1042-2587

Involvement in Knowledge-Acquisition Activities by Venture Team Members and Venture Performance

Gaylen N. Chandler
Douglas W. Lyon

This research uses concepts of organizational learning to analyze knowledge acquisition by management teams in emerging firms. Involvement in ongoing knowledge-acquisition activities is positively and significantly related to venture performance. In addition, task environment dynamism is a positive moderator of the relationship between involvement in knowledge-acquisition activities and venture performance.

Introduction

Is involvement in ongoing knowledge-acquisition activities related to venture performance? Although this question has been addressed occasionally in the existing body of literature, the knowledge and capabilities of entrepreneurs and entrepreneurial teams have almost always been viewed as a static "stock" rather than a dynamic resource that changes over time through learning (Bird, 1995). Research on the capabilities of start-up companies has focused on the human capital of key individuals at start-up or at some point in time early in the firm's development (Baum, Locke, & Smith, 2001; Cooper, Gimeno-Gascon, & Woo, 1994; Dimov & Shepherd, 2005). We propose that to better understand the venture development process it is necessary to move beyond an analysis of the "stock" of human capital and to begin to consider the learning that occurs after start-up.

Ongoing learning is important because new venture teams do not possess all of the relevant knowledge required for the success of their ventures. These knowledge gaps exist for three predominant reasons. First, evidence suggests that entrepreneurs rarely compose teams based on complementary capabilities, but rather focus on mutual interest or attraction (Chandler, Honig, & Wiklund, 2005). Thus, the new venture team may not initially possess the knowledge, skills, and abilities necessary to drive new venture development. Second, in some industries emerging firms are likely to face more rapid advances in technology, accelerated globalization, and greater competitive intensity than in the past

Please send correspondence to: Gaylen N. Chandler, tel.: (316) 978-5253; e-mail: gaylen.chandler@wichita.edu, and to Douglas W. Lyon at lyon_d@fortlewis.edu.

(Zahra & Bogne, 2000). Even in more stable industries, the task environments (Castrogiovanni, 1991) in which emerging firms operate change when they acquire new customers and suppliers, deal with different regulatory agencies, confront different competitors, and obtain different kinds of financing. These changes in the task environment often create situations that require knowledge that was not initially possessed by new venture team members. Third, changes in the internal environment may require additional knowledge. The internal environment changes when new team members and employees are added to accommodate growth (Hanks, Watson, Jansen, & Chandler, 1993). When these changes occur it is often necessary for the management team to acquire or develop additional competencies to address the dominant problems that emerge as the organization develops (Kazanjian & Drazin, 1990).

By closely examining how the knowledge-acquisition activities of venture team members are related to organizational performance, ours is the first research in the entrepreneurship literature to provide empirical evidence that involvement in vicarious and search-and-notice learning activities after venture start-up is significantly related to venture performance. In addition, we analyze more types of knowledge-acquisition activities than do any of the previous studies we reviewed. Finally, we integrate the organizational learning literature (Huber, 1991) with the literature on training evaluation (Salas & Cannon-Bowers, 2001; Van Buren & Erskine, 2002) to provide a theoretical perspective for our study.

After reviewing the literature and presenting a research model, we define constructs and develop and test hypotheses. We then report the results of a study of 124 emerging ventures and provide evidence that engagement in knowledge-acquisition activities is positively associated with venture performance.

Theoretical Perspective

Our basic research model stipulates that involvement of venture team members in knowledge-acquisition activities, both before and after venture start-up, is positively associated with venture performance. In addition, we show that task environment dynamism moderates the relationship between organizational learning and venture performance such that involvement in knowledge-acquisition activities is more efficacious in rapidly changing task environments.

