<tr>
<th></th>
<th>High Inductive Reasoning Ability</th>
<th>Low Inductive Reasoning Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert</td>
<td>n = 28</td>
<td>n = 28</td>
</tr>
<tr>
<td>Novice</td>
<td>n = 38</td>
<td>n = 40</td>
</tr>
</tbody>
</table>

Dependent variables: VALUE and LIKERT
Data set classified by inductive reasoning score.
Dependent variables: RELEV and METH
Data set classified by deductive reasoning score

<table>
<thead>
<tr>
<th></th>
<th>High Deductive Reasoning Ability</th>
<th>Low Deductive Reasoning Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert</td>
<td>n = 22</td>
<td>n = 33*</td>
</tr>
<tr>
<td>Novice **</td>
<td>n = 38</td>
<td>n = 40</td>
</tr>
</tbody>
</table>

*one subject did not have a deductive reasoning score
**although the numbers are the same (e.g., 38 and 40) the subjects in the high inductive reasoning category and the high deductive reasoning category are not exactly the same. The same is true for the low reasoning categories.

A summary of the results of the ANOVAs is reported below. The abbreviation NSM indicates that no significant model was found. A table reference in the model column indicates that the details of a significant model is found in that table.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE = overall medical practice valuation</td>
<td>Table 10</td>
</tr>
<tr>
<td>LIKERT = Likert valuation score</td>
<td>NSM</td>
</tr>
<tr>
<td>RELEV = relevant item task weighted score</td>
<td>Table 11</td>
</tr>
<tr>
<td>METH = method choice weighted score</td>
<td>Table 12</td>
</tr>
</tbody>
</table>

For both the overall medical practice valuation and the relevant item task, reasoning ability produces a significant main effect. There is no interaction and
expert/novice classification is not significant (see Tables 10 and 11). This means that, as expected, inductive reasoning ability is an important factor in the overall valuation (design) task while deductive reasoning ability is an important factor in the relevant item (hypothesis evaluation) task. Further, the mean medical practice valuation of high inductive novice reasoners is closer to the mean medical practice valuation of high inductive reasoning experts. Additionally, the standard deviation of medical practice valuation is less for high reasoners than for low reasoners. This indicates that high reasoning novices and high reasoning experts have less variability in their valuations than do low reasoner novices and experts. This lower variability can be thought of as a positive performance trait. That is, a client who went to two different valuators to value the same business would potentially receive valuations closer to each other if those two valuators had high inductive reasoning ability. High inductive reasoners do better than low inductive reasoners on the design task. Similarly, high deductive reasoners have higher mean relevant item scores (better performance) than do low deductive reasoners for this task (hypothesis evaluation).

The finding for the choice of valuation method dependent variable is different. The significant main effect is expert/novice instead of reasoning ability. This is an unexpected result. It means that experts outperformed novices regardless of reasoning ability (see Table 12). Thus, there is support for hypothesis H3 in relation to the overall valuation and relevant item tasks but not for the method choice task.

Although reasoning ability was not significant on this task, a troublesome
### Table 10
Analysis of Variance
Dependent Variable = VALUE
(overall medical practice valuation)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Inductive Reasoning Novices</td>
<td>298,727</td>
<td>142,488</td>
<td>40</td>
</tr>
<tr>
<td>High Inductive Reasoning Novices</td>
<td>254,639</td>
<td>43,553</td>
<td>38</td>
</tr>
<tr>
<td>Low Inductive Reasoning Experts</td>
<td>272,586</td>
<td>71,437</td>
<td>28</td>
</tr>
<tr>
<td>High Inductive Reasoning Experts</td>
<td>251,656</td>
<td>40,310</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>9.390E+12</td>
<td>1</td>
<td>9.390E+12</td>
<td>1180.033</td>
<td>0.000*</td>
</tr>
<tr>
<td>Expert/Novice Main effect</td>
<td>8.964E+09</td>
<td>1</td>
<td>8.964E+09</td>
<td>1.127</td>
<td>0.290</td>
</tr>
<tr>
<td>High/Low Reasoner Main Effect</td>
<td>3.886E+10</td>
<td>1</td>
<td>3.886E+10</td>
<td>4.884</td>
<td>0.029*</td>
</tr>
<tr>
<td>Interaction</td>
<td>2.976E+09</td>
<td>1</td>
<td>2.976E+09</td>
<td>0.374</td>
<td>0.542</td>
</tr>
<tr>
<td>Residual</td>
<td>1.034E+12</td>
<td>130</td>
<td>7.957E+09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant at $\alpha = .10$
Table 11
Analysis of Variance
Dependent Variable = RELEV
(relevant item task weighted score)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Deductive Reasoning Novices</td>
<td>11.70</td>
<td>3.988</td>
<td>40</td>
</tr>
<tr>
<td>High Deductive Reasoning Novices</td>
<td>12.89</td>
<td>3.958</td>
<td>38</td>
</tr>
<tr>
<td>Low Deductive Reasoning Experts</td>
<td>12.06</td>
<td>3.220</td>
<td>33</td>
</tr>
<tr>
<td>High Deductive Reasoning Experts</td>
<td>13.45</td>
<td>2.345</td>
<td>22</td>
</tr>
</tbody>
</table>

Tests of Between-Subjects Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>19760.246</td>
<td>1</td>
<td>19760.246</td>
<td>1547.413</td>
<td>0.000*</td>
</tr>
<tr>
<td>Expert/Novice Main Effect</td>
<td>6.667</td>
<td>1</td>
<td>6.667</td>
<td>0.522</td>
<td>0.471</td>
</tr>
<tr>
<td>High/Low Reasoner Main Effect</td>
<td>52.735</td>
<td>1</td>
<td>52.735</td>
<td>4.130</td>
<td>0.044*</td>
</tr>
<tr>
<td>Interaction</td>
<td>0.312</td>
<td>1</td>
<td>0.312</td>
<td>0.024</td>
<td>0.876</td>
</tr>
<tr>
<td>Residual</td>
<td>1.658E+11</td>
<td>117</td>
<td>1.417E+09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant at α = .10

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Table 12
Analysis of Variance
Dependent Variable = METH
(method choice weighted score)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Deductive Reasoning Novices</td>
<td>9.675</td>
<td>3.277</td>
<td>40</td>
</tr>
<tr>
<td>High Deductive Reasoning Novices</td>
<td>8.947</td>
<td>3.862</td>
<td>38</td>
</tr>
<tr>
<td>Low Deductive Reasoning Experts</td>
<td>11.941</td>
<td>3.025</td>
<td>34</td>
</tr>
<tr>
<td>High deductive Reasoning Experts</td>
<td>10.818</td>
<td>3.711</td>
<td>22</td>
</tr>
</tbody>
</table>

Tests of Between-Subjects Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>13571.238</td>
<td>1</td>
<td>13571.238</td>
<td>1129.615</td>
<td>0.000*</td>
</tr>
<tr>
<td>Expert/Novice Main Effect</td>
<td>135.635</td>
<td>1</td>
<td>135.635</td>
<td>11.290</td>
<td>0.001*</td>
</tr>
<tr>
<td>High/Low Reasoner Main Effect</td>
<td>27.142</td>
<td>1</td>
<td>27.142</td>
<td>2.259</td>
<td>0.135</td>
</tr>
<tr>
<td>Interaction</td>
<td>1.239</td>
<td>1</td>
<td>1.239</td>
<td>0.103</td>
<td>0.749</td>
</tr>
<tr>
<td>Residual</td>
<td>1561.825</td>
<td>130</td>
<td>12.014</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant at $\alpha = .10$
aspect of this finding is that the mean scores for low deductive reasoning novices
and low deductive reasoning experts are higher than the mean scores of high
reasoning novices and experts (high score = better performance). This was
investigated further.

