THE PRACTICAL INTELLIGENCE OF HIGH POTENTIAL ENTREPRENEURS

J. ROBERT BAUM
Smith School of Business
University of Maryland
College Park, MD 20742
Tel: (301) 405-3908
Fax: (301) 314-8787
e-mail: jrbaum@rhsmith.umd.edu

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ABSTRACT

I draw upon social cognition theory to develop a model of practical intelligence, its antecedents, and its effects upon the exploitation phase of entrepreneurship. The model was tested through interviews with 22 printing industry CEOs and responses from 133 founders of early stage high potential printing businesses. Higher levels of practical intelligence predicted higher venture growth across 3 years. Relevant venture and industry experience (product, process, and market experience) and learning styles figured in a web of relationships that related with practical intelligence and subsequent venture growth. This is the first empirical study of entrepreneurs' cognitive ability.

Successful exploitation of opportunities through development of new ventures is critical for economic well being (Gartner & Carter, 2003; Shane & Venkatraman, 2000). However, over 50% of new ventures terminate within 5 years (Aldrich, 1999); thus, it is important to understand the factors that drive new venture success. Personal characteristics of entrepreneurs, together with features of the venture opportunity itself, are among the strongest predictors of successful opportunity exploitation through venture creation (Baum, Locke, & Smith, 2001). Indeed according to venture financiers, early venture survival and growth depend largely upon the characteristics of the entrepreneur (Shepherd, 1999; Zopounidis, 1994).

An array of entrepreneurs' personal characteristics have received empirical attention as predictors of venture performance (e.g., personality, competencies, cognition, motivation, and behavior). Some attention has been devoted to the search for successful entrepreneurial behavior (Baker, Miner, & Eesley, 2003; Baum & Wally, 2003; Hmieleski & Corbett, 2004); however, entrepreneurs' cognition stands out in terms of the frequency of recent theoretical studies and the strength of recent empirical findings (Baron, 2004, Baum & Locke, 2004; Busenitz & Barney, 1997; Krueger, Reilly, & Carsrud, 2000; Mitchell, Busenitz, Lant, McDougall, Morse, & Smith, 2002; Mitchell, Smith, Seawright, & Morse, 2000; Simon, Houghton & Acquino, 2000).

Despite increased attention to entrepreneurs' cognitions, Sternberg (2004) noted that issues of "know how" have received little attention. "Know how" includes cognitive dimensions of ability such as practical intelligence and learning. Although each "know how" concept has demonstrated significant empirical relationships across multiple professions, roles, and situations with performance (Klein, 1989; Klein & Crandall, 1995; Kolb, 1984; Salas & Klein, 2001; Sternberg, Wagner, Williams, & Horvath, 1995), no ability concepts have received empirical attention by entrepreneurship researchers.

Sternberg (2004) suggested that practical intelligence may be a powerful ability concept predictor of entrepreneurship performance. I share this view because I believe that practical intelligence best reflects abilities that enable entrepreneurs to cope with their extreme situation (high uncertainty, urgency, insufficient personal resources, and rapid change). For example, practical intelligence enables rapid decision-making about specific practical problems and opportunities.

Insert Figure 1 About here

My purpose is to understand the performance effects of practical intelligence and to understand how entrepreneurs learn from experience to gain the useful knowledge that underlies practical intelligence. As shown in Figure One, in pursuit of these goals I present hypotheses about a web of relationships among experience, learning, practical intelligence, and venture performance. Consistent with past tests of social cognition theories, I focus on relevant experience and practical intelligence in terms of a specific industry (Kayes, 2002; Sternberg, 2000) and study venture growth during the early exploitation phase of entrepreneurship because it is a best indicator of the results of a crucial phase of entrepreneurship (Covin & Slevin, 1997; Shane and Venkaraman, 2000). I chose to study high potential entrepreneurs and define them as growth-oriented founders who manage their young promising ventures with a vision to employ at least 100 within 10 years. High potential entrepreneurs, in contrast with mom and pop or "lifestyle" entrepreneurs, reflect the ideal type that guides thinking about those who drive dynamic capitalism (Aldrich, 1999). Taken together, the research questions are: (1) Do venture and industry-specific experience (e.g., product, process, and market experience), learning

orientation, and *practical intelligence* impact venture growth, and (2) how are the concepts interrelated?

This empirical study makes contributions to researchers and practitioners: (1) It extends social and cognitive psychology theories about entrepreneurship to include *cognitive ability* (practical intelligence); only motivation, decision heuristics, and related behaviors had been explored before (Baker et al. 2003; Baron, 2004; Baum & Locke, 2004; Busenitz & Barney, 1997). (2) The study offers empirical support for those who point to experience as the seminal predictor of entrepreneurship success (Ardichvili, Cardozo, & Ray, 2003). (3) It extends theory that explains the effects of experience through learning and practical knowledge (Mainemelis, Boyatzis, & Kolb, 2002), and (4) The study introduces Sternberg's measurement of practical intelligence to the entrepreneurship literature (Sternberg, Wagner, Williams, & Horvath, 1995). Predictors were measured across a 2-year period to assess their stability, and performance was measured across a 3-year period.

