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Tacit Knowledge and Practical Intelligence:
Understanding the Lessons of Experience

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This report addresses the role of practical intelligence and tacit knowledge in understanding how individuals learn from experience and develop expertise. We present background on the notion of practical intelligence as an alternative to conventional conceptualizations of intelligence, and the exploration of the acquisition and utilization of tacit knowledge as elements of practical intelligence. We review research on practical intelligence and, in particular, highlight findings from over 15 years of research on tacit knowledge. We then address new directions aimed at understanding how individuals learn from experience and acquire tacit knowledge, and present new approaches for identifying and promoting managerial and leadership potential that are based on ongoing research on practical intelligence.

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Abstract

This report addresses the role of practical intelligence and tacit knowledge in understanding how individuals learn from experience and develop expertise. We present background on the notion of practical intelligence as an alternative to conventional conceptualizations of intelligence, and the exploration of the acquisition and utilization of tacit knowledge as elements of practical intelligence. We review research on practical intelligence and, in particular, highlight findings from over 15 years of research on tacit knowledge. We then address new directions aimed at understanding how individuals learn from experience and acquire tacit knowledge, and present new approaches for identifying and promoting managerial and leadership potential that are based on ongoing research on practical intelligence.

Tacit Knowledge and Practical Intelligence: Understanding the Lessons of Experience

The ability to learn from experience is a key to success in almost any domain. When individuals are asked how they master their jobs, they often say they learned through "trial and error" or through "experience." Consider the lesson learned in the following story from a U.S. Army company commander:

> My battalion commander is a micro-manager. Twice a day I go to battalion headquarters to coordinate with each member of the battalion staff. I see the battalion commander only at staff meetings or when he wants to see me. I always try to take care of problems at my level and only have gone to the battalion commander twice with problems I couldn't handle. One time it was for a marital problem with one of my lieutenants. The battalion commander gave me advice and sent me on my way. The other time it was for a soldier gang in the battalion. I went to him as soon as I found out about it and together we went to the brigade commander for advice. A fellow company commander who went to the battalion commander all the time with routine matters was removed from command after 12 months. Another company commander always looked for opportunities to brief the battalion commander, but the commander would always blow him away with probes and questions on the details.

This commander learned that by handling problems on his own and only seeking out the boss's advice when absolutely necessary, he maintained his autonomy and reduced the boss's opportunity to micro-manage . It was not a lesson he learned in a classroom or read in a manual. It reflected knowledge that this leader acquired by learning from his personal experience about what did and did not work in that situation.

Many researchers have shown that experience serves as a major source for acquiring job-relevant knowledge and skills, which, in turn, have a direct influence on how well individuals perform their jobs (e.g., Borman, Oppler, & Pulakos, 1993; McCall, Lomabardo, & Morrison, 1998; McCauley, Ruderman, Ohlott, & Morrow, 1994; Schmidt, Hunter, & Outerbridge, 1986; Tesluk & Jacobs, 1998). Furthermore, research on the development of expertise suggests that experts in a given domain have accumulated an extensive base of knowledge that they can apply flexibly to most problems (Ericsson, 1996; Sternberg, 1995). What is not well understood is how individuals learn from experience and what distinguishes those who learn effectively from those who do not.

One measure of the ability to learn from experience is the acquisition of "tacit knowledge." Sternberg and his colleagues (Sternberg, 1988, 1997; Sternberg et al., 2000; Sternberg & Horvath, 1999; Sternberg, Wagner, Williams, & Horvath, 1995; Sternberg & Wagner, 1986) consider the acquisition and utilization of tacit knowledge, often characterized as "street smarts" or "common sense," to be an aspect of practical intelligence. Tacit knowledge represents what one needs to know to get along in daily life that typically is not explicitly taught or even verbalized. The knowledge is considered tacit because often it is not readily articulated by the individual or widely shared within the performance domain (Sternberg et al., 2000). Terms like *professional intuition* and *professional instinct* have been used to characterize the tacit quality of knowledge associated with individuals who are successful in their respective domains.