Bonner and Pennington (1991) indicate that there can be “a large element of
knowledge-based inference” related to a choice task. The METH score represents
the performance on a choice task. Additional 2x2 factorial analyses of variance
were conducted using the control variables related to knowledge (YRSVAL-
general valuation domain knowledge, CERT-subspecialty knowledge, and
YRSCPA-general business knowledge). Subjects are divided into high knowledge
and low knowledge groups using a median split procedure (Pincus 1990). For
example, subjects with YRSVAL values above the median are placed in the high
group and subjects with values at or below the median are placed in the low group.
Three separate 2x2 ANOVAs are then evaluated with the dependent variable
METH and levels representing 1) expert/novice and high/low YRSVAL, 2)
expert/novice and high/low CERT, and 3) expert/novice and high/low YRSCPA. A
model that exhibits the expected relationship among mean scores of high/low
reasoners is generated when the YRSVAL (general valuation domain knowledge)
control variable is used. In this model, like the model with levels for high/low
reasoning ability, the expert/novice main effect is significant. The model is
reported in Table 13.

The mean method choice scores for novice subjects who exhibit high levels
of general valuation domain knowledge are higher than the scores of low general
Table 13
Analysis of variance
Dependent Variable = METH
(method choice weighted score)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Domain Knowledge Novices</td>
<td>8.706</td>
<td>3.371</td>
<td>34</td>
</tr>
<tr>
<td>High Domain Knowledge Novices</td>
<td>9.795</td>
<td>3.683</td>
<td>44</td>
</tr>
<tr>
<td>Low Domain Knowledge Experts</td>
<td>11.296</td>
<td>3.049</td>
<td>27</td>
</tr>
<tr>
<td>High Domain Knowledge Experts</td>
<td>11.690</td>
<td>3.607</td>
<td>29</td>
</tr>
</tbody>
</table>

Tests of Between Subjects Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>13918.901</td>
<td>1</td>
<td>13918.901</td>
<td>1156.902</td>
<td>0.000*</td>
</tr>
<tr>
<td>Expert/Novice Main Effect</td>
<td>162.639</td>
<td>1</td>
<td>162.639</td>
<td>13.518</td>
<td>0.000*</td>
</tr>
<tr>
<td>High/Low Knowledge Main Effect</td>
<td>17.783</td>
<td>1</td>
<td>17.783</td>
<td>1.478</td>
<td>0.226</td>
</tr>
<tr>
<td>Interaction</td>
<td>3.920</td>
<td>1</td>
<td>3.920</td>
<td>0.326</td>
<td>0.569</td>
</tr>
<tr>
<td>Residual</td>
<td>1564.054</td>
<td>130</td>
<td>12.031</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*statistically significant at \( \alpha = .10 \)

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valuation domain knowledge novice subjects. The same relationship exists for the experts. It appears that as Bonner and Pennington (1991) hypothesize, performance on a choice task is related more to knowledge.

Summary

Experts and novices are classified by a sensitivity analysis of experience and knowledge variables. A logistic regression model that incorporates three independent variables—total number of business valuations, total number of medical practice valuations (two experience variables), and valuation certification scale score (a knowledge variable)—is used as a cross check of expert/novice classification accuracy. The final expert group (n = 47) has more total valuation experience, more medical practice valuation experience, and more and higher levels of business valuation certification than the novice group (n = 78).

Hypothesis H1 examines the relationship between reasoning ability and performance for the expert group. The statistical methodology used to test these hypotheses is linear regression. For the expert group, it was found that inductive reasoning ability is a determinant of performance for high inductive reasoning experts in the overall valuation task. For research purposes hypothesis H1 states that reasoning ability is not expected to be important for the expert. The findings are that inductive reasoning ability is a determinant of performance in the overall valuation task for high reasoning ability experts only.

Hypothesis H2 looks at the relationship between reasoning ability and performance for the novice group. Inductive reasoning ability is a significant
variable in two models where benchmarked overall medical practice valuation is the dependent variable.

Hypothesis H3 states that high reasoning ability novice performance approaches the performance of experts. A comparison is made between the performance of high and low reasoning novices and the performance of high and low reasoning experts. The statistical methodology used is 2x2 factorial analysis of variance (ANOVA). For two tasks, the overall medical practice valuation and the relevant item task, high reasoning novice performance approaches expert performance. But, for the valuation method choice task it does not. For this task all experts clearly outperformed novices. The next chapter discusses some possible limitations related to the findings and outlines proposed future research.
Chapter 7
DISCUSSION, LIMITATIONS, AND CONCLUDING REMARKS

This chapter contains a discussion of the statistical results of the study. This is followed by a brief look at some of the limitations of this study, some suggestions for future research, and concluding remarks.

Discussion

This study has employed the expert-novice comparison methodology using the guidelines of the "expert paradigm" as outlined by Libby (1995). Experts and novices were classified based on a sensitivity analysis of two experience related variables and three knowledge related variables. The initial classification was mathematically checked against a logistic regression model which correctly classified 94 percent of the subjects. The use of experience and knowledge variables to distinguish experts and novices is consistent with prior literature that discusses the identification of experts (Bouwman and Bradley 1997). One contribution of this study is that it shows that experts in business valuation can be identified by a combination of task specific experience, domain specific experience, and business valuation certification credentials held.

The primary premise of this study is that reasoning ability is important for a novice faced with an ill-structured business valuation task. Moreover, reasoning ability is not expected to be as important to the expert because the expert has developed problem-solving schema that direct his/her problem-solving strategy. However, the results of the study support the premise that reasoning ability is
important for both the expert and the novice.

Previous studies have shown that a broad construct called *general problem-solving ability* is an important determinant of expert performance (Bonner and Lewis 1990; Bonner, Davis and Jackson 1992; Libby and Tan 1994). In this study it is shown that reasoning ability, a sub-component of this broad construct, is important for both the novice business valuator and the expert. The context of this study is the valuation of a medical practice for sale to another practitioner. This valuation is framed in four ill-structured cognitive tasks which require reasoning skill (e.g. *design, hypothesis generation, hypothesis evaluation, and choice*). The more ill-structured the tasks are for a given subject, the more reasoning is required. Although no cognitive task solely involves deductive or inductive reasoning, certain tasks are oriented toward one type of reasoning more than the other. The construction tasks of *design* and *hypotheses generation* are oriented toward inductive reasoning. The reduction tasks of *hypothesis evaluation* and *choice* are oriented toward deductive reasoning.

**Construction Tasks.** For the *design* task inductive reasoning ability was a significant determinant of performance for the expert group who exhibited high overall reasoning ability (Table 7). This is not a totally unexpected result since the research hypothesis is framed in a way that reasoning ability would not at all be important for the expert. The actual expectation is that it is not as important for the expert as it is for the novice. This is substantiated since inductive reasoning ability was found to be a determinant of performance only for the high reasoning ability
experts.

For both the entire novice group and the high reasoning ability novice group inductive reasoning is found to be an important element of performance for the overall medical practice valuation (Tables 8, and 9). In addition, the number of medical practice valuations is important. In the regression models that tested hypothesis H2 (in respect to benchmarked overall medical practice valuation) the coefficients of the two significant variables (inductive reasoning score and number of medical practice valuations) are negative. That is, the greater the number of medical practice valuations the lower the benchmarked valuation score, and the higher the reasoning score the lower the benchmarked valuation score. This is the expected direction since the overall valuation score is the absolute value of the deviation from the expert panel mean score. Thus, novices with a large number of medical practice valuations (domain specific task experience) and a high reasoning score (high reasoning ability) have valuations that are closer to the expert panel mean value.

It has previously been established that domain specific experience (number of medical practice valuations for the business valuator) is an important determinant of performance (Bonner and Lewis 1990). However, the importance of reasoning ability (a sub-component of general problem-solving ability) has not previously been shown. The finding that reasoning ability matters for novices and experts is an important finding since it is widely believed that reasoning ability can be enhanced through training. Thus, the overall business valuation process can be enhanced by training in reasoning.
For the hypothesis generation task no significant regression model could be developed using the stepwise technique, for either the expert group or the novice group. These findings indicate that that reasoning may not be important for this type of task. However, caution is urged since the statistical power of the regressions is low. This findings don’t necessarily mean that reasoning is not important in this type of task, but merely that it wasn’t demonstrated in this study.