Hopefully, this study will contribute to understanding how some entrepreneurs acquire more practical intelligence than others and about whether practical intelligence is a predictor of successful early stage entrepreneurship. If practical intelligence is useful, educators may be able to plan curricula to more effectively help would-be entrepreneurs develop practical intelligence (Fiet, 2002). Understanding the tacit knowledge component of practical intelligence and showing the effectiveness of practical intelligence in new venture situations may also help entrepreneurs and their stakeholders understand that seemingly intuitive decisions can be effective in high uncertainty urgent situations.

THEORETICAL BACKGROUND

Practical Intelligence: Applied Tacit Knowledge

Intelligence has not received much attention in academic discussions of entrepreneurship. Perhaps this is because adult intelligence is commonly conceived in general terms ("g") wherein it is stable and not subject to significant improvement through training (Jensen, 1998; Ryna, Sattler, & Lopez, 2000). Nevertheless, intelligence remains an assumption of entrepreneurship success, just as it is a significant predictor of leadership in larger established organizations (Mumford, Zaccaro, Harading, Jacobs, & Fleishman, 2000). To my knowledge, general intelligence has never been measured in entrepreneurs, probably due to the fact that entrepreneurship researchers hold that general intelligence is a person-centric variable that does not go far in explaining differences in entrepreneurs' behavior (Gartner, 1988).

However, recent thinking on intelligence expands and supplements the "g" factor of mental tests (Jensen, 1998) and proposes situationally specific "successful intelligence" as the ability to adapt to, shape, and select environments to accomplish one's goals (Sternberg, 2000). Sternberg's "triarchic theory" of successful intelligence encompasses three broad abilities: critical analytic thinking, creativity, and practical implementation of ideas (Sternberg, 1988).

The latter type of successful intelligence, implementation of ideas (e.g. practical intelligence), is most interesting for this study because the focus here is on the phase of entrepreneurship that involves opportunity exploitation (Shane & Venkataraman, 2000). That is, I study new venture success during the first stage after founding. Bhide (2000) suggests that this is the most important stage of entrepreneurship, in terms of future economic and social impact.

Practical intelligence is the skilled application of a store of relevant tacit knowledge within a personally important context; such as the entrepreneurship setting (Sternberg, 2000).

Tacit knowledge refers to knowledge gained from everyday experience that has an implicit, unarticulated quality (Polanyi, 1969). Within specific domains, tacit knowledge is the basis for expertise (Klein & Hoffman, 1993; Sonnentag, 1998), and it involves pattern recognition including procedural patterns, acquired informally from experience (Sternberg et al., 1995; Berman, Down, & Hill, 2002.). In summary, *skillfully applied relevant tacit knowledge is "practical intelligence".*

Entrepreneurs are immersed in situations that require application of relevant tacit knowledge. These situations and challenges develop as entrepreneurs introduce new products and processes to new markets. In the emergent firm with its dynamic competitive environment, decisions are made on ill-structured problems with limited information and resources. Typically, fast decisions are required without time for thorough research and analysis. Even if there were sufficient time, there would be no point in searching for information that does not exist or which becomes useless as dynamic markets shift and technology becomes obsolete (Baum & Wally, 2003). This extreme setting distinguishes entrepreneurs from other types of leaders and managers; thus, I believe that study of "practical intelligence" may yield useful insights about those who respond quickly to opportunities, acquire and systematize new scarce resources, and achieve entrepreneurial rents.

In search of empirical studies of entrepreneurs' practical intelligence, I reviewed entrepreneurship research about decision making processes, intuition, schema, and scripts and found no direct references to general, successful or practical intelligence (Busenitz & Barney, 1997; Krueger, Reilly, & Carsrud, 2000; Minniti & Bygrave, 2001; Mitchell et al., 2002; Mitchell et al., 2000; Sarasvathy, 2001; Simon, Houghton & Acquino, 2000). In contrast, the effects of tacit knowledge have been studied in four empirical studies of entrepreneurs that

appeared over 12 years in *Frontiers of Entrepreneurship Research* (Dyke, Fischer, & Reuber, 1989; Reuber, Dyke, & Fisher, 1990; Marchisio & Ravasi, 2001; Samuelsson, 2001). However, none of these involved a study of the *application* of tacit knowledge, and none offered a comparison of successful vs. less successful early stage entrepreneurs. Tacit knowledge was not measured in terms of the entrepreneurship setting, nor was it measured according to Sternberg's (1995) methodology.

Despite the absence of empirical studies about entrepreneurs and practical intelligence, I believe that Sternberg et al.'s (1995) finding of a relationship between practical intelligence and personal success will translate powerfully to the entrepreneurship domain. In the early stage of a new business, entrepreneurs operate in weak situations, imprinting every facet of the new company. Many treat their new ventures as extensions of the self, experiencing the success and failure of their ventures personally. Thus, I propose that practical intelligence about specific venture input to output relationships will aid entrepreneurs as they choose strategies and take actions to achieve high venture growth.