In this report, we present an overview of the construct of tacit knowledge and its theoretical basis in practical intelligence. Next, we review nearly 15 years of research on the relationship of tacit knowledge to everyday performance in domains ranging from academic

psychology to military leadership. Then, we consider new approaches for assessing and promoting one's ability to learn from work experience by means of tacit knowledge and practical intelligence. We conclude with directions for future research aimed at improving our understanding of how leaders, and employees in general, learn effectively from their experiences.

<center>Practical Intelligence and Tacit Knowledge</center>

Practical intelligence is formally defined as the ability that individuals use to find an optimal fit between themselves and the demands of the environment through their adapting to their environment, shaping (or modifying) their environment, or selecting a new environment in the pursuit of personally-valued goals (Sternberg, 1985, 1997, 1999b). Practical intelligence represents one of several concepts that have received increasing attention in recent years as an alternative to traditional views of intelligence. The traditional view (Brand, 1996; Jensen, 1998; Ree & Earle, 1993; Schmidt & Hunter, 1998; Spearman 1927) proposes that many of the competencies needed for success can be viewed as associated with one general intelligence (or ability) factor. A number of researchers have argued that g presents a restricted view of the abilities individuals need to succeed in everyday life, and have proposed broader perspectives that include concepts like interpersonal and intrapersonal intelligence (Gardner, 1983, 1993, 1999), emotional intelligence (Goleman, 1995; Mayer, Salovey, & Caruso, 2000), and creative and practical intelligence (Sternberg, 1985, 1997, 1999b). Our focus is on the concept of practical intelligence as it underlies the acquisition and utilization of tacit knowledge.

<u>Practical Intelligence</u>

The concept of practical intelligence emerged from concerns that traditional intelligence tests measure abilities associated primarily with academic rather than practical tasks (see Berg,

2000; Ceci &Roazzi, 1994; Sternberg & Wagner, 1986; Wagner, 2000). In other words, the types of problems found in academic settings and on most intelligence tests often differ in many ways from the types of problems found in everyday life.

Building on a distinction made by Neisser (1976), Sternberg and his colleagues (Sternberg, 1985, 1997; Wagner & Sternberg, 1986) have identified several characteristics that distinguish academic from practical problems. Academic problems tend to be (a) formulated by others, (b) well-defined, (c) complete in the information they provide, (d) characterized by having only one correct answer, (e) characterized by having only one method of obtaining the correct answer, (f) disembedded from ordinary experience, and (g) of little or no intrinsic interest.

Practical problems, on the other hand, tend to be (a) unformulated or in need of reformulation, (b) of personal interest, (c) lacking in information necessary for solution, (d) related to everyday experience, (e) poorly defined, (f) characterized by multiple "correct" solutions, each with liabilities as well as assets, and (g) characterized by multiple methods for selecting a problem solution. Given the differences in the nature of academic and practical problems, it is no surprise that people who are adept at solving one kind of problem may well not be adept at solving problems of the other kind. Research on practical problem solving provides evidence in support of this distinction (e.g., Cornelius & Caspi, 1987; Denney, 1989).

Studies of practical problem solving have been conducted with schoolchildren (Carraher, Carraher, & Schliemann, 1985; Perret-Clermont, 1980), racetrack handicappers (Ceci & Liker, 1986, 1988; Ceci & Roazzi, 1994; Ceci & Ruiz, 1992), grocery shoppers (Lave, Murtaugh, & de la Roche, 1984; Murtaugh, 1985), and college students performing computer simulated tasks (Dörner & Scholkopf, 1991), to name a few. These studies have shown fairly consistently that

individuals who perform well on various non-academic tasks do not necessarily perform well on comparable assessments in an academic context. For example, Lave et al. (1984) found that grocery shoppers who were able to calculate the cost per unit of items in order to identify items with the best value, were unable to perform equally well on a written math test. Ceci and Liker (1986, 1988) similarly found that the ability of racetrack handicappers to use complex algorithms to predict post time odds was unrelated to their IQ scores.