Emerging ventures face inevitable knowledge gaps that exist because of initial deficiencies or because of changing external and internal environments. An emerging research stream addresses how venture teams acquire knowledge that they did not have when they started the business (e.g., Lichtenstein, Lumpkin, & Shrader, 2003; McGee & Sawyerr, 2003; Ucbasaran, Lockett, Wright, & Westhead, 2003; Zahra & Filatotchev, 2004). This emerging body of literature can be categorized within the organizational learning literature. Although organizational learning has been discussed frequently in conjunction with continued innovation in larger and older firms, it has not yet become a focal issue in the entrepreneurship literature (Ireland, Hitt, Camp, & Sexton, 2001).

Our research is part of this emerging stream that addresses organizational learning in emerging firms. Organizational learning is an organizational-level phenomenon, yet theorists point out that all learning takes place at an individual level (March, 1988; Simon, 1991). Organizations can take advantage of the acquisition of knowledge by their individual members by embedding that knowledge into the organization's shared mental model (Argyris & Schon, 1996) and by integrating new members who have knowledge that an organization previously did not have (Simon; Wiersema & Bantel, 1993). Although

it is accepted that learning can occur without impacting organizational outcomes (Huber, 1991), from the perspective of the organization, learning is most valuable when it leads to positive outcomes at the organizational level (Arthur, Bennett, Edens, & Bell, 2003). Indeed, learning would not be of much interest to organizations if it did not link to organizational level outcomes.

A central theme in the organizational learning literature is the acquisition of knowledge that the organization did not previously possess (Huber, 1991). Huber states that organizations acquire knowledge through five different processes: (1) congenital learning, (2) experimental learning, (3) vicarious learning, (4) searching and noticing, and (5) grafting. *Congenital learning* is analogous to human capital, and is the stock of knowledge possessed by the organization at a baseline time period (Huber), in our case, the point of time the business was started. *Experimental learning* takes place when people in organizations learn by the outcomes of past decisions and apply that knowledge to present decisions. *Vicarious learning* occurs when individuals learn from the behaviors and outcomes achieved by other people. *Search-and-notice learning* happens when individuals seek information to solve specific problems. *Grafting* occurs when individuals who possess knowledge not possessed by others in the organization become a part of the organization. In Table 1 we display a representative group of 15 knowledge-acquisition articles in the entrepreneurship literature. As evidenced from Table 1, none of the articles discuss more than three of Huber's five knowledge-acquisition categories. The most often researched areas are congenital learning (Baum et al., 2001; Chandler & Jansen, 1992; Davidsson & Honig, 2003; Honig, 2001; Ravasi & Turati, 2001; Reuber & Fischer, 1994; Scherer, Adams, Carley, & Wiebe, 1989) and experimental learning (Ariño & de la Torre, 1998; Cope, 2003; Govindarajan & Trimble, 2004; Honig; Lichtenstein et al., 2003; Minniti & Bygrave, 2001; Ravasi & Turati; Zahra & Filatotchev, 2004). Only one article seeks to empirically capture vicarious learning (McGee & Sawyerr, 2003), one describes searching and noticing (McGee & Sawyerr), and three discuss grafting (Chandler et al., 2005; Ravasi & Turati; Ucbasaran et al., 2003).

Of the 15 articles we reviewed, only Ravasi and Turati (2001) addressed as many as three of Huber's (1991) categories. Thus, based on the articles represented in Table 1, we test a model that is more comprehensive than has been typical in this research stream. We measured and tested four of the five categories of knowledge acquisition discussed by Huber: (1) congenital learning, (2) vicarious learning, (3) searching and noticing, and (4) grafting. We did not attempt to measure or test experimental learning. We assume that experimental learning occurred and that it is an important part of the entrepreneurial learning process. However, according to Huber, experimental learning is most often acquired unintentionally or unsystematically. Huber also notes that studies of experimental learning have employed laboratory experiments, direct observation, computer simulations, and the retrospective analysis of organizational events. In our literature review, all of the studies of experimental learning justifiably used observational and longitudinal methodologies (e.g., Ariño & de la Torre, 1998; Honig, 2001; Minniti & Bygrave, 2001; Ravasi & Turati). Therefore, we did not deem it feasible to adequately capture experimental learning with the survey methodology we employed in this study.