> Hypothesis 1: The greater the entrepreneur's venture specific practical intelligence, the greater the subsequent growth of the entrepreneur's new venture.

Venture and Industry Experience: Benchmarking the Practical Intelligence Explanation of Venture Growth

In pursuit of understanding how practical intelligence is formed, I explore the relationships among experience, learning, knowledge, and practical intelligence. However, I first propose a direct relationship between experience and venture performance to support a test of the value of the internal process explanation. Prior experience is the perceptual input for many

social cognition theory processes including learning (Lord & Maher, 1989), tacit knowledge, and practical intelligence (Sternberg et al., 1995). In these theories, experience-based input triggers the process of transformation, interpretation, storage and retrieval and consequent behavior (Kolb, 1984; Lord & Maher, 1989; Torbert, 1972; Reason, 1994). Prior experience is a dominant antecedent of manager-driven organization outcomes (Autio, Sapienza, & Almeida, 2002) and new venture performance (Bird, 1989; Vesper, 1994).

Past entrepreneurship research has identified experiences that are relevant for successful new venture creation: (1) identifying technology opportunities and efficiency opportunities (Bhide, 2000), (2) aggregating human resources (Timmons, 2000), (3) finding financial resources (Smith & Smith, 2000), and (4) organizing (systems and organization building) (Baum & Locke, 2004). Scholars are increasingly interested in the high early stage success rates of "habitual" or repeat entrepreneurs (Davidsson & Honig, 2002; Starr, Bygrave, & Tercanli, 1993; Stuart & Abetti, 1990; Ucbasaran, Westhead, & Wright, 2003). Indeed, research offers consistent evidence that opportuntity recognition experience and new venture organizing expertise are valuable beyond the founding event itself (Baum & Locke, 2004).

A second category of relevant experience is industry experience: (1) product, (2) process, and (3) market experience. Hart, Stevenson and Dial (1995) posit that *industry* knowledge and related industry networks are important assets in specifying the new venture's need for resources, finding those resources, selecting partners, and structuring more flexible contracts with resource providers. Herron & Robinson (1993)) found that 15% of new venture performance variance was accounted for in terms of the entrepreneur's technical industry experience. Experience (within a team) in a similar industry was positively related to growth in innovative ventures (Samuelsson, 2001). Financiers also point to specific career experience as most important for

predicting entrepreneurs' job performance. Indeed, venture capitalists note that industry experience that is tightly related with the products, processes, or business models proposed for financing as the most important characteristic of the team (Smith & Smith, 2000). Others also point to the significance of technical expertise for positive new venture financing outcomes (Bruno & Tyebjee, 1985). Indeed, industry experience may be most valuable in identifying the tangible and intangible needs of the early stage venture (Box, Watts, & Hisrich, 1994; Chandler, 1996).

Taken together, important person-level forces exist that affect new venture growth. However, not all of the effects may be explained by cognition. For example, reputation and resource networks are experience-based forces that probably impact venture performance. Prior experience provides learning about environmental selection that yields healthier venture populations) (Aldrich, 1999). The focus of this study is upon the cognitive path from experience to venture path; however, I propose the following hypotheses about the direct effects of experience to establish a benchmark for evaluation of this study's more articulated internal indirect explanation:

> Hypothesis 2a: The greater the entrepreneur's venturing experience, the greater the subsequent growth of the entrepreneur's new venture.

> Hypothesis 2b: The greater the entrepreneur's relevant industry experience, the greater the subsequent growth of the entrepreneur's new venture.

Experience and the Learning Styles of Entrepreneurs

"Experience is the best teacher, but only if one learns from experience. What matters most is not the amount of experience one has but how much one has learned from experience." (Sternberg, 2004: 195). While early stage entrepreneurs are engaged in a particular industry-specific context, they acquire the tacit and explicit knowledge necessary to build a competitively successful firm. Because tacit knowledge, a component of practical intelligence, is "in our heads," it cannot by definition be explicated or formalized in text or shared with team members; thus, it is not easily imitated. Because it is held privately, tacit knowledge is not available for competitors. It is a more valuable and persistent source of competitive advantage than explicit knowledge.

The tacit knowledge component of practical intelligence consists of at least two types of knowledge resources—one learned by repetition of deliberate practice (e.g., practicing the pronunciation of foreign words or an athletic or artistic skill) and one learned without awareness or incidentally through experience of even one occurrence (Martz & Shepherd, 2003). Since nascent and existing entrepreneurs are unlikely to engage in conscious practice of skills, the implicit learning form is most relevant. "Implicit learning is the acquisition of knowledge that takes place largely independently of conscious attempts to learn and largely in the absence of explicit knowledge about what was acquired" (Reber, 1993: 5). The tacit knowledge formed through implicit learning is available in a flash for entrepreneurs' important fast decision making, just as it is available for musicians who unconsciously translate mental imagery into a musical performance (Krampe & Ericsson, 1996).