One area that particularly demonstrates the distinction between academic and practical problems is the domain of business management. Traditionally, managers were taught to follow rational models in solving managerial problems. Rational models are based on the assumption that a set of problem-solving principles can be applied to most, if not all, situations (Isenberg, 1984; Kepner & Tregoe, 1965; Plunkett & Hale 1982). Many researchers discovered that successful managers rarely followed a rational problem-solving approach (Isenberg, 1986; McCall & Kaplan, 1985; Mintzberg, Raisinhani, & Theoret, 1976). Instead they were action-oriented very early in the problem-solving process, their analyses were cursory rather than exhaustive, and their responses were based on their personal experience with analogous problems rather than on more formal principles of problem solving. Schön (1983) further suggested that much of managerial competence appears as action that is nearly spontaneous, and based more on intuition than on rationality. It is "ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is in our action" (Schön, 1983, p. 49).

The action-oriented knowledge that Schön (1983) referred to is consistent with the approach of Sternberg and his colleagues (see Sternberg et al., 2000; Sternberg, Wagner, & Okagaki, 1993; Sternberg et al., 1995; Wagner, 1987: Wagner & Sternberg, 1985). Individuals

draw on a broad base of knowledge in solving practical problems, some of which is acquired through formal training and some of which is derived from personal experience. The latter often is not openly expressed or stated—it guides action without being readily articulated, and thus, is considered tacit.

Tacit Knowledge

The term tacit knowledge has roots in works on the philosophy of science (Polanyi, 1966), ecological psychology (Neisser, 1976), and organizational behavior (Schön, 1983), and has been used to characterize knowledge gained from everyday experience that has an implicit, unarticulated quality. Schön (1983) argued that by recognizing patterns of events in their experiences, individuals create frameworks and schemata—most of which are latent—to make sense of their experiences. These schemata are continually tested in practice and updated as environmental conditions change. Tacit knowledge is conceptualized by Sternberg and his colleagues (Sternberg, 1997; Sternberg & Horvath, 1999; Sternberg et al., 1995; Sternberg et al., 2000) according to three main features corresponding to the conditions under which it is acquired, its structural representation, and the conditions of its use.

First, tacit knowledge generally is acquired with little support from other people or resources. In other words, the individual is not directly instructed as to what he or she should learn, but rather must extract the important lesson from the experience even when learning is not the primary objective. Formal training environments facilitate certain knowledge-acquisition processes, which include selective encoding (sorting relevant from irrelevant information in the environment), selective combination (integrating information into a meaningful interpretation of the situation), and selective comparison (relating new information to existing knowledge) (Sternberg, 1988). When these processes are not well supported, as often is the case in learning

from everyday experiences, the likelihood increases that some individuals will fail to acquire the knowledge.

Second, tacit knowledge is viewed as procedural in nature. It is often context-specific knowledge about what to do in a given situation or class of situations. Drawing on Anderson's (1983) distinction between procedural and declarative knowledge, tacit knowledge can be considered a subset of life-relevant procedural knowledge that is drawn primarily from personal experience rather than formal instruction. As is the case with much procedural knowledge, knowledge gained from everyday experience tends to guide action without being easily articulated (Anderson, 1983).

The third characteristic feature of tacit knowledge is that it has direct relevance to the individual's goals. Knowledge that is based on one's own practical experience will likely be more instrumental to achieving one's goals than will be knowledge that is based on someone else's experience or that is overly generic and abstract. Drawing on the earlier example, the officer's goal was to reduce the negative effect of a micromanaging boss. He learned that by only bringing certain issues to the boss's attention and handling more trivial issues on his own, he was able to minimize the boss's micromanagement.

Research on Tacit Knowledge and Practical Intelligence

Sternberg and his colleagues (e.g., Sternberg et al., 1993; Sternberg et al., 1995; Sternberg et al., 2000; Wagner, 1987; Wagner & Sternberg, 1985; Wagner, Sujan, Sujan, Rashotte, & Sternberg, 1999) have developed and validated tests of tacit knowledge with academic psychologists, salespersons, high school and college students, civilian managers, and military leaders, among others. The measurement instruments used to assess tacit knowledge typically consist of a series of situational descriptions accompanied by a variety of possible

response options. These types of measures are similar to those characterized in the literature as situational judgment tests (SJTs; Chan & Schmitt, 1998; Legree, 1995; Motowidlo, Dunnette, & Carter, 1990). Individuals are presented with practical problems relevant to their performance domain (e.g., a manager intervening in a dispute between two subordinates) followed by a set of options or strategies for solving the problem (e.g., meet with the two subordinates individually to find out their perspectives on the problem; hold a meeting with both subordinates and have them air their grievances). Respondents are asked either to choose the best and worst alternatives from among a few options, or to rate on a Likert scale the quality or appropriateness of several potential responses to the situation.