Reduction Tasks. Performance on two reduction tasks, hypothesis evaluation (relevant item task) and choice (valuation method choice) is examined. For the expert group no significant regression model is developed for either task. However, high deductive reasoning ability is shown to be an important element when the raw scores for the relevant item task is examined (Table 11). It was demonstrated that deductive reasoning ability is important for the high reasoning ability expert as well as the novice. For the expert, this is contrary to hypothesis H1 but not totally unexpected. Deductive reasoning is shown to be a significant predictor for novice and expert performance in the hypothesis evaluation task. (although it appears to be more significant for the novice group). It is interesting to note that the mean value of the high reasoning novice scores obtained on the hypothesis evaluation task (relevant item identification) are slightly higher than the scores of low reasoning ability experts. High deductive reasoning novices did quite well on this task. A major implication of this is that training in deductive reasoning can be associated with improved performance on hypothesis evaluation tasks.

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The results of the choice task are different. There was no significant regression model developed for either the novice or expert group when this task was considered. On the other hand, a significant expert/novice main effect is shown in the factorial ANOVA model. Experts clearly outperformed novices in this task. Reasoning ability was not demonstrated to be a factor of performance for this task. Bonner and Pennington (1991) indicate that knowledge can be a significant determinant of performance in this type of task. The result of an additional analysis of variance is consistent with this perspective (Table 13).

Some Limitations and Implications for Future Research

In this section some limitations of the research are discussed. Associated with these limitations are ideas for future research. This section is not meant to be comprehensive. Rather, limitations and future research ideas that are considered most important are outlined.

Statistical Power. Statistical power is almost always an issue in behavioral accounting studies. This is largely due to the lack of control associated with determining the number of subjects that will participate in a behavioral study. In the current study, as is typical for behavioral studies, the number of participants is determined on a post hoc basis rather than an ex ante basis. This study has classified forty-seven subjects as experts and seventy-eight subjects as novices. In some cases where the regression methodology is used, the sample size for low
reasoning ability experts is as low as twenty one.\textsuperscript{15} For the novice group the sample size of seventy-eight is sufficient for power of 80\% when the alpha level is relaxed to $\alpha = 0.10$\textsuperscript{16}.

The problem with low statistical power is that the failure to reject a hypotheses related to reasoning ability not necessarily mean that reasoning ability is not a determinant important. It merely means that the importance or non-importance may not have been demonstrated by this study.

Future research is needed to more fully investigate the relationship between reasoning ability and expert performance. Two possible ways that this could be accomplished would be to 1) have a larger sample of expert subjects in future research or 2) determine a way to increase the expected effect size of reasoning as it relates to performance by experts.

\textbf{Measurement Error.} Any behavioral study is subject to some measurement error. The error can be due to subjective factors or random factors. In this study there is potential for subjective measurement error in the measurement of the two dependent variables \textsc{RELEV} (relevant item score) and \textsc{METH} (method choice score). These two variables are measured by weighted scores developed from a content analysis of expert panel responses. The potential exists that researcher bias has influenced the weighting schemes. The implication of this is that the statistical conclusions regarding these variables may be less reliable than

\textsuperscript{15} Assuming a 'medium effect size', a regression using six independent variables where $\alpha = 0.10$ and $n = 21$ will have ex ante power of .25 or 25\%.

\textsuperscript{16} Power of 80\% "has become widely accepted as the norm" (Baroudi and Orlikowski 1989).
those related to the other independent variables. On the other hand, the potential for subjective bias related to variables VALUE (overall valuation) and LIKERT (Likert score) is much lower since these variables are directly associated with a subject’s task score.

The potential for measurement error also exists in respect to the classification of subjects into expert and novice categories. Although variables chosen for classification largely agree with previous research there may be a better way to distinguish expertise than by examining two experience and three knowledge related variables.

Future research is needed to develop more precise measures of task scores. Also other experimental tasks, in addition to those contained in this study, that exemplify construction and reduction tasks related to reasoning need to be developed. Finally, more research is needed to develop means of classifying experts from novices.

**Structural Equations.** Libby and Tan (1994) developed the data from the Bonner and Lewis (1990) study into a system of structural equations that are useful in predicting the relations among experience, knowledge, and ability for different audit judgment tasks. The primary purpose of the current study was to determine if reasoning ability is a significant predictor variable for performance in ill-structured business valuation tasks. This idea is supported by the findings of the current study. A future research extension of the current study is to use the data to develop a system of structural equations that will more clearly delineate the relationships of
experience, knowledge and reasoning ability to novice performance in design and hypothesis evaluation tasks.

This future research is suggested by the nature of the variables contained in this research. The overall valuation result is almost certainly impacted by the relevant items considered by the valuator as well as by the valuation method choices. Thus, dependent variables RELEV (relevant item score) and METH (method choice score) are likely predictor variables in a more fully developed VALUE equation. This lends itself to further study using a structural equation methodology. This is also a limitation of the current study. Although reasoning ability has been shown to be a significant variable for two of the cognitive tasks, the possible relationships among reasoning ability and the experience and knowledge variables has not been fully investigated.

External Validity. Any generalizability of the results from this study are limited to the specific tasks of overall valuation and relevant item identification for business valuators. A case has been made that the sample is representative of the business valuator population. It is believed that for these two tasks the results would be the same over a larger sample of business valuators. However, the results may not apply to other professionals who perform the same type of cognitive tasks (e.g. design and hypotheses evaluation).

Previous accounting literature has discussed these two types of cognitive tasks in respect to auditors (Bonner and Pennington 1991). Future research is needed to determine if the findings of this study apply to groups other than business
valuators. "Is reasoning ability an important determinant of performance for accountants in ill-structured design and hypothesis evaluation tasks in contextual settings other than business valuation?"

Concluding Remarks

The major findings of this study are that, for both expert and novice business valuators, reasoning ability is a significant predictor variable for performance in design and hypothesis evaluation tasks. These findings contribute to the body of behavioral accounting literature that continues to explore the relationships among experience, knowledge, ability and performance for the accounting profession. A specific contribution of the study is that reasoning ability, a sub-component of the broad construct general problem-solving ability, has been shown to be important in two ill-structured cognitive tasks.

Additionally, this study contributes to the cognitive difference stream of accounting research. Commercially available psychometric tests have been used in previous accounting studies (Pincus 1990; Mills 1996). However, for the first time, the California Critical Thinking Skills Test was used as a research instrument with accountants and business valuators as subjects.

As with any study, there are limitations associated with the current study. Nevertheless, the hope is that the findings of this study will provide a solid basis for future research.
BIBLIOGRAPHY


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APPENDIX A

Medical Practice Valuation Case

On the following pages you will find information related to the medical practice of an established family practitioner who wishes to sell his practice. Based on the information provided please estimate the value of the practice if it were being sold to a young physician who has just completed his residency. Please record the date that you completed the case and your start and finish times. If you were interrupted while working the case please note this at the end. Start time is recorded on the next page. Finish time is recorded at the end of the case materials. There is no time limit for the completion of the case. Immediately following the case materials are some background information questions.

AGAIN, THANK YOU FOR TAKING YOUR VALUABLE TIME TO COMPLETE THESE MATERIALS. YOUR CONTRIBUTION TO ACADEMIC RESEARCH IS APPRECIATED.
Scenario

Dr. Joseph, a well established family practitioner, has hired your firm to value his practice. He has been approached by a young doctor who is just finishing his residency. The young doctor wants to buy the practice if the value can be satisfactorily established. The potential buyer has hired another valuation firm that is currently completing the valuation of Dr. Joseph's practice. You personally know the other valuator. Your belief is that the other valuator is knowledgeable, fair and ethical. Dr. Joseph has stated that he wants the negotiations to go smoothly as he has accepted a position at a nearby medical school beginning some six months from now. It is Dr. Joseph's belief that if two reputable valuators arrive at similar values then the deal will move quickly. He has stated that he does not want your firm to be an advocate for a high value for his practice but rather he wants you to come up with your best estimate of fair market value given the circumstances.