Beyond these deep processes of learning and recall are theories of experiential learning. One of the more widely used and well-researched theories (Kolb, 1984) posits that learning occurs as individuals grasp experience and transform that experience. The theory shows a cycle

of input and transformation as individuals experience the world concretely, reflect on that experience, "theorize" on the causes and consequences of experience, and attempt to experiment behaviorally to create new experiences of a more optimal kind. These behavioral experiments (trying to do things or interact differently) result in new concrete experiences, and the cycle of learning continues. Of course, the cycle can begin with abstract inputs that might arise from reading or lectures. The individual might test these concretely and reflect on the results and so forth.

Kolb (1984) proposes that people differ in their approach to learning. He identified four orientations: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Concrete experience (CE) refers to real events that generate real consequences of relative success and failure for the individual. CE emphasizes conscious personal involvement with events and people in everyday situations. Those who tend to learn through concrete experience rely more on feelings than on systematic solutions and are more able to be open-minded and adaptable to change. Reflective observation (RO) refers to the individual's capacity to examine experience and ask questions of himself or herself about how it came about and what it might mean. Persons who use RO understand ideas and situations from different points of view, tend to be patient, and prefer careful judgment to action. Abstract conceptualizing (AC) is characterized by theorizing or using models of situations to gain access to alternative ways to behave in future similar events. People who prefer AC tend to rely upon systematic planning and abstract ideas to solve problems. Active experimentation (AE) orientation involves experimenting with changing behavior or situations to achieve different results. People who prefer this style take a practical approach to life, are concerned with what

really works, and value action and results that may influence yet another cycle of concrete experience with chances for improved action and improved results.

The validity of Kolb's (1984) theory and measures [The Learning Styles Inventory (LSI)] have been substantiated in hundreds of empirical studies of students and business organizations (Kolb & Kolb, 2002); however, to my knowledge, the experiential learning model has only been tested once with an entrepreneurial sample (Bailey, 1986). Bailey used the LSI on 67 company founders. He found that higher performing ventures were associated with entrepreneurs who had a preference for concrete experience and reflective observation. The results for reflective observation in Long's study appear to be inconsistent with Kolb's (1984) definitions and the new venture situation. Indeed, Urlich and Cole (1987), in a paper about entrepreneurship training, supported the view that entrepreneurs prefer concrete experience to it's "opposite" of abstraction, but they suggest that entrepreneurs favor active experimentation over it's "opposite," reflection. Furthermore, Kolb's description of the accommodator style of learning (AE plus CE) has face validity as a descriptor of entrepreneurs. Accommodators prefer to do things, to carry out plans and tasks, and to get involved in new experiences. They are comfortable with adaptation because they tend to be opportunity-seeking risk-accepting lovers of change (Bird, 1989). This is fully consistent with the conditions of the uncertain, changing, and urgent entrepreneurship situation. Quick action and trial and error behaviors are appropriate because market information is inadequate (Baum, 2003).

Minniti and Bygrave (2001) proposed that entrepreneurial learning is change in knowledge which comes from choices made in the context of industry experience. They suggest that the key to optimizing outcomes is the willingness of entrepreneurs to slow down their convergence on a choice (keep learning open to new inputs and schema change). In slowing

down the decision process, the learning entrepreneur takes time to explore several, but potentially better alternatives, similar to what Kolb (1984) called reflective observation. Smith, Gannon, Grimm, and Mitchell (1988) empirically offered a similar conclusion that comprehensive decision-making (which would be slower and more reflective) produced better results. However, others seeing the fast paced context of entrepreneurship (Baum & Wally, 2003) argue that there is little time for reflection and the more active, experimental style is likely to be more successful. Based on the earlier discussion of learning styles, I opt to test the relationship of experience to and through the active, experimental (CE) learning style. If the relationship from this empirical test is low or insignificant, that finding would validate the reflective learning (RO) approach suggested in the Minniti and Bygrave model (2001), since the learning measure is ipsative (i.e., these are psychometrically "opposites"). Taken together, the two component scales of the accommodator orientation (AE and CE) separately reflect stereotypical entrepreneur behaviors that are used to cope with barriers to market entry, shifting market preferences, and surprise opportunities (Barrett, 1998; Gartner, Bird & Starr, 1992), so I propose that AE and CE play a role in the entrepreneur's cognitive path from experience to practical intelligence:

> Hypothesis 3a: The greater the entrepreneur's venturing experience, the greater the intensity of the entrepreneur's learning through concrete experience.

> Hypothesis 3b: The greater the entrepreneur's relevant industry experience, the Greater the intensity of the entrepreneur's learning through concrete experience.

> Hypothesis 3c: The greater the entrepreneur's venturing experience, the greater

the intensity of the entrepreneur's learning through active experimentation.