In tacit-knowledge (TK) tests, the situational descriptions represent actual incidents from which individuals learned an important lesson about how to perform their job, and reflect knowledge that was not taught in school nor read in a textbook or manual. A sample question from the Tacit Knowledge Inventory for Military Leaders (TKML; see Hedlund et al., 1998) is shown in Figure 1. Individuals are asked to rate the quality or appropriateness of various possible responses to the situations described. Their level of knowledge is assessed by comparing their ratings against a standard, which is derived from the opinion of experts or a theoretical framework.

We briefly summarize findings from the research conducted on tacit knowledge to date. This review is organized around the relationship of TK to the constructs of experience, general cognitive ability, personality. and performance. We include in this review findings by other researchers who have taken similar approaches to studying practical intelligence.

Tacit knowledge and experience. Following the defining characteristics of tacit knowledge, it is assumed that experience leads to the acquisition of tacit knowledge. Experience

in this case can be viewed as a necessary but not sufficient condition for the acquisition of TK, since what the individual learns from experience is instrumental in the learning process (Sternberg et al., 2000). Research on the more general concept of job knowledge has shown that experience has a direct effect on the acquisition of job-relevant knowledge (Borman et al., 1993; Schmidt et al., 1986). Research on TK also generally supports the relationship between knowledge and experience, with a few exceptions.

There are many ways to define experience, including years of experience, rank or level in the organization, job status, or title. These different conceptualizations often produce different results. In terms of years of experience, or tenure, studies conducted with salespersons and managers have found that individuals with more years of experience scored significantly higher on TK tests (Wagner, 1987; Wagner et al., 1999). However, two studies, one with civilian managers and the other with military leaders, found that the number of years spent in a job or organization correlated negatively with TK scores (Sternberg et al., 2000). In both cases, further research showed that the individual's level in the organization correlated positively with TK scores (Hedlund, Sternberg & Psotka, 2000). These findings suggest that mere time in a job may not guarantee learning, and that individuals who do learn may change positions more often within and across organizations. Several other studies provide further evidence of a positive correlation between job level, or rank, and TK scores (Antonakis, Hedlund, Pretz, & Sternberg, 2001; Wagner & Sternberg, 1985; Wagner, 1987), and also have shown mean differences in scores between groups at different career stages (e.g., undergraduates, business graduate students, and business managers).

Taken together, these findings suggest that the relationship between experience and tacit knowledge is not fully resolved. What is clear, however, is that experience is not simply a proxy

for knowledge. Two individuals may spend the same amount of time in a job, but not achieve the same level of learning. Rank or level may be a better measure of experience because it indicates, at least hypothetically, that an individual has gained the necessary knowledge for job promotion. Several researchers (e.g., Quinones, Ford, & Teachout, 1995; Tesluk & Jacobs, 1998) have suggested that purely quantitative measures do not provide much insight about the developmental impact of an individual's experience. Tacit-knowledge tests can provide a more direct method of evaluating that impact.

Tacit knowledge and general cognitive ability. Tacit knowledge, as an aspect of practical intelligence, is viewed as largely distinct from general cognitive ability (g). Therefore, one of the goals of TK research has been to establish the discriminant validity of TK tests relative to traditional tests of intelligence.

Tacit-knowledge tests typically exhibit trivial and nonsignificant correlations with measures of g, with some exceptions. In samples of undergraduate students, business managers and salespersons, scores on a test of verbal reasoning exhibited nonsignificant correlations with scores on TK tests (Wagner, 1987; Wagner & Sternberg, 1985, 1990; Wagner et al., 1999). Eddy (1988), in a study of Air Force recruits, found that scores on four factors of the Armed Services Vocational Aptitude Battery (ASVAB; vocational-technical information, clerical/speed, verbal ability, and mathematics) exhibited near-zero correlations with scores on a TK test for managers.