Although the empirical research with respect to organizational learning and venture performance is limited, the training evaluation literature provides evidence that learning by individuals in an organization can translate into organizational-level outcomes. Bartel (1994) showed that participation in training programs improved worker productivity and allowed companies to become more competitive. Researchers have used meta-analytic techniques to demonstrate that participation in training frequently has a positive impact on

Table 1

Representative Entrepreneurship Studies Focusing on Learning Issues

Study	Empirical/ Conceptual	Major premise	Congenital	Experiment	Vicarious	Grafting	Searching
Ariño & de la Torre, 1998	E	Comparative case study shows learning from the process of initiating joint ventures		x			
Baum et al., 2001	E	Survey-based research showing that preexisting human capital impacts performance	x				
Chandler & Jansen, 1992	E	Survey-based research showing that preexisting human capital impacts performance	x				
Chandler et al., 2005	E	Adding team members does not improve performance				x	
Cope, 2003	C	Organizational learning in entrepreneurial firms is triggered by significant discontinuous events		x			
Davidsson & Honig, 2003	E	Survey-based research showing that preexisting human capital impacts performance	x				
Govindarajan & Trimble, 2004	E	Case study research showing that theory focused planning fosters learning through strategic experiments		x			
Honig, 2001	E	Survey-based research showing that entrepreneurs and intrapreneurs use different learning processes based on contextual issues	x	x			
Lichtenstein et al., 2003	C	Discusses behavioral, cognitive, and action models of entrepreneurial learning		x	x		x
McGee & Sawyerr, 2003	E	Survey-based research focusing on the information search activities of small businesses			x		x
Minniti & Bygrave, 2001	C	Focuses on experiential learning through success and failure		x			
Ravasi & Turati, 2001	E	Comparative case study shows causal indeterminacy, related knowledge, control of process, and uncertainty of perception of return impact learning processes	x	x		x	
Reuber & Fischer, 1994	E	Survey-based research showing that preexisting knowledge impacts performance	x				
Scherer et al., 1989	C	Developing congenital entrepreneurial characteristics through parental modeling	x				
Ucbasaran et al., 2003	E	Entry of team members is assumed to impact the level of human capital in the team. Factors related to entry and exit are evaluated.				x	
Zahra & Filatotchev, 2004	C	Describes how managers of firms transitioning from emergence to professionalism learn through watching and experimenting		x	x		

worker productivity and organizational performance (Arthur et al., 2003; Guzzo, Jette, & Katzell, 1985). The level of evaluation most relevant to organizations occurs when training is linked to organizational outcomes (Blanchard & Thacker, 2006). Based on training-evaluation logic, a significant relationship between involvement in knowledge-acquisition activities and venture-performance outcomes such as venture performance, provides evidence that learning is likely to have occurred (Van Buren & Erskine, 2002).

Research regarding the knowledge acquisition of venture teams is more complex than studies of training evaluation because it is not sufficient to assess the outcomes of a single training program, but rather it is necessary to evaluate involvement in a variety of knowledge-acquisition activities. However, our approach is consistent with the training evaluation literature in which relationships between training activities and organizational results are assessed without directly measuring intervening process variables (e.g., Arthur et al., 2003).

In harmony with the training evaluation literature, the research model that we seek to validate postulates that when team members participate in knowledge-acquisition activities they acquire skills and knowledge that are used in the organization to enhance venture performance. We specifically measure and test four of Huber's (1991) five types of organizational learning: congenital learning, vicarious learning, search-and-notice learning, and grafting.