Hypothesis 3d: The greater the entrepreneur's relevant industry experience, the greater the intensity of the entrepreneur's learning through active experimentation.

Learning and Practical Intelligence

To complete the path explanation of the relation of experience to practical intelligence, I propose that entrepreneurs' preference for an accommodation style of learning (concrete experience and active experimentation) enables the accumulation of relevant practical intelligence. Again, I offer separate hypotheses about the relation between experience and learning consistent with findings that the AC and CE scales are distinct concepts (Kolb & Kolb, 2002).

Hypothesis 4a: The greater the orientation of the entrepreneur's learning through concrete experience, the greater the entrepreneur's practical intelligence.

Hypothesis 4b: The greater the orientation of the entrepreneur's learning through active experimentation, the greater the entrepreneur's practical intelligence.

The Mediation Model Test

I expect that experience translates directly to new venture growth for reasons beyond cognition; but learning and practical intelligence mediate a second process that adds to our understanding of entrepreneurship success. Thus, I expect the significant direct effects of

experience upon new venture growth (H2a and H2b) to be diminished when the indirect effects of (1) experience upon learning (H3a, H3b, H3c, and H3d), (2) learning upon practical intelligence (H3a and H3b), and (3) practical intelligence upon new venture growth (H4a and H4b) are included. Together with significant direct effects between experience and learning, learning and practical intelligence, and between practical intelligence and new venture growth, this condition will confirm that the effects of industry experience upon new venture growth are mediated by components of Kolb's LSI and practical intelligence (Baron & Kenny, 1986).

> Hypothesis 5: The significance of the direct effects of industry experience upon new venture growth is reduced when the indirect effects of industry experience through learning and practical intelligence are included in a full effects model that also exhibits significant direct effects for experience, learning, and intelligence.

METHODOLOGY

I chose to survey members of an association in the printing industry. This industry is established, fragmented, competitive, and changing rapidly. Improved production and management technologies have revolutionized the creation, production, and distribution of products. Competition from internet-oriented operations and foreign companies is threatening, and many product markets are in turmoil due to shifting customer “make vs. buy” preferences. Some customers are competitors. Many printers have taken advantage of the situation by processing customers’ direct mail, and some aggressive printers in the sample are experimenting with order fulfillment. Thus, entrepreneurial behavior is important within large established printing companies as well as newer and smaller businesses. The printing industry is ancient but

surprisingly dynamic. There are hundreds of new businesses that have been founded by innovators who see competitive openings and opportunities to build great companies.

Requests to participate were mailed in to 3418 CEOs in 2001. The CEOs were members of the largest printer trade association. Incentives were offered, and 822 (24%) agreed to participate. Questionnaires were distributed in early 2002 online and in hard copy. 746 usable responses were received. The representativeness of the 746 respondents, in terms of region of residency and firm size, was verified with X^2 similarity tests. Fifty cases of self-reported financial performance data were compared with Dun and Bradstreet, Inc. (2002) data. Again, X^2 similarity tests supported claims that the data were not dissimilar.

Valuable special additional incentives were offered to 472 CEOs who, according to trade association data, had founded their companies since 1998 and who had more than 5 full time employees. This group fit many of the "high potential entrepreneur" standards. 312 of the target group agreed to participate and supplied usable responses (66% of the target group, 9% of the population). The 312 responses from the target group were screened so that only owner - managers who had founded their firms since 1998 and who intended to grow their businesses to over 100 employees within 10 years were included (Brush, 1995). The resultant sample of 133 is 4% of the population; however, it includes over 50% of the high potential entrepreneurs (as defined here) in the population.

Two PhD students and I constructed an initial survey from interviews with twenty-two founders and managers of printing companies. The survey with scenarios was piloted and adapted through interaction with ten industry CEOs. The questionnaire collected personal and firm demographics, a description of the company, growth intentions, measures of industry-specific product, process, and market experience, learning orientations, and three scenarios

followed by options to measure practical intelligence and sources of financing. In addition, financial goals, financial performance since inception (employment and revenues), and measures of regional industry dynamism were collected.

Insert Table 1 About here

Measurement Model, Measures, and Controls

The 11 measurement model concepts (latent variables), number of measurement items, collection format format, LISREL 8.3 composite reliability (CR), and research source for each concept are shown in Table 1. An abbreviated summary of the measures and controls follows:

(1) *New Venture Growth*. New venture growth was measured with two items (CR = .92): (1) the compound annual sales growth rate from year-end 2001 to year end 2004, and (2) the compound annual employment growth rate from year-end 2001 to year-end 2004. Despite follow-up efforts, 9 of the entrepreneur/CEOs who qualified for the sample in all other respects had incomplete performance data. These cases were completed with data from Dun and Bradstreet, Inc. (2002 - 2005*).*

(2) *Venture Experience*. Venture experience was measured in terms of the number of ventures the entrepreneur had founded, plus the number of ventures in which the entrepreneur participated as a member of a new venture management team. (CR = 1.00).