A few studies have found significant correlations between g and TK, but these relationships are not always in the positive direction. In research with military leaders, scores on a verbal reasoning test (Terman, 1950) exhibited correlations ranging from near zero and nonsignificant, to moderate and significant ($r = .25$, $p < .01$), with a TK test for military leaders (Sternberg et al., 2000). The result regarding the moderate relationship of TK to Terman's test is

not surprising given that many of these officers had demonstrated high levels of academic achievement prior to assuming their leadership positions. More importantly, as we review below, TK scores explained variance in leadership performance beyond scores on the verbal reasoning test, thus indicating that TK tests are measuring something distinct from g. A study by Fox and Spector (2000) also found a moderate and significant correlation ($r = .25$, $p < .01$) between scores on a practical intelligence test and g with a sample of undergraduate students. Although these results indicate that tests of practical and general intelligence may share some common variance, they do not suggest that they are measuring the same construct.

In contrast to the above findings showing a positive relationship between TK scores and g, one study conducted in Kenya found that TK scores actually correlated negatively with scores on tests of g (Sternberg et al., 2001). These results suggest that, in certain environments, the development of practical skills may be emphasized at the expense of the development of academic skills. Such environments are not limited to rural Kenya: Artists, musicians, athletes, and artisans all may decide that development of skills other than those taught in school can be of more value to them than are the more academic skills.

Tacit knowledge and personality. In addition to exhibiting discriminant validity from measures of g, TK tests also appear to be distinct from personality tests. Wagner and Sternberg (1990) found that TK scores generally exhibited nonsignificant correlations with several personality-type tests, including the California Psychological Inventory, the Myers-Briggs Type Indicator, and the Fundamental Interpersonal Relations Orientation-Behavior (FIRO-B) with a sample of business executives. The exceptions were that TK scores correlated with the Social Presence factor of the California Psychological Inventory, and the Control Expressed factor of

the FIRO-B. However, TK scores consistently accounted for significant incremental variance beyond the personality measures, even when the zero-order correlations were significant.

Tacit knowledge and performance. An important criterion for evaluating the validity of TK tests is their ability to explain individual differences in performance. Simply put, individuals who learn effectively from experience should be more successful. In addition, because tacit knowledge is a form of practical intelligence rather than academic intelligence, TK scores should explain aspects of performance that are not accounted for by indicators of g.

Tacit-knowledge tests have been found to predict performance in a number of domains and using a number of criteria. Several studies have found that TK scores correlated significantly with salary and merit-based increases (Wagner & Sternberg, 1985; Wagner, 1987). Tacit-knowledge scores have also been found to correlate significantly with performance ratings for bank managers (Wagner & Sternberg, 1985), military leaders (see Sternberg et al., 2000), and a general sample of workers in the U.S. and Spain (Grigorenko, Gil, Jarvin, & Sternberg, 2000).

Additional research with academic psychologists and salespeople provides further validity evidence. Tacit knowledge scores of academic psychologists correlated with measures of scholarship including citation rate, number of publications, and quality of department (Wagner, 1987; see also Wagner & Sternberg, 1985). Wagner et al. (1994), found that TK scores of salespeople correlated with sales volume and sales awards received.

In assessing the predictive validity of TK tests relative to conventional ability tests, Wagner and Sternberg (1990) found that TK scores of business executives explained 32% of the variance in performance on a managerial simulation beyond scores on a traditional IQ test. In a study with military leaders, TK scores accounted for small (4 to 6%) yet significant variance in leadership effectiveness beyond scores on tests of verbal intelligence. These studies provide

evidence that tacit knowledge accounts for variance in performance that is not accounted for by traditional tests of abstract, academic intelligence. Other researchers have obtained similar results. Colonia-Willner (1998) found that TK scores of bank managers significantly predicted an index of managerial skill, whereas psychometric and verbal reasoning did not. Pulakos, Schmitt, and Chan (1996) found that a situational-judgment test, designed to measure the practical intelligence of entry-level professionals in a federal investigative agency, predicted performance ratings, and that scores on the practical intelligence test were not accounted for by a measure of g.