A fellow valuator in your office has been working on the project. She has already partially completed the valuation process. She has completed items such as conducting client interviews, physically visiting the office, obtaining information from Dr. Joseph's CPA firm, and collecting some market comparable information. She was called out of town on a personal emergency and you have been asked to complete the valuation. Her file notes begin on the next page.
FILE NOTES

Business Description:

1. **Form of Organization:** The business is the physician family practice of Dr. Stephen E. Joseph located at:

   777 American Way
   Suite 2500
   Midamerica City, USA

   Dr. Joseph is a sole practitioner who has organized his business as “Dr. Joseph. MD” a SubChapter S corporation. In 1997 the corporation paid Dr. Joseph a salary of $125,000. Dr. Joseph is the only shareholder in the corporation. A reputable local CPA firm maintains the financial and tax records of the business. The CPA firm is cooperative and has furnished us with summaries of financial and tax data.

2. **History:** Dr. Joseph, age 43, started his solo practice some eight years ago when he moved into a new office building adjacent to a newly built 180 bed hospital. He has occupied the same 2500 square foot office since that time. Dr. Joseph has had a distinguished career. He refers his patients to the best specialists in the city and he has an excellent reputation among his peers. He has never had a malpractice claim filed against him.

3. **Market and patients:** The practice is located in an affluent growing suburb. The majority of patients are from young upper middle class families.
The office has a laboratory and an x-ray room. Routine lab tests and routine x-rays are performed in the office. Anything other than routine laboratory or x-ray work is referred to the hospital which is connected to the office building by an elevated walkway. The office building contains offices of specialists from all major disciplines. If at all possible, patients with difficult problems are referred to specialists in the same building. Dr. Joseph is the only family practitioner in the building.

The office space is leased. The terms of the lease are standard for this type of comparable office space. There is plenty of parking by the building with overflow space across the street in the hospital parking lot.

The practice mix is 10% medicare, 30% managed care contracts and 60% health insurance. There are almost no patients who are not covered by some sort of insurance. The majority of patients are seen for routine or extended office visits.

Most of the patients who require hospitalization are first referred to a specialist. Dr. Joseph's fees are average for this city.

Dr. Joseph sees 90-100 patients per week. He averages a little over 40 hours per week in the office. The office is open 40 hours per week Monday through Friday. In the past he has typically taken three weeks vacation per year. The office is closed for ten holidays per year. All employees are given two weeks vacation per year.

4. Management: The office has two full-time secretaries. Both are trained to do billing, filing, reception and appointment scheduling. The office is fully

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computerized for billing and appointment scheduling. Collection of accounts receivable, financial statement preparation and all tax return preparation is handled by the CPA firm. The CPA firm has furnished us with a schedule of aged accounts receivable. The collection rate averages 97% and there are very few old receivables.

The practice also employs two full-time LPNs who work with Dr. Joseph. They have been trained to handle routine procedures, perform routine lab tests and operate the x-ray equipment.

All employees were interviewed. They appear competent, highly motivated and indicated that they would like to remain with the practice if it is sold. They have met the potential buyer and voiced their approval of him.

5. Major assets and equipment: The practice has recently purchased new office furniture, new computers and new lab equipment. The loan for the equipment is in the corporation name. The x-ray machine is three years old.

A separate valuation of all fixed assets was performed. Details of the replacement cost valuation are contained in the supplemental file and are summarized here:

<table>
<thead>
<tr>
<th>Asset</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office furnishings</td>
<td>$20,000</td>
</tr>
<tr>
<td>Medical equipment</td>
<td>$100,000</td>
</tr>
<tr>
<td>Computer equipment and software</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

There are approximately 7,000 patient records in the practice files. The records appear to be well maintained. No valuation has been placed on them at this time. In addition, there has been no calculation of practice 'goodwill'.
There is an assignable lease on the 2500 square foot office. The lease term is for seven years with six years remaining as of May 1, 1998. The lease calls for a 2% increase in rent for each of the six years. The current rental rate per square foot for the office space is below average for the surrounding community.

6. **Demographic and economic factors:** Dr. Joseph's practice is located in a large midwestern city with a current population of around 890,000. There are 18 hospitals in the city.

   The city and region are in a growth cycle. The Chamber of Commerce, which has been reliable in the past, projects a continuing population growth of 5 percent per annum for at least the next five years. Employment is steady and the job market continues to grow. The population of citizens over 50 is less than the national and state average for a city this size.

   There are very few family practices in this area of the city. For the city as a whole the managed care market is lower than the national average for this size city.

   When the secretaries were interviewed, they indicated that there is no formal policy to follow up no show appointments although they sometimes do. The business has not had a formal marketing plan beyond advertising in the telephone book and word of mouth.

7. **Miscellaneous issues:** After the sale, Dr. Joseph will remain in the practice for at least three months to assist in transition. The buyer has arranged for a 50% down payment (provided the parties and the bank agree on the purchase price).
The remainder will be financed by Dr. Joseph over a five year period. Dr. Joseph and the buyer both want malpractice tail coverage that will cover both doctors during the transition stage. Dr. Joseph is willing to sign a two year non-compete contract.

TASK 1: Preliminary Evaluation

Based only on the written information contained on pages 2 through 6, what is your initial impression of the valuation of this practice compared to other sole practitioner family medicine practices in the same geographic area? Please place an 'X', anywhere along the line, at the point that represents your initial impression.
TASK 2: Relevant Items

Based only on the written information contained on pages 2 through 6, what do you consider to be the five most important items of information as far as the valuation is concerned? Briefly explain why each is important.

1.

2.

3.

4.

5.

Next page: The next page contains a balance sheet provided by Dr. Joseph's CPA firm. Please review the statement and answer the question at the bottom of the page.
Accrual Basis Balance Sheet  
Medical Practice of Dr. Joseph, MD (SubChapter S)  
As of December 31, 1997

ASSETS
Current Assets:
- Cash $16,600
- Accounts Receivable, net of Uncollectibles 50,400
- Prepaid Expenses 8,997
- Medical and office supplies 7,650
- Total Current Assets 83,647

Furniture and Equipment (at cost):
- Office furniture, fixtures, medical equipment and computers 151,600
  - Less: accumulated depreciation—Note 1 52,676
  - Net Furniture and Equipment 98,924
- Total Assets 182,571

LIABILITIES AND OWNER’S EQUITY
Liabilities:
- Accounts Payable 9,700
- Wages Payable 5,623
- Accrued Expenses 19,017
- Notes Payable -Less than 1 Yr. 10,000
- Total Current Liabilities 44,340
- Equipment loan—Note 2 40,000

Owners Equity
- Capital Stock 87,600
- Retained earnings 10,631
- Total Liabilities and Owner’s Equity 182,571

Note 1- Straight Line Depreciation used
Note 2- Payable over a four year period (1999-2002)

TASK 3: Balance Sheet Adjustments
As part of your valuation methodology would you make any adjustments to the Balance Sheet?  NO ____

YES ____
If your answer is yes please make the adjustments on this sheet.
This page contains income information provided by the CPA firm. Look it over and then continue on to the next page.