Congenital Learning

Congenital learning, as defined by Huber (1991), is the collective knowledge of environments and processes that founders as a group already possess prior to the initiation of the organization. It includes the knowledge of how to work within specific societal institutions and context specific work knowledge. In the entrepreneurship literature, the knowledge, skills, and abilities possessed by founders have usually been addressed under the label of human capital (e.g., Cooper et al., 1994; Gimeno, Folta, Cooper, & Woo, 1997; Huber). In our view congenital learning is synonymous with human capital, which is defined as knowledge—usually equated with abilities—together with the application of such knowledge (Ulrich, 1998). Researchers agree that congenital learning is something that individuals possess and bring to the organization (e.g., Cooper et al.). In the entrepreneurship literature, the years of preownership education, attainment of educational degrees prior to start-up, years of relevant experience prior to start-up, and completion of training programs prior to venture initiation have been used as indicators of congenital learning (Barro & Lee, 2001; Cooper et al.).

How should congenital learning relate to venture performance? The resource-based view of the firm (Barney, 2001) states that when resource-based capabilities are abundant, firms survive more easily, grow more rapidly, are more profitable, and have more organizational slack (Beard & Dess, 1988; Chandler & Hanks, 1994; Child, 1972). Emerging firms with higher levels of congenital learning have more capabilities. Consistent with the rationale of the resource-based view, we hypothesize that the congenital learning of the founders at the time of venture initiation is positively related to the performance of the emerging venture (Chandler & Jansen, 1992; Cooper et al., 1994). The premise that congenital learning is related to venture performance has been successfully verified (Cooper et al.; Davidsson & Honig, 2003), but it has not been integrated into a broader knowledge-acquisition model such as we have developed in this study.

Hypothesis 1: The congenital learning of the venture team as measured by prestart level of education and years of industry experience is positively associated with venture performance.

Vicarious Learning and Searching and Noticing

After start-up, new ventures often require additional knowledge. This additional knowledge may be necessary to fill gaps in congenital knowledge (Chandler et al., 2005), react to a changing task environment (Zahra & Bogne, 2000), or respond to business growth and expansion (Hanks et al., 1993). This knowledge can be gained vicariously or by searching out and/or noticing specific relevant information (Huber, 1991). Vicarious learning involves learning through the experience of others. Search-and-notice learning involves seeking out information in response to specific problems that need solutions. Although we recognize Huber's theoretical distinction between the constructs, we integrate both vicarious and search-and-notice learning into a single construct because our behavioral-based measures capture what people do, and not the reason behind their doing. For example, the actual activities in which people engage for vicarious and search-and-notice learning may include reading, talking to knowledgeable people, observing successful practices in other settings, involvement in benchmarking activities, attending seminars and workshops, or participation in formal education activities.

Cooke, Salas, Cannon-Bowers, and Stout (2000) point out that when attempting to measure team knowledge, it is important to focus on relevant knowledge domains. A substantial body of research has identified the knowledge and capabilities required for success in start-up businesses. We reviewed this literature with an eye for those competencies that entrepreneurs could enhance through vicarious learning or search-and-notice learning activities. Man, Lau, and Chan (2002) conducted a comprehensive review of the literature, reviewing 12 models presented by previous researchers (e.g., Adam & Chell, 1993; Bartlett & Ghoshal, 1997; Baum, 1994; Bird, 1995; Chandler & Jansen, 1992; Durkan, Harrison, Lindsay, & Thompson, 1993; Gasse, 1997; Hunt, 1998; Lau, Chan, & Man, 1999; McClelland, 1987; Mitton, 1989; Snell & Lau, 1994). Informed by the review, Man et al. presented a conceptual model of entrepreneurial competencies. The model includes the following typology of entrepreneurial competence: (1) *Opportunity competence* includes the ability to recognize opportunity and to envision taking advantage of it. It requires being forward looking and innovative in products, product applications, and organizational processes. (2) *Relationship competence* includes the ability to build cooperation and trust, persuasive ability, and communications and interpersonal skills. It includes understanding and staying close to customer needs and having the ability to sell the product or service to customers. (3) *Organizing competence* requires an understanding of how to organize different physical, financial, technological, and human resources, and how to set up and monitor effective and efficient production or service provision systems. (4) *Strategic competence* is related to setting, evaluating, and implementing firm strategies. It requires knowledge of the technological environment, and the ability to exploit relevant technologies for strategic gain. (5) *Conceptual competence* includes absorbing and understanding complex information, risk taking, and innovativeness. (6) *Commitment competence* drives the entrepreneur to move ahead with the business.