(3) *Industry Experience*. Experience was measured in terms of the number of years the entrepreneur had (a) worked as a printing industry manager, (b) served eight printing product markets (a list was supplied), and (c) been involved with thirteen printing techniques and

services (a list was supplied). The three measures developed a CR = .88 in the SEM measurement model.

(4) and (5) *Concrete Experience and Active Experimentation*. Learning orientations were measured with the Kolb Learning Styles Inventory -IIa (LSI-1993) CE and AE scales. Each scale involves 12 items, which are combined, according to the 1993 Kolb manual. Concrete experience and active experimentation were single inputs for the structural equation measurement model, and their construct validity is supported in multiple studies of the LSI (Kolb & Kolb, 2002), thus CR = 1.00 for both.

(6) *Practical Intelligence* was developed with responses to three scenarios that followed design suggestions by Sternberg et al. (1995). One scenario begins, "Assume that it is your third year as founder/CEO of Quality Printing. Your business grew according to your plan for your first two years, but sales have fallen. Unfortunately, you were counting on a 10% volume increase to keep all of your presses busy …" The 150 word scenario continues to explain the cost of a recently purchased machine in terms of % of sales, cash flow challenges, break even and market conditions. The respondents were presented with a list of 10 actions and told to read the entire list of options and then rank order the list according to their best sequential plan of action. The actions include layoffs, cut compensation, sales promotion, incentives, etc. A standard "best practice" ranking was developed using the average ranking employed by respondents from the top 50 companies in terms of sales and employment growth among the 746 study respondents. Ranking variances ($\Sigma\ \delta_{\cdot}^{2}$) from the best practices standard were developed for each of the 133 respondents studied here. The reversed variance was the single input measure of practical intelligence. Sternberg et al. report satisfactory construct validities for the scenarios and standards that they used; however, the test employed here has not been tested for

test-retest validity, nor has it been tested beyond the single scenario employed here. Two other scenarios were provided. One involves the possibility of developing a patentable process to enable printing on thinner paper. The third scenario reports about an opportunity to become a participate in a medical mutual insurance company that may expose your business to additional risk but save you an amount equal to 5% of last year's revenures. The participants reversed ranking variance scores developed a CR = .73 across the three response sets.

Four controls were included to clarify the relations among the independent and dependent variables: (7) *Size* of the venture was represented as the number of full time employees at the end of 2001. (8) *Age* of the firm was measured as the number of years since founding. (9) *Industry Dynamism* was also measured with 5 LRF statements (CR = .74). (10) *Past Venture Growth* was measured with two items: (1) per-cent growth in revenues and (2) per-cent growth in employment during 2000. CR = .90. (11) *External Financing* was measured as the % of the total capital employed that is provided by any external source (friends and family, banks, governments, angels, middle market private equity sources or other institutional sources). All companies in the study are independent ventures.

RESULTS

LISREL 8.3 and PRELIS 2 were used to: (1) evaluate concept validity [i.e., "composite reliability", convergent, and discriminant validity], (2) perform confirmatory factor analysis to verify the validity of the proposed configuration of causal concepts, and (3) test the hypotheses (Joreskog & Sorbom, 1993). The measurement model (Table 1) shows that the measurement model had 10 concepts with CR > .80 and 1 concept with CR between .70 and .79. All measure coefficients were significant ($t > 2.0$; $p < .05$); thus, claims of convergent validity were

supported. Discriminant validity was verified by determining for each latent variable that the average variance extracted by the latent variable's measures was larger than the latent variable's shared variance with any other latent variable (Fornell & Larcker, 1981). Discriminant validity is also supported because no bivariate polychoric correlation in excess of .45 exists between predictor concepts except between the two LSI scale items: concrete experience and active experimentation (p = .48), which is expected (Jones, Lanctot, & Teegan, 2000). Common source bias was checked with LISREL confirmatory factor analysis by linking a common latent variable with all of the scale-based self-reported measures (2 independent concept measures and 2 controls). The resultant coefficient LAMBDA = .05 (t = .28, p <.05) indicated that common variance was less than 2%. In summary, the measurement model exhibited reliable measurement of the latent concepts, convergence of the measures of each concept, and divergence of the concepts.

Predictor concept data were collected again in 2004 from the high potential entrepreneur participants. A slightly modified questionnaire was used (Respondents were asked to report the experience measures without inclusion of venture and industry experience subsequent to founding); however all other independent concepts were measured without change. The statistical similarity of responses across the two and one half year period was analyzed utilizing univariate homogeneity testing of the response pairs (PRELIS 2 HT: Aish & Joreskog, 1990). This test yielded chi-squared statistics for the 9 items that measured experience, learning, and intelligence. Excepting the three intelligence measures, no chi-squared had p<.05 and the average was p = .38, which supports my claim that the CEO responses were stable across the period of measurement of the outcome. The three measures of practical intelligence reflected significant change. All three averages increased over the period. I also used multiple sample

analysis (LISREL MSA) of the 133 CEO latent variable matrices to analyze the similarity of covariance matrices across the two samples of independent concepts (Joreskog & Sorbom, 1993). I set the lambda, iota, and theta matrices equal to zero for both samples, which forced variance into the phi matrix. I then tested the hypothesis that the phi matrices were equal by minimizing the fit function across the two. Chi Squared (5, N = 2) = 6.44 resulted. With the equality constraint relaxed, the chi square value dropped to 3.22, so the hypothesis of equal latent variable relationships was tenable for the independent concepts.