Based on the research to date, several conclusions can be made regarding tacit knowledge and practical intelligence. First, tacit knowledge generally increases with experience, although merely spending time on a job does not assure that knowledge will be acquired. Second, measures of tacit knowledge appear to be distinct from measures of general intelligence and personality traits. Third, TK tests predict performance in several domains using both objective (e.g., sales, salary) and subjective criteria (e.g., performance ratings). Finally, studies that have examined the incremental validity of TK tests have consistently found TK scores to account for unique variance beyond tests of general intelligence (Wagner, 2000).

The expanding research on practical intelligence and tacit knowledge highlights the importance of exploring alternative approaches to understanding the competencies associated with success. More research is needed however to provide further evidence to support these conclusions, and to catch up to the nearly 100 years of research on g. Given the encouraging findings so far, a number of promising new directions have emerged in the area of practical intelligence research and are addressed in the remainder of this report.

New Directions for Research on Practical Intelligence

Tacit knowledge—and practical intelligence more broadly—represents one of several approaches being pursued to understand the competencies beyond g that underlie success. This approach holds particular promise in two areas: (a) understanding how individuals learn from experience and develop expertise, and (b) the development of methods for identifying and promoting managerial and leadership potential.

Understanding the Development of Expertise

Tacit knowledge can be viewed as a manifestation of developed expertise resulting from practical experience. It is well established that experts have an extensive and well-developed knowledge base in their given performance domain (Chi, Glaser, & Farr, 1988; Ericsson, 1996). Research also indicates that experts differ from novices in the ways they process information and solve problems (Charnes, Krame, & Mayr, 1996; Patel & Groen, 1991). Sternberg (1998, 1999a) has further suggested that intelligence should be characterized a form of developing expertise. According to this view, intelligence is a function of an ongoing interaction of genetic and environmental factors that results in the acquisition and consolidation of a set of knowledge and skills needed for high-level mastery in one or more performance domains. As such, understanding how individuals learn from experience and acquire tacit knowledge can provide insight into both the development of expertise and practical intelligence.

Many researchers have explored the development of expertise, but primarily focused on the stages of knowledge acquisition in individuals (Anderson, 1987, 1993) or the role of deliberate practice (e.g., Ericsson, 1996). Anderson's ACT theory, for example, is aimed at understanding the stages involved in skill acquisition. Individuals first encode information in a declarative form. In the next stage, this declarative knowledge becomes represented as

procedures about what to do in certain situations. Eventually, the procedures become highly automated, thus requiring fewer cognitive resources on performing the task.

Our focus is on understanding the cognitive processes underlying the development of expertise, or more specifically, the acquisition of tacit knowledge. By understanding these processes, we can explore new methods of measuring an individual's potential to learn, and new approaches to facilitating learning from experience. Preliminary work aimed at understanding the acquisition of tacit knowledge is reviewed next, and implications of this work for the assessment and development of practical intelligence are then discussed.

Knowledge-acquisition processes. The first study to explore TK acquisition was an experiment conducted by Okagaki, Sternberg, and Wagner (cited in Sternberg et al., 1993), which focused on methods of facilitating the acquisition of TK. The study examined three key acquisition processes discussed earlier: selective encoding, selective combination, and selective comparison. Various cues were provided to participants to help them (a) to distinguish relevant from irrelevant information (selective encoding), (b) to integrate information according to rules of thumb (selective combination), and (c) to relate the information to prior knowledge or experience (selective comparison).

Okagaki et al. found that individuals who received the selective-encoding and selective-combination prompts exhibited the most gain in scores on a TK test. These findings suggest that prompting individuals to selectively encode and selectively combine information can enhance the acquisition of tacit knowledge. How well individuals use these processes on their own without prompting may provide valuable insight into their potential to learn, or more generally, their practical ability.

Practical problem-solving skills. A second study currently underway, focuses more broadly on the information-processing components that are applied to solving everyday problems (Antonakis et al., 2001). According to Sternberg (1985, 1997), information-processing components consist of metacomponents, performance components, and knowledge-acquisition components. Metacomponents, or metacognitive skills, are executive processes used to plan, monitor, and evaluate problem solving. These processes include problem recognition, problem definition, allocation of resources, strategy formation, solution monitoring, and outcome evaluation. Performance components are processes applied directly to solving problems, and include inferring relations between stimuli, applying relations inferred in one situation to another, and comparing items of information. Finally, knowledge-acquisition components refer to the processes previously described: selective encoding, selective combination, and selective comparison. These components are used interactively in the process of solving and learning from everyday problems.