Because we are interested in learned capabilities, we included opportunity, relationship, organizing, and strategic competencies in our measurement model. We omitted conceptual competencies from our measurement model because they involve cognitive processing skills. These holistic capabilities include working memory capacity and speed of concept activation that under normal circumstances are relatively impervious to instructional intervention (Royer, Cisero, & Carlo, 1993). The cognitive skills consisting of an integrated mixture of specific facts and procedures for using those facts (Royer et al.) are already addressed by the four competencies we include in our measures. In addition, we omitted commitment competencies, because drive or need for achievement is viewed as a

personality trait (e.g., Phillips & Gully, 1997). Personality traits are comparatively stable and relatively immune to training interventions.

If the entrepreneurial competencies enumerated by Man et al. (2002) are not present at start-up, or if changing conditions render existing knowledge inadequate, the requisite knowledge about strategies, practices, and technologies can be acquired vicariously or sought out, noticed, and learned through a variety of informal and formal knowledge-acquisition activities (Huber, 1991). Thus, organizations can learn vicariously by imitating or avoiding specific practices they observe in other companies (Campbell, 1965; Cyert & March, 1963; Levitt & March, 1988; Miner & Haunschild, 1995). Consistent with this approach, an abundant practitioner literature espouses the need to seek out and benchmark the best practices in an industry (e.g., Adam & VandeWater, 1995; Richman & Koontz, 1993). In addition, they may learn vicariously through reading, listening, attending workshops and seminars, or enrollment in formal university programs. Search-and-notice learning, for example, includes environmental scanning and competitor analysis (McGee & Sawyerr, 2003). The most important point for the current research is that members of venture teams seek information they do not possess, usually in response to a specific problem and to enhance strategic effectiveness (Simon, 1991). McGee and Sawyerr found that young and small high-tech firms frequently sought information from external sources, often informally through network contacts, but sometimes through more formal avenues, and that they tended to benefit from the information. Ko (2004) also provided evidence that weak network ties are often used by entrepreneurs to gather and verify information.

From a practical perspective, whether learning vicariously or through search-and-notice approaches, the behaviors involved might include talking to people familiar with the particular industry; benchmarking activities; gathering information about competitors and competitive practices; reading trade journals and publications; and attending seminars, workshops, and other structured educational experiences such as involvement in formal trade-school or university-based training.

Consistent with the logic in our first hypothesis, the acquisition of new knowledge should lead to enhanced resource-based capabilities (Barney, 2001), which should in turn lead to stronger venture performance. Hence, our second hypothesis is based on the rationale inherent in the resource-based view that knowledge acquisition leads to venture performance.

Hypothesis 2: Participation of team members in knowledge-acquisition activities (vicarious learning and search-and-notice learning) is positively related to venture performance.

Grafting

Grafting, the final category discussed by Huber (1991), is the practice of adding new members to the organization who possess knowledge that the organization did not previously have (Wiersema & Bantel, 1993). The knowledge attained in such a way must subsequently be shared and used within the organization to be considered organizational learning (Simon, 1991). The standard prescription for dealing with changing environmental conditions and different stages of development is to add team members and employees who possess the necessary competencies (Barringer & Ireland, 2006). The literature views grafting as an adaptive mechanism (Boeker, 1997) that should better align the firm with the environment and result in superior performance. Thus, grafting is thought to play an important role in the development of emerging organizations.

Hypothesis 3: The grafting of new management team members after venture start-up is positively related to venture performance.