Insert Table 2 About here

Table 2 shows the "fit" results of the structural equation modeling. The indirect and total effects models fit the data well, but the direct effects only model is marginal. The total effects model is significantly better than the indirect effects model (e.g., the X^2 reduction is significant for the degrees of freedom removed) and it has the best fit [X^2(220, n = 118) = 464.20; GFI = .94; AGFI = .91; RMR = .069; and RMSEA = .044]. Table 2 also shows the standardized structural equation coefficient results.

As hypothesized, entrepreneur's venturing and industry experience has a significant direct path with new venture growth (H2A and H2b), even with controls for size, age, dynamism, past growth, and external financing included in the model. However, the overall fit of the experience-only model is only "fair" which indicates that a small amount of variance has been explained. The indirect effects model is significantly better than the experience-only model, and it supports H1, H3a, H3b, H3c, H3d, H4a and H 4b. In summary, experience is mediated by

learning and practical intelligence. With H2a and H2b added, the total effects model affords strong support for all of the hypotheses. The mediation hypothesis, (H5) is supported because (1) the direct effects of experience upon new venture growth are reduced when the indirect effects through learning and practical intelligence are included, and (2) the effects of practical intelligence upon new venture growth in the standardized indirect effects model are reduced from Lambda = ..36* to Lambda = .29* when the direct effects of experience are included. The organization size, industry dynamism, and external financing controls were significant which points to the importance of external effects in studies of venture performance that focus on internal factors.

I reran the SEM total effects solution without practical intelligence and with paths directly from concrete experience and active experimentation to new venture growth. The Lambda coefficients between CE and AE and growth were significant, so CE and AE are stand-alone mediators of experience. Nevertheless, the fit of the modified model was significantly lower. Beginning with the hypothesized model, I added paths from CE and AE to new venture growth. The Lambda for CE was not significant and the Lambda for AE was marginally significant, and the overall fit was not significantly better. Thus, I am confident that the total effects model configuration of Figure 1 is the best description of the likely causal paths among the concepts studied with the data. In summary, the SEM presented has a valid measurement model and good fit; thus, the latent variable coefficients are useful indicators of the relationships among the study's concepts.

DISCUSSION, FUTURE RESEARCH, AND LIMITATIONS

The most important contribution of this study is that entrepreneurial competency clearly includes learning and intelligence, which were not previously studied together in entrepreneurship research. The measurement of practical intelligence is an important advance for the study of entrepreneurial competence and decision-making. I found that entrepreneurs who prefer to learn through concrete experience and active experimentation and who have high practical intelligence achieve higher venture growth. Previous social and cognitive psychology laboratory studies of learning and practical intelligence had established validity and significance for predicting outcomes, but these concepts had never before received simultaneous consideration nor attention in a field study of entrepreneurs. Beyond the specific findings, this study provides support for the growing cohort of researchers who believe that an internal explanation of entrepreneurship performance is possible and useful (Baron, 2004).

The cognitions studied fit the typical entrepreneur's situation. That is, I believe it is not surprising that the learning and intelligence cognitions found here to relate strongly with entrepreneurship performance appear to help entrepreneurs quickly navigate their urgent, uncertain, and rapidly changing environment. For example, it is hardly useful to invest heavily in data collection in uncertain situations and where resources are scarce. Indeed, there may be no information at all for entrepreneurs who operate in new markets or with new products; thus, experimentation is an appropriate strategy. Nor is there time for reflective thinking in the rapidly changing context of a new venture. In short, the formation of knowledge structures that are "at the ready" and that are assimilated quickly with current conditions by entrepreneurs with practical intelligence seem to be useful resources in urgent and rapidly changing situations.

Future studies might extend the study of successful intelligence by testing the two

untested types of successful intelligence proposed by Sternberg et al. (1988) - analytic intelligence and creative intelligence. Creative intelligence, in particular, may be a predictor of success in new ventures that compete on the basis of technology (Shane & Venkataraman, 2000). Thus, creativity intelligence testing that is consistent with the testing designs of Sternberg et al., may help researchers understand successful entrepreneurs' invention and innovation processes.

Entrepreneurship research may benefit from a broader study of learning styles. I measured learning style with only two of the four scales employed by Kolb (1984). One early study found that a sample of entrepreneurs preferred the reflective observation style of learning. This surprising result, in light of its conflict with the entrepreneur stereotype (Timmons, 2000), suggests that a more complete study than performed here should investigate the effects of all of the Kolb learning styles.