Accrual Basis Income Statements  
Dr. Joseph, MD(a subchapter S corporation)  

<table>
<thead>
<tr>
<th>Year</th>
<th>Fees Received</th>
<th>Operating Expenses</th>
<th>Operating Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>$312,700</td>
<td>125,000</td>
<td>2,048</td>
</tr>
<tr>
<td>1996</td>
<td>286,650</td>
<td>115,000</td>
<td>1,573</td>
</tr>
<tr>
<td>1995</td>
<td>260,852</td>
<td>105,000</td>
<td>938</td>
</tr>
<tr>
<td>1994</td>
<td>232,158</td>
<td>100,000</td>
<td>658</td>
</tr>
<tr>
<td>1993</td>
<td>204,299</td>
<td>90,000</td>
<td>664</td>
</tr>
</tbody>
</table>

### Detailed Summary of 1997 Operating Expenses

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physician expenses:</strong></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>$125,000</td>
</tr>
<tr>
<td>Travel (includes cost of CPE courses)</td>
<td>4,307</td>
</tr>
<tr>
<td>Malpractice Insurance</td>
<td>6,000</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>4,000</td>
</tr>
<tr>
<td>Social Security</td>
<td>4,055</td>
</tr>
<tr>
<td>Disability Insurance</td>
<td>1,200</td>
</tr>
<tr>
<td>Beeper</td>
<td>2,000</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>700</td>
</tr>
<tr>
<td><strong>Employee salaries and benefits</strong></td>
<td></td>
</tr>
<tr>
<td>Two LPNs @ $12.00 per hour</td>
<td>49,920</td>
</tr>
<tr>
<td>Two Secretaries @ $8.00 per hour</td>
<td>33,280</td>
</tr>
<tr>
<td>Employee Benefits and taxes (approximately 20% of salaries)</td>
<td>16,540</td>
</tr>
<tr>
<td><strong>Accounting and Legal</strong></td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Office Expenses:</strong></td>
<td></td>
</tr>
<tr>
<td>Rent (2,500 sq. ft @ $8.50 per square foot)</td>
<td>21,250</td>
</tr>
<tr>
<td>Utilities</td>
<td>4,000</td>
</tr>
<tr>
<td>Office supplies</td>
<td>5,000</td>
</tr>
<tr>
<td>Medical supplies/ drugs</td>
<td>5,000</td>
</tr>
<tr>
<td>Telephone</td>
<td>6,200</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>2,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>10,000</td>
</tr>
<tr>
<td>Interest expense (equipment loan)</td>
<td>5,200</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>310,652</td>
</tr>
</tbody>
</table>
Additional Information:

The following market data were obtained from the local medical association and from sales records kept by your firm and a reliable business brokerage. Your colleague used the comparable approach to compare seven recent sales of family practices. She considered items such as number of years in practice, size of office, gross fees, book value of tangible assets, replacement value of tangible assets, location, pretax income before taxes to MD, goodwill, patient base, etc.

Comparable Sales Data for Sole Practitioner Family Practices within Dr. Joseph’s city and Region for the Last Two Years

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Three practices considered to be of lower value than Dr. Joseph’s</th>
<th>Two practices considered to be very comparable to Dr. Joseph’s</th>
<th>Two practices that were probably higher in value than Dr. Joseph’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Final sales price as a % of gross fees received</td>
<td>55-70%</td>
<td>70-95%</td>
<td>95-110%</td>
</tr>
<tr>
<td>2. Final sales price as a multiple of pretax income before income to the MD</td>
<td>1.6-2.0</td>
<td>2.0-2.5</td>
<td>2.5-3.2</td>
</tr>
<tr>
<td>3. Goodwill as a % of gross fees</td>
<td>20-24</td>
<td>24-35</td>
<td>35-40</td>
</tr>
</tbody>
</table>

The following net income information was obtained from the local medical association, the American Medical Association salary survey and from salary records maintained by your firm. The information is for family practitioners.

<table>
<thead>
<tr>
<th>Year</th>
<th>Median</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>$130,200</td>
<td>$139,600</td>
</tr>
<tr>
<td>1996</td>
<td>$125,000</td>
<td>$134,200</td>
</tr>
<tr>
<td>1995</td>
<td>$119,200</td>
<td>$129,000</td>
</tr>
<tr>
<td>1994</td>
<td>$109,500</td>
<td>$123,500</td>
</tr>
</tbody>
</table>

Please continue to the next page for some questions.
TASK 4: Choice of valuation method(s)
Briefly describe your choice of method(s) for this valuation. Please furnish enough
details about your method(s) so that a person with limited business
valuation experience (me) can follow and understand your procedures.
Briefly explain why you believe that the method(s) chosen are best for this
type of valuation.

Continue to the next page
TASK 5: Discount Rate
If you are going to use a discount rate in your calculations what is it? Describe in detail, how you arrived at the rate. Please be very specific (i.e. if the rate is comprised of different components list each component).

[ ] Discount Rate

Not applicable, I will not use a method that requires a discount rate

Continue to the next page
TASK 6: Growth Rate
If you are going to use a growth rate for fees received what is it? Please describe how you arrived at the rate.

☐  Not applicable, I will not use a method that requires a growth rate assumption

Growth Rate
TASK 7: Excess Earnings Premium
If you are going to assign an excess earnings premium to the practice, what is that premium? Please explain how you arrived at that amount.

Not applicable, I will not use a method that requires excess earnings determination

Excess Earnings Premium

Continue to the next page
TASK 8: Capitalization Rate
If you are going to use a capitalization rate in your valuation what is it? Please explain in detail. Be specific (i.e. if different components are part of the overall rate explain each component). Also, do you believe that there is a difference between the capitalization rate and the discount rate? Explain.

Not applicable I will not use a method that requires a capitalization rate

Capitalization Rate
TASK 9: Actual Valuation
At this point please assign a single specific value to the practice. You may refer to any of the case materials. Describe in detail the valuation method(s) used.

Be specific as to any assumptions such as discount rates, capitalization rates, growth rates, etc.

Practice Valuation
When discussing this value with your client would you be more comfortable suggesting a value range? If so, please put that range in the second box.

Description of Methods Used:

Continue to the next page
TASK 10: Method Reconciliation
If you used more than one valuation method for this medical practice and the values from each method were different how did you determine the final valuation for the practice? Please justify and explain your decision.

Please be very specific.

Continue to the next page
TASK 11: Sale to the hospital

Are you familiar with the integrated delivery system (IDS) concept?

☐ If Yes, answer the questions below

☐ If No, continue to the next page

a. If the nearby hospital wanted to buy the practice for its new Integrated Delivery System (IDS) would your value for the practice be different? Higher? Lower? Explain.

b. If Dr. Joseph wanted to continue to work in his practice under the new IDS instead of taking the medical school job what salary do you recommend that he try to negotiate?

Continue to the next page
This is the final task of the case.

**TASK 12: Represent the Buyer**
Would your value be different if you represented the buyer instead of the seller?


This completes the case study please record your finish time.

Finish Time
If you were interrupted while working the case what is your estimate of time to complete it?

FINALLY, ON THE FOLLOWING PAGES I WOULD LIKE TO ASK YOU SOME BACKGROUND QUESTIONS AND TO SOLICIT YOUR OPINION ABOUT THE CASE MATERIALS.
APPENDIX B
Background Information

1. Firm name: ________________________________

2. Position/Title: ________________________________

3. Telephone and email: ________________________________

4. What percentage of your time do you spend on business valuations?

If not a majority of your time, what other areas do you spend time on?

5. Did you use any decision aids while working the case? _____ Yes _____ No

If ‘yes’, which ones? (please be specific)

6. Did you consult with anyone regarding completion of the case?

If so, who specifically?

What was the specific issue for consultation?

Do you routinely consult with others before releasing final valuations?

If so, whom do you usually consult?

7. On a scale of 0 to 100 estimate a confidence level for your answers on tasks 1-10 contained in the case: (mark NA if the task was not applicable to your valuation)

Task 1 Preliminary Evaluation ______
Task 2 Relevant Items ______
Task 3 Balance Sheet Adjustments ______
Task 4 Choice of Valuation Method ______
Task 5 Discount Rate ______
Task 6 Growth Rate ______
Task 7 Excess Earnings Premium ______
Task 8 Capitalization Rate ______
Task 9 Actual Valuation ______
Task 10 Method reconciliation ______
8. Was the information contained in the business valuation case realistic?

Mark an 'X' anywhere along the line.