Some researchers have associated these processes with the development of expertise (e.g., Dorner & Scholkopf, 1991; Smith, Ford, & Kozlowski, 1997). Dorner and Scholkopf (1991) suggested that experts tend to exhibit better use of metacognitive skills, or metacomponents, than do novices. They are better able to monitor the effectiveness of their problem-solving strategies and to modify ineffective strategies as needed. Smith et al. (1997) suggested that metacognitive skills facilitate the development of what they call "adaptive expertise" by enabling individuals to "recognize novelty or change, select potential responses, monitor and evaluate progress, and modify or create different responses to the task if necessary" (p. 96).

These information-processing components serve as the basis for our approach to measuring an individual's potential to learn from experience and thus develop expertise in a given domain. In other words, we are attempting to measure how well the individual (a) defines a problem, (b) decides what information to attend to and how to interpret the information, (c) generates and evaluates a set of solution alternatives, and (d) chooses and monitors a course of action. These processes are measured using detailed, complex problem descriptions, akin to those found in in-basket tests or case studies. Individuals are presented with 1-2 pages of background on the problem along with various supporting documents (e.g., memos, financial reports, performance evaluations, email exchanges, etc.). They are asked to read and sort through the information, and to answer a set of open-ended questions designed to assess their use of various problem-solving processes. Sample questions include: "What do you consider to be the main problem to be addressed? What information did you focus on in defining the problem? and What course of action would you take to address the problem you identified?" Rating scales to judge the responses of novices are developed for each of the questions by categorically aggregating responses of experts to create a "gold-standard" scoring schema. Novices who generate a response, as identified by experts, receive a score based on the weighting (i.e., the frequency) of the experts' response. In this way, a measure of the efficacy of novices' responses, that is, of how well they exhibit each of the metacognitive processes in managing the case-study problem, can be developed.

Preliminary findings aimed at understanding the acquisition of tacit knowledge indicate that more experienced officers (i.e., Captains) score significantly higher than less experienced officers (i.e., Lieutenants) on the scale composites (Antonakis, et al., 2001). Based on these

findings, it appears that metacognitive skills of novices are not as well developed as those of more experienced individuals.

<u>Measuring Practical Intelligence Through Learning Potential</u>

A similar approach to examining practical problem-solving skills has been utilized to measure the practical intelligence of MBA program applicants (Hedlund et al., 2001). This project was initiated by the University of Michigan Business School to develop a measure of managerial potential for MBA applicants as a supplement to the widely used Graduate Management Admissions Test (GMAT). The GMAT, like most standardized aptitude tests, may be a better indicator of how an individual will perform on academic rather than practical problems. Because the goal of most business schools is to produce top business leaders in addition to successful students, developing a measure of an individual's potential to be a successful leader through the ability to solve practical problems is a promising approach.

In the initial stage of this research, we explored two methods of measuring practical intelligence. One is based on the method of measuring tacit knowledge described earlier, which uses situational judgment problems (SJPs); the other is based on the approach to measuring practical-problem solving skills, which uses case scenario problems (CSPs). Several management scenarios were developed and administered to two incoming classes of over 800 MBA students. Data were collected on each student's GMAT score, undergraduate GPA, first year GPA in the MBA program, and performance evaluation for an applied consulting project. Additional data will be collected on job placements, salaries, and job satisfaction.

Preliminary analyses have been conducted on data from the first class and indicate that scores on both the situational judgment and case scenario problems predicted first year GPA (academic performance) and ratings on the applied project (practical performance). In addition,

scores accounted for variance in GPA and applied project grade beyond that accounted for by

GMAT scores and undergraduate GPA. The case scenario problems, which measure practical

problem-solving skills, provided greater incremental validity than did the situational judgment,

or tacit knowledge, problems. The results so far are encouraging and lend support to the claim

that success on academic and nonacademic problems depends on more than what is measured by

conventional intelligence or ability tests. However, further research is required before conclusive

findings can result.