Task Environment Dynamism as a Moderating Variable

Does the environment within which a firm operates influence the efficacy of the learning? The task environment includes those individuals and organizations with which a company must interact in order to do business (Castrogiovanni, 1991). The outcome effectiveness of learning is likely to depend on the amount of adaptation that is required by the task environment in which the new venture operates (Boeker, 1997). In our context, task environment dynamism refers to the rate of unpredictable change that exists in the task environment (Sharfman & Dean, 1991). Product and technology changes in the task environment require adaptation and place new demands on members of the management team (Wiersema & Bantel, 1993). Although many new firms may not be in highly dynamic task environments, there are likely to be differences in the dynamism of task environments across companies and across industries.

Organizational learning is often cited as an appropriate response to changes in the environment (Kraatz, 1998; Tushman & Romanelli, 1985). Thus, in dynamic environments, organizations that scan and analyze more alternatives perform better (Priem, Rasheed, & Kotulic, 1995). Therefore, as the task environment becomes increasingly dynamic, we expect involvement in all types of knowledge-acquisition activities to be increasingly functional. This suggests that environmental dynamism moderates the relationship between involvement in knowledge-acquisition activities and venture performance. Thus:

Hypothesis 4: Task environment dynamism is a positive moderator of the relationship between congenital learning as measured by education and venture performance.

Hypothesis 5: Task environment dynamism is a positive moderator of the relationship between congenital learning as measured by experience and venture performance.

Hypothesis 6: Task environment dynamism is a positive moderator of the relationship between participation of team members in vicarious learning and search-and-notice learning and venture performance.

Hypothesis 7: Task environment dynamism is a positive moderator of the relationship between grafting and venture performance.

Methods

Sample

We test these hypotheses using a cross-sectional survey of businesses organized in Utah in 1993 in either the corporate or limited-liability-company form. Our sampling frame was a census of firms registered as corporations and limited-liability companies still shown as active firms by the Utah State Department of Commerce in 1999. Firms had completed their first 5 years when they were surveyed in 1999. A time period of 5 years was chosen because previous case research indicated that venture teams stabilized with regards to membership within the first five years (Chandler & Hanks, 1998). In addition, we wanted to study new firms, but we also wanted to study firms old enough to have established performance patterns.

The data collection process followed that proposed by Dillman (1978). Questionnaires were mailed to the individual listed as the president of each of 988 firms. One hundred and twelve questionnaires were returned as nondeliverable to the current address. Follow-up postcards were sent 1 week after the initial mailing, followed by a second mailing of the questionnaire 2 weeks later. One month after the second mailing, attempts were made to phone each of the individuals listed as president in nonresponding firms. A total of 620 companies were reached by telephone. This resulted in 65 more firm presidents who consented to participate. An additional copy of the questionnaire was mailed to those who consented, resulting in 42 additional responses. After the process was completed we collected data from 183 firms, for a response rate of 21%. We dropped 59 firms from analysis because their registration in 1993 represented a name change or a change in business form. We included the 124 firms that were organized as new organizations in 1993 in our analysis.

The president or CEO of each company was asked to answer questions with respect to company, size, age, and performance, as well as his or her knowledge-acquisition activities and the knowledge-acquisition activities of members of the management team. We instructed respondents to include individuals as part of the management team if they had equity ownership in the company and played an active role in managerial decision making. This definition is consistent with other studies of entrepreneurial teams (Ucbasaran et al., 2003).

After collecting data from the CEOs we sent a copy of the questionnaire to an individual listed as a vice president in each of the 183 firms. We received only nine complete responses that could be matched with questionnaires we had already collected. With this small subsample of nine firms, with two raters per firm, we evaluated the interrater reliability of our measures using the formula indicated by Ebel (1951). Reliability measures that are greater than .70 are deemed acceptable for research purposes (Nunnally, 1978) and indicate substantial agreement among raters.

We tested for nonresponse bias. There were no significant differences between the first and second waves of data with respect to team size, number of employees, sales levels, or industry representation. Subsequently, we collected basic information through a telephone survey from a random sample of 50 nonresponding firms with regards to the number of founding team members, firm size in number of employees, sales level, and SIC codes and found no significant differences between responding firms and nonresponding firms.