Very Realistic   Moderately Realistic   Not Realistic

_1_____________2_____________3_______4_____________5________

9. What is the assessment of your ability to objectively value a medical practice such as the one in the case study? Mark an 'X' anywhere along the line.

High Ability   Moderate Ability   Low Ability

_1_____________2_____________3_______________4__________5____________

10. Approximately how many medical practice valuations have you done? (include any that you have assisted on).
Number of valuations:

11. Approximately how many business valuations of any type have you done? (include those that you have assisted on).
Number of Valuations:

12. Are you working on a business valuation certification?
If 'yes', which one? ____________________________ Approximately how many hours have you spent working toward certification?

13. During your career, approximately how many hours of business valuation continuing professional education have you received? (include firm sponsored as well as outside training but do not include time spent working toward business valuation certification. i.e. for this question include post certification CPE only.)
Number of CPE Hours:

14. How many years of experience do you have in a professional capacity? (include time worked in business valuation and professional capacities other than business valuation).

Number of years business experience:

Years involved in business valuation:
Years of other business experience:

15. Please indicate the professional licenses/certificates that you hold and the approximate date of certification. (CPA, CVA, ASA, etc.)
Licenses/Certificates:

16. Please list the college or university degrees that you hold.
Degrees:

17. Excluding business valuation CPE and time spent on university degrees, please estimate other types of formal business instruction that you have received.
Firm training (weeks/days/hours?):

CPE other than business valuation (hours?):

Other formal business training (weeks/days/hours?):

18. Are there any additional factors that you consider important to a medical practice valuation that were not included in this case?

19. General Comments?

I know that you have put a lot of time and effort into the case study. Thank you very much. I hope that you found it interesting. Please complete the CCTST and CCTDI before returning the materials to me. Thanks again.
APPENDIX C

THE CALIFORNIA CRITICAL THINKING SKILLS TEST

FORM B

DIRECTIONS: Read each question carefully, then select the best choice from among those provided. There are 54 test questions. Each test question is of equal value. So, use your time wisely. You may write in this test booklet if you wish.

1. Passage: "Charlie, don't worry about it. You'll get a promotion someday. You're working for a good company. Right? And everyone who works for a good company gets a promotion sooner or later." Assuming all the support statements are true, the conclusion
   A= could not be false.
   B= is probably true, but may be false.
   C= is probably false, but may be true.
   D= could not be true.

2. Passage: "Look at those cars speeding one right behind the other, all lined up perfectly straight. They are so close to each other that if any car suddenly stops, the one behind will smash into its rear end. So, if the first car stops suddenly, there will be a crash involving all of them." Assuming its premises are true, the main claim of this passage
   A= could not be false.
   B= is probably true, but may be false.
   C= is probably false, but may be true.
   D= could not be true.

3. Passage: "Like a knife right through our heart, the oil pipeline project has cut our town in two! Politically those to its east and those to its west no longer see one another as citizens of the same town. The division has led to mistrust, tear and open hostility. Folks, that's why I'm convinced that the pipeline project was a big mistake for our town." Assuming all the supporting statements are true, the speaker's conclusion
   A= could not be false.
   B= is probably true, but may be false.
   C= is probably false, but may be true.
   D= could not be true.

4. Consider the claim: "Even Martin Luther King Jr. experienced self-doubt sometime or other," as this claim relates to the following reasons: "Think about it, everyone who seeks fundamental changes in the social order must risk the lives and fortunes of many people. Martin Luther King Jr., acknowledged to be a compassionate reformer and advocate of non-violence, sought fundamental changes in the social order. And, nobody can put lives and fortunes at risk without, at least on some occasions, experiencing self-doubt." Assuming all the statements made as part of the reason are true, the initial claim
   A= could not be false.
   B= is probably true, but may be false.
   C= is probably false, but may be true.
   D= could not be true.
5. "Not all the managers are ready for the conference." expresses the same idea as:
   A= All the managers are not ready for the conference.
   B= None of the managers are ready for the conference.
   C= Someone ready for the conference is not a manager.
   D= Some manager is not ready for the conference.

6. Suppose "Only those seeking action and excitement should join the Navy" were true. Which of the following would express the same idea?
   A= You shouldn't seek action and excitement except by joining the Navy.
   B= You shouldn't join the Navy unless you seek action and excitement.
   C= If you seek action and excitement, you should join the Navy.
   D= If you join the Navy you should seek action and excitement.

7. Suppose a biologist lecturing about household pets said, "The dog offers several temperaments." Which would be the best interpretation of this claim?
   A= There is a dog which has more than one temperament.
   B= All dogs have several temperaments.
   C= Not every dog has the same temperament.
   D= There is a thing that has more than one temperament and it is a dog.
   E= All of the above are equally acceptable interpretations.

8. "Mewyerkers make trouble." means the same thing as:
   A= People don't make trouble unless they are Mewyerkers.
   B= If anyone is a Mewyerker, then that person makes trouble.
   C= If anyone makes trouble, then that person is a Mewyerker.
   D= There is at least one person who is a Mewyerker who makes trouble.
   E= All of the above mean the same thing.

9. Which of the following is roughly equivalent to saying, "It is not true that if Greene repaired the car then Andrews repaired the boat."
   A= Greene repaired the car, yet Andrews did not repair the boat.
   B= Greene did not repair the car unless Andrews repaired the boat.
   C= Either Greene repaired the car or Andrews repaired the boat.
   D= If Andrews didn't repair the boat, Greene didn't repair the car.
   E= None of the above is even roughly equivalent.

10. Consider this passage: "(1) In most industrialized countries adolescents do not join the work force until they are over twenty. (2) Indeed, some sociologists argue that a country's economic sophistication can be measured in terms of average age of entry to the work force. (3) Psychological studies suggest that various adolescent anxieties are far more evident in industrialized countries. (4) However, it would be a mistake to think that adolescents who work are less likely to find some joy in their labor." The above passage is best described as:
    A= An attempt to show that sentence (1) is true.
    B= An attempt to show that sentence (2) is true.
    C= An attempt to show that sentence (3) is true.
    D= An attempt to show that sentence (4) is true.
    E= None of the above because no attempt at proof is made.
For Questions 11 and 12 use this passage: 

"(1) To judge if an action is right or wrong we must apply ethical principles no matter what consequences or results might actually follow. (2) Right actions are those performed with the intention of being just, telling the truth, and respecting the rights of others; wrong actions are those performed knowing one is violating these principles. (3) One can imagine a situation in which telling the truth would actually lead to great harm for our nation. For example, (4) suppose you know that a candidate for president was guilty of a sexual indiscretion many years ago. (5) Suppose you know this candidate, if elected, would surely solve our foreign and domestic problems, restore our national pride, and go down in history as our greatest president. (6) But you also know public awareness of this past sexual indiscretion surely will mean the end of any chance this candidate has to be elected president. (7) Yet, when asked detailed questions by the media about this candidate’s sexual history, you cannot avoid answering. (8) Telling the truth demands that you reveal the candidate’s past sexual indiscretion. (9) So, telling the truth can be the right thing to do even if it leads to great harm for our entire nation."

11. Which sentence in the passage above is the main conclusion or claim?

12. Sentence (2) in the passage above is best described as
   A = an intermediate claim linking sentence (1) to (3).
   B = an immoral claim which is logically irrelevant.
   C = a reason in support of sentence (1).
   D = the main conclusion or claim of the passage.
   E = an explanation or clarification of sentence (1).

13. "Many new and very specialized departments have been created recently within the corporation. This proves that the corporation is very interested in more sophisticated approaches to reaching the marketplace. “ This passage is best described as missing the unstated
   A = conclusion. "Management wanted new approaches to reaching the marketplace.”
   B = conclusion. "Corporations exist primarily, if not exclusively, to serve the interests of their owners.”
   C = conclusion. "The corporation will soon do a better job of reaching the marketplace.”
   D = premise. "The corporation was failing to reach the marketplace before these new departments were developed.”
   E = premise. "These new departments are working on sophisticated, new approaches to reaching the marketplace.”