Facilitating Learning from Experience

Finally, in addition to evaluating an individual's potential to become a successful leader,

our approach to measuring metacognitive processes underlying the practical intelligence of

individuals may be applied to the development of more effective managers and leaders. Because

experience is arguably the most important source of learning for managers and leaders (Davies &

Easterby-Smith, 1984; McCall et al., 1988; Wagner & Sternberg, 1985), it makes sense to

provide opportunities for individuals to capitalize on their experiences. One way to enhance

experience is to learn about the experiences of successful individuals. Reading about a situation

someone else has faced can help an individual reflect on an experience he or she has encountered

or can prompt the individual to seek out the types of experiences that will promote his or her own

learning. Tacit-knowledge scenarios may provide a valuable source of lessons from experience.

A second way to promote learning from experience is to help individuals develop the

skills underlying knowledge acquisition. Clearly some individuals learn more effectively from

their experiences than do others. Once a better understanding of the processes that underlie the

acquisition of tacit knowledge is gained through research like that described above, efforts could

be directed toward promoting the development and use of these processes in individuals. For

example, individuals could be taught strategies to help them to selectively encode, selectively combine, and selectively compare information, as in the study by Okagaki et al (cited in Sternberg et al., 1993). Alternatively, individuals could be given practice defining problems, sorting information, generating solutions, and monitoring outcomes in the context of realistic problem scenarios. Continuous feedback could be provided to these individuals on how effectively they used these processes, allowing them to correct inappropriate strategies and thus to learn how to regulate their metacognitive abilities.

Conclusions

The identification, assessment, and development of practical problem-solving skills represent promising new directions in the study of practical intelligence and tacit knowledge. There are, however, many areas that require further research attention.

First, additional research is needed to build on the findings that tacit knowledge is related to experience and performance, yet is distinct from general cognitive ability and personality. A related issue that needs to be addressed is the relationship among the various conceptualizations of intelligence. As the proliferation of these concepts continues, it will be important to determine whether social intelligence, emotional intelligence, and practical intelligence are distinct constructs or represent components of a common construct.

Second, several researchers have called for more efforts to understand how individuals learn from their experiences and what factors predict how well an individual will learn on the job (McCauley et al., 1994; Tesluk & Jacobs, 1998). The potential to learn and adapt will become increasingly important in light of rapidly changing technologies, increasing globalization, and changing workforce demographics. Measures like those being pursued with MBA business students and military leaders may become increasingly useful in the future.

Finally, once the practical learning process is better understood, methods for enhancing experience-based learning can be developed and tested. Such research might explore the effectiveness of metacognitive skills, learning strategies, or different instructional methods (e.g., discovery learning) for improving an individual's ability to learn from experience. The evidence to date from our own research program as well as research by others suggests that practical intelligence and tacit knowledge are promising avenues for further understanding the competencies underlying successful real-world performance.

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Figure 1. Sample question from the tacit knowledge inventory for military leaders.

1	2	3	4	5	6	7	8	9
Extremely Bad		Somewhat Bad		Neither Bad Nor Good		Somewhat Good		Extremely Good

You are a company commander, and your battalion commander is the type of person who seems always to "shoot the messenger"--he does not like to be surprised by bad news, and he tends to take his anger out on the person who brought him the bad news. You want to build a positive, professional relationship with your battalion commander. What should you do?

_____ Speak to your battalion commander about his behavior and share your perception of it.

_____ Attempt to keep the battalion commander "over-informed" by telling him what is occurring in your unit on a regular basis (e.g., daily or every other day).

_____ Speak to the sergeant major and see if she/he is willing to try to influence the battalion commander.

_____ Keep the battalion commander informed only on important issues, but don't bring up issues you don't have to discuss with him.

_____ When you bring a problem to your battalion commander, bring a solution at the same time.

_____ Disregard the battalion commander's behavior: Continue to bring him news as you normally would.

_____ Tell your battalion commander all of the good news you can, but try to shield him from hearing the bad news.

_____ Tell the battalion commander as little as possible; deal with problems on your own if at all possible.