Venture and industry experience were surprisingly strong independent variables in the study. Experience related significantly with new venture performance, even when the causal path from experience to learning to practical intelligence was entered in the model. This suggests that experience is a powerful predictor and that the cognitive model is only a partial explanation of the intervening process between experience and new venture growth. Indeed, the SEM explained only 24% of the variance in new venture growth, which is good for studies of firm level effects of individual difference variables; however, the situationally specific experience variable employed here was responsible for 8% of the explained variance directly and an undetermined amount through learning and intelligence indirect effects.

Limitations

First, practical intelligence is context specific, and I drew conclusions from the study of an established industry that is undergoing rapid change. The effects of learning and intelligence that I found may not translate to industries that compete on the basis of technology or on the basis of unique new products. Second, I controlled for organizational and industry factors, but I have no control for the commercial feasibility or quality of the entrepreneur's plan for competition. Third, I followed Sternberg et al. (1995) to measure practical intelligence, but the process involves static fictitious settings. More comprehensive measurement of practical intelligence may involve field data collection about responses to real business problems. Fourth, I found stable measurement of the predictors across two and one half years and the outcome viable was measured across 3 years; however, the lag is hardly sufficient to claim to claim that a causal relationship exists. Fifth, I modeled with linear equations rather than multiple-order equations because structural equation modeling is not well suited to testing non-linear models. Sixth and finally, I utilized self-reports for some measures; however, the tests for common source bias and the use of financial data for measuring outcomes appears to indicate that the threat is small.

Nevertheless, these possible failures to specify the optimal concepts and the exact form of the relationships do not diminish the value of the primary finding – that experienced entrepreneurs who learn through concrete experience and active experimentation and who develop practical intelligence are more likely to run rapidly growing ventures. The findings have practical implications because the learning styles that I studied can be taught. This suggests that students, nascent entrepreneurs, and entrepreneurs who are making less effective strategic or operational decisions and who have discrepant learning styles might usefully be coached to

adopting alterative styles. Of course, financiers will be interested in yet another cluster of personal dimensions that may help them predict their returns from new ventures.

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TABLE 1
MEASUREMENT MODEL

Latent Variables	# Items	Format	CR*	Research Reference
New Venture Growth	2	(2004-2001)	.92	Low & MacMill'n (1988)
Venturing Experience	1	Self-report questions	1.00	Vesper (1992)
Industry Experience	3	Self-report questions	.88	Vesper (1992)
Concrete Experience	12**	Per the LSI scales	1.00	Kolb & Kolb (1993)
Active Experiment'n	12**	Per the LSI scales	1.00	Kolb & Kolb (1993)
Practical Intelligence	3	Scenario-st'd-variance	1.00	Sternberg et al. (1995)
Initial Size	1	2001 employees	1.00	Pugh et al. (1968)
Age	1	Years since founding	1.00	Low & MacMill'n (1988)
Dynamism	5	5-point scales	.74	Priem et al. (1995)
Past Growth	2	(2000-1999)	.90	Low & MacMill'n (1988)
External Financing	1	Self-report question	1.00	

Notes:

* CR, Composite reliability, is an indication of internal consistency such as ALPHA. CR is the sum of the square roots of the item squared multiple correlations, squared, and divided by the same quantity plus the sum of the error variances (Werts, Linn, & Joreskog, 1974).

** Twelve items are used to develop the Kolb and Kolb dimensions, but they are summarized to create one item for the SEM analysis.

TABLE 2
Structural Equation Results: Direct, Indirect, and Full Effects Models

Predictor	Outcome	Direct Effects	Indirect Effects	Total Effects
Practical Intelligence	New Venture Growth		.36*	.29*
Venture Experience	New Venture Growth	.32*		.16*
Industry Experience	New Venture Growth	.26*		.13*
Initial Size	New Venture Growth	-13*	-.13*	-.14*
Age	New Venture Growth	-.12	-.07	-.08
Dynamism	New Venture Growth	.12	.18*	.16*
Past Growth	New Venture Growth	.14*	.12	.12
External Financing	New Venture Growth	.18*	.16*	.13*
Concrete Experience	Practical Intelligence		.44*	.40*
Active Experimentation	Practical Intelligence		.52*	.48*
Venture Experience	Concrete Experience		.31*	.24*
Venture Experience	Active Experimentation		.19*	.14*
Industry Experience	Concrete Experience		.32*	.26*
Industry Experience	Active Experimentation		.22*	.19*
Fit Statistics:				
	X^2	555.96	499.46	464.20
	Degrees of freedom	226	221	220
	GFI	.86	.89	.94
	AGFI	.84	.86	.91
	RMR	.089	.082	.069
	RMSEA	.069	.066	.044

Parameter estimates are from the completely standardized solution.
* = "t" > 2.0 ($p<.05$); N = 133

FIGURE 1
Theoretical Model: The Relationship of Entrepreneur's
Experience, Learning Styles, and Practical Intelligence to New Venture Performance