14. Consider these statements: "Julius Caesar was Emperor of Rome in the first century BC. Every Roman emperor drank wine and did so using exclusively pewter pitchers and goblets. Whoever uses pewter, even once, has lead poisoning. Lead poisoning always manifests itself through insanity.” Which of the following must be true if all of the above arc true?
   A = Lead poisoning was common among the citizens of the Roman Empire.
   B = Exclusive use of pewter was a privilege reserved for Roman Emperors.
   C = Whoever else, Julius Caesar was certainly insane.
   D = Those who suffer from insanity used pewter at least once.
15. Consider these statements true: "Stylish dressers are neither flashy nor dull. If someone is not flashy, then such a person is tasteful." Which of the following must be true, if both of the above are true?

A= If someone is a stylish dresser, then person is dull but tasteful.
B= No tasteful dressers are dull.
C= Stylish dressers are neither tasteful nor dull.
D= Every stylish dresser is tasteful and not dull.
E= None of the above.

16. Consider these statements true: "If David envies anyone, he envies Ann. There are many whom Ann does not envy, and David is one of them. But in today’s world, everyone envies somebody." Which of the following must be true, if all of the above are true?

A= Somebody envies everyone.
B= David envies Ann.
C= Ann envies nobody.
D= None of the above.

Questions 17 and 18 are based on the following fictional situation:
The city of Dallas has exactly seven districts - 1, 2, 3, 4, 5, 6, and 7. The mayor must name exactly five people, each from a different district, to serve on the City Council. Any combination of five people will do, except that if someone from district 1 is named, no one from district 5 can be named. But, if someone from 3 is named, someone from 5 must be named. And, if anyone from district 2 is named, the mayor must then name a person from district 6 to serve as well.

17. Here are five possible combinations of people the mayor of Dallas might name to serve on the City Council. Which is the only combination that meets all the conditions?

A= 1, 2, 3, 6, 7
B= 1, 4, 5, 6, 7
C= 2, 3, 4, 5, 6
D= 2, 3, 4, 5, 6
E= 1, 2, 4, 5, 6

18. Assume the mayor decides not to name anyone from district number 7. In that case, which other district must be excluded from representation on the City Council?

A= 1, B= 2, C= 3, D= 4, E= 5

19. Consider the “goladem” relationship. It is defined as follows: “Only humans are goladems. But not every member of the human species has goladems. Nobody can be a goladem to themself, but today every human is someone’s goladem. If someone is your goladem, then all that person’s goladems are your goladems too. If someone is your goladem, then you cannot be that person’s goladem. Assume the first two humans, the long ago deceased ancestors of our species, were named Sara and William.” Given this meaning of “goladem” we can say for sure

A= All of us are goladems to Sara and William.
B= Sara and William are goladems to one another.
C= Sara or William is each their own goladem.
D= Someone is neither Sara’s nor William’s goladem.
E= None of the above because this concept does not make sense.
For Questions 20 and 21 use this fictitious case: "In a scientific study of college women who smoked one or more packs of cigarettes a day for at least two years. 85% of the women who quit smoking showed a 15% improvement in lung capacity within 45 days of quitting. That this improvement could have happened randomly or by chance was ruled out experimentally with high levels of confidence."

20. If true, these findings would confirm that
   A = Smoking causes decreased lung capacity.
   B = Smoking restrictions should be enacted on college campuses.
   C = Diet is not a factor in the relationship between smoking and lung capacity.
   D = The researcher had a vested interest in stopping smoking.
   E = Smoking is statistically correlated with decreased lung capacity in college women.

21. If the information in this case were true, which of the following hypotheses would not have to be ruled out in order to confirm the claim that for about 85 out of 100 adults who smoke one or more packs of cigarettes a day for at least two years. a 15% improvement in lung capacity can be obtained within 45 days of quitting smoking?
   A = Improvement in lung capacity is limited to females, but improvement in lung capacity will not be evident in males who quit smoking.
   B = Since smokers under-report the amount they really smoke, the actual relationship between quitting and lung capacity improvement is greater than indicated.
   C = Since the women studied were predominantly Hispanic or Asian, these findings do not apply to the adult population of the United States in general.
   D = Since college officials failed to keep this research project confidential, the college women and the scientists involved knew the purpose of the study.
   E = In college women, changes in lung capacity result from other factors, such as changes in physical fitness, health, blood pressure, and fatigue level.

22. Assume that whenever the train is late, Marvin and Kathy are hungry and irritable. Given that assumption, which of the following must be true?
   A = The train is late. Marvin is hungry and Kathy is irritable.
   B = If Kathy is hungry but Marvin is not irritable, the train is not late.
   C = If Marvin is irritable or Kathy is hungry, the train is late.
   D = If the train is not late, Marvin and Kathy are neither irritable nor hungry.
   E = If Kathy and Marvin are hungry or irritable, the train is late.

23. Working on a marketing problem, the account executive argued. "Proposal L is better than proposal X. But, proposal Y is better than proposal L! Yet, proposal M is better than proposal Y. So, proposal Y is better than proposal J." Which information must be added to the account executive's argument to require that the conclusion be true, assuming all the premises are true?
   A = Proposal I is worse than proposal M.
   B = Proposal I is worse than proposal L.
   C = Proposal X is worse than proposal J.
   D = Proposal L is worse than proposal J.
For Questions 24 and 25 use this fictitious case: "Research at fifteen public universities showed that graduating seniors who majored in the humanities averaged 53 on a standardized test of general career preparedness. In the same study, graduating seniors who majored in the sciences averaged 55; those who majored in engineering or business scored 54. A second study, conducted at ten private universities, showed that graduating seniors who majored in engineering or business scored 56; those who majored in the humanities averaged 54 on the same career preparedness test. A third study of a select group of young adults who had gone directly into full-time jobs after high school and did not attend college. Matched to the earlier groups by age and high school achievement, these were good students whose financial situations simply made college impossible. Their average score on the same test was 32. The difference between 32 and the other mean scores was found to be statistically significant at the .05 level of confidence."

24. Initially, the most plausible scientific hypothesis regarding these data is
   A = graduating from college is correlated with general career preparedness
   B = there should be financial aid for good students in need so they can attend college
   C = going to college is not related to being generally prepared to enter a career
   D = more testing is needed before a plausible hypothesis can be formulated
   E = a person who scores 60 or higher is generally prepared to enter a career

25. To scientifically disconfirm choice C in question 24, one would have to
   A = find a college graduate who is not generally prepared to enter a career.
   B = find that 95% of all young adults were generally prepared to enter careers.
   C = find there is less than 5% chance that the relationship occurs randomly.
   D = do nothing. There is no way to scientifically disconfirm that hypothesis.

26. "There seem to be two popular arguments in favor of the death penalty. One is that the cold fear of being put to death will deter others from committing the same terrible crimes. The second is that the death penalty appears more economical than the alternative, which is life in prison. But every scientific study conducted so far shows that the economic realities strongly favor life imprisonment. That people in general think the death penalty saves money doesn't change the economic facts! So, the death penalty should be abolished." The speaker's reasoning is best evaluated as
   A = poor. It did not show the relevance public opinion.
   B = poor. It did not address the argument about deterring others from crime.
   C = good. It shows the death penalty probably should be abolished.
   D = good. But it is factually mistaken about abolishing the death penalty.

27. "The median selling price of single family homes fell sharply throughout 1989 and continued down during the recession that began in 1991 and lasted into 1992. During the same period of time, interest rates and real estate prices fell sharply. These facts establish that single family homes are real estate." The best evaluation of the speaker's reasoning is
   A = good thinking, but not all the facts are stated accurately.
   B = good thinking, because single family homes are considered real estate.
   C = bad thinking. One can draw no conclusions about the prices of single family homes given facts about real estate and interest rates.
   D = bad thinking. The selling price of new cars went down during that same time, but that does not prove that a single family house is a new car.

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28. "As the long shadows of Saturday slowly purpled the late afternoon sky, little Carol Ann bicycled back and forth on the sidewalk in front of her house. Soon it would be night and her slumber party would start. Carol Ann had invited all her little friends. They would eat pizza, watch funny movies, and stay up very late telling scary stories. Carol Ann could hardly wait. She wished the sun would go away faster, pass beyond the hills, and let night come. She decided to peddle her bike as hard as she could to drive the sun away. She peddled and peddled. And the harder she peddled, the darker it became. Yes, night was coming! The slumber party was coming! Carol Ann peddled harder and harder. And when it was finally dark she was very tired. But she was very happy as well. Carol Ann thought about what had happened and decided she could make any boring old afternoon turn into a happy night, if she really worked hard at it."

The best evaluation of Carol Ann's reasoning is:

A= good. What evidence does she have that if she had not worked so hard, it would not have happened?
B= poor. The sun goes around the earth with or without her peddling hard.
C= poor. That it happened after she peddled so hard doesn't mean it happened because she peddled so hard.

29. The speaker said, "Journalists should be guided by the public's right to know, which implies a full and accurate presentation of all significant facts. At the same time, as patriots, journalists should also be guided by the interests of national security, which require that governmental secrecy be maintained. Nobody can say for certain which value is more important - the American public's right to know or national security. This can create some agonizing dilemmas. For example, a journalist may discover the exact hour and location of a top secret military attack ordered by our own government. The American public has the right to know what its government is doing, particularly in a matter as serious as a military attack. But publishing the facts before the attack might aid the enemy and lead to a costly military defeat for our country."

The best evaluation of the speaker's reasoning is:

A = poor thinking, because the law says national security is more important.
B = poor thinking, because in practice journalists do choose one value over another.
C = good thinking, because the public's right to the truth cannot be compromised.
D = good thinking, because in the abstract these important values conflict.

30. "A complete set of tableware contains at least four dinner plates, four soup bowls, four dessert dishes, four coffee cups, and four saucers. For our purposes we will say these twenty pieces are the only pieces in a "basic set." There are many other pieces in a complete set. Manufacturers often include small salad bowls, large serving platters, salt and pepper shakers, a creamer and a sugar bowl, and even a butter dish. For now call these additional pieces the "accessory set." Now, suppose you receive a complete set of tableware as a gift. So, from what we know now, we can conclude that among the pieces in the basic set there are precisely four each of dinner plates, soup bowls, dessert dishes, coffee cups, and saucers." The author's way of demonstrating this conclusion is best evaluated as:

A = poor. It proves nothing as in "The ocean is water because it is water."
B = poor. It fails to consider the pieces in the accessory set.
C = good. The author enumerates the various pieces in a complete set of tableware.
D = good. The conclusion is an accurate restatement of the given facts.
For Questions 31, 32, 33 and 34 focus on the faulty inference in the following Fictional case:

A speech writer working for a white supremacist group claimed that white Americans were "genetically superior to Blacks, Hispanics, Asians, Iranians and all the other mongrel races in terms of native human intelligence." To support this claim, the speech writer quoted a study which compared two groups of tenth graders. Each group was given the same exam covering European geography. The exam focused on European rivers, mountain ranges, countries, capital cities, agriculture, industry, religion, music and languages. Group A was 35 tenth graders, 34 of whom were whites with Anglo-European family names. Group A students attended a private college prep school in wealthy Orange County, California. That school requires ninth graders to take a year of European history. Group B was 40 tenth graders, all but 4 of whom were Hispanic, Black, Asian or Middle Eastern. Group B students attended a public high school in a violent, gang infested ghetto community of south central Los Angeles County. Ninth graders at the public high school take a year of world history. The writer pointed out that Group A did significantly better on the geography test than Group B.

31. Suppose a political scientist objected, saying, "The inference from these data to the claim being made is faulty because this researcher overlooks the guarantees in the US Constitution regarding equal educational opportunity." If true, is this political scientist's reason good or not, and why?
   A= Good reason. A violation of key rights makes a study unacceptable.
   B= Good reason. Equal educational opportunity is a vague concept.
   C= Bad reason. These rights were respected in the original research.
   D= Bad reason. These rights are irrelevant to this research.

32. Suppose a developmental psychologist argues, "The inference from these data to the claim being made is faulty because the study does not take into account the impact of environment on intelligence." If true, would this psychologist's reason be a good or a bad reason, and why?
   A= Bad reason. Nobody had proven that environment can affect learning geography.
   B= Bad reason. It is very difficult to measure the effects of environment on intelligence.
   C= Good reason. This factor must be taken into account.
   D= Good reason. Environment, not genetics is the major factor determining intelligence.

33. Suppose a female social worker objected, "You can't expect group B children to be as intelligent. After all, they come from a background of poverty, crime and broken families." If true, would this social worker's reason be a good or bad reason, and why?
   A= Good reason. Poor neighborhoods mean poor schools, poor schools mean poor teachers, poor teachers mean poor students, poor students mean poor test scores.
   B= Bad reason. Regardless of socioeconomic conditions, intelligence depends on the quality of the school you attend.
   C= Bad reason. Poverty, wealth and family circumstances do not make a person more or less intelligent.
   D= Good reason. Regardless of race, children from these kinds of backgrounds are less intelligent than children from wealthy backgrounds.
34. Suppose a militant African-American student teacher angrily objected, "What do you expect! The rich kids took a course in European history, but the poor kids didn't. Sure, they're going to know more about Europe." If true, would this student teacher's reason be a good reason or a bad reason, and why?

A= Bad reason. She is only a student teacher and probably does not have the research or teaching experience to support her claims.

B= Good reason. Knowledge of facts does not measure intelligence.

C= Good reason. The differences in what they were taught in the ninth grade would tend to give Group A an advantage over Group B on that geography exam.

D= Bad reason. She's obviously responding defensively because she is Black and feels insulted by the conclusions the speech writer drew.

THAT WAS THE LAST QUESTION

If time permits, you may go back and check your answers.
ABSTRACT

This study investigates the linkage between cognitive reasoning abilities and performance in ill-structured tasks. Prior accounting research shows that the broad construct known as general problem-solving ability is directly related to performance in ill-structured audit tasks (Libby and Tan 1994). General problem-solving ability has been defined as having sub-components comprised of verbal, quantitative, memory, and cognitive reasoning abilities (Libby 1995). Most prior accounting studies have either controlled for performance differences associated with the sub-component abilities or have just ignored them. This has created a gap in behavioral accounting research (Shanteau 1995; Bouwman and Bradley 1997). This study seeks to partially fill that gap by ascertaining whether or not a sub-component of general problem-solving ability (e.g. cognitive reasoning ability) is associated with performance in ill-structured business valuation tasks.

Departing from an audit focus, this study uses business valuators as research subjects. The sample of 134 business valuators includes individuals from 42 different states, Puerto Rico, and Canada. Subjects are asked to value a medical practice using researcher developed case materials. Additionally, subjects are asked to complete Form B of the California Critical Thinking Skills Test (CCTST).

Scores representing performance on the cognitive tasks of design, hypothesis generation, hypothesis evaluation, and choice are derived from the case materials. Overall cognitive reasoning ability scores and sub-scores are provided by performance on the CCTST. Subjects are divided into expert (n=56) or novice (n=78) categories based on two experience related factors and two knowledge related factors. Subjects
are further divided into high reasoning ability and low reasoning ability categories based on CCTST scores. Factorial analyses of variance and OLS regression models are used to evaluate hypotheses relating cognitive task performance on the medical practice case to cognitive reasoning ability.

The findings are consistent with the idea that cognitive reasoning ability (a sub-component of general problem-solving ability) is a determinant of performance in certain ill-structured business valuation tasks. Specifically, cognitive reasoning ability is important for all novices and for high reasoning ability experts when the design task is considered. Cognitive reasoning ability is important for high reasoning ability experts and high reasoning ability novices when the hypothesis evaluation task is considered.