Measures

Congenital Learning. To capture congenital learning, we relied on the measures most frequently used in the literature: education and experience. In a review of the literature that focuses on measuring team knowledge, Cooke et al. (2000) indicated that although there are many conceptual papers on team knowledge, there are relatively fewer that attempt to measure it. However, they state that the most commonly used approach when aggregating for team members is to use an average for the team. Following their lead, we aggregated by averaging the responses of all team members. Respondents were asked to report education and experience levels of team members when the business was started in 1993. Such measures have been used previously in entrepreneurship research (e.g., Baum et al., 2001; Chandler & Jansen, 1992; Cooper et al., 1994; Reuber & Fischer, 1994). Education was measured on a 5-point scale: (1) less than high school, (2) high school or GED, (3) some college or trade school education, (4) 4-year degree, and (5) graduate degree. Using

the small subsample described above, interrater reliability for this measure is .84. Experience was measured by years of experience in the current industry. Interrater reliability for this measure is .83.

Vicarious Learning and Search-and-Notice Learning. When attempting to measure team knowledge, it is important to focus on relevant knowledge domains (Cooke et al., 2000). Consistent with this recommendation we designed measures to capture the *vicarious learning* and *search-and-notice learning* activities with respect to four key domains of entrepreneurial competence defined by Man et al. (2002). Our measures are consistent with those used in the training-evaluation literature (e.g., Blanchard & Thacker, 2006; Hicks & Klimoski, 1987). In the training-evaluation literature it is typical to have an experimental design with control groups in which some groups receive training and some do not. Thus, the measure is the presence or absence of training. Although we do not use an experimental design we measured the presence or absence of training by asking the CEO to indicate for each member of the management team whether that individual member had been involved during the past year in (1) informal knowledge-acquisition exercises including talking to knowledgeable people in the industry, benchmarking best practices in the industry, and reading books and articles; (2) attendance at not-for-credit seminars and workshops; and (3) involvement by team members in formal education at trade schools, colleges, and universities with respect to developing (a) opportunity competence, (b) relationship competence, (c) organizing competence, and (d) strategic competence. Each question was answered by yes or no and compiled in a cumulative scale (Trochim & Donnelly, 2006). Thus, a team member participating in the three types of knowledge-acquisition activities for all four categories of key entrepreneurial capabilities would receive a score of twelve. These scores were averaged (Cooke et al.) for all team members to provide an indicator of the amount of involvement in knowledge-acquisition activities for the team as a whole. Although it might be deemed problematic for the CEO to answer for other team members, interrater reliability for the scale is .80, indicating substantial convergence.

Grafting. We measured grafting by asking the CEO to report how many individuals had been added to the new venture management team after start-up. We did not seek to directly measure the congenital learning of members added to the team. This is consistent with how other scholars have measured additions to the team (e.g., Chandler et al., 2005; Ucbasaran et al., 2003). Forty-two firms reported adding one or more management team members. Interrater reliability for the measure is .81.

Venture Performance. Company presidents were asked to provide sales figures for the last two complete years encompassed in the study. Venture performance for this study is represented by sales growth from 1997 to 1998. This was calculated using a standard growth formula ([1998 Sales—1997 Sales]/1997 Sales). Previous research shows that sales and venture performance figures are reliable when self-reported (Brush & Vanderwerf, 1992; Chandler & Hanks, 1993). Interrater reliability for venture performance is .96.

Environmental Dynamism. We also asked respondents to answer a series of questions about their business environment. Task environment dynamism has been shown to be an important component of the environment (Dess & Beard, 1984). Perceived task environment dynamism was measured by a multiple item scale including items referencing the degree of technological and product change in the industry consistent with the scale proposed by Miller and Droge (1986) (coefficient alpha .74) and modified for use in new

ventures by Chandler, Keller, and Lyon (2000) (coefficient alpha .80). Coefficient alpha for the dynamism scale in the current study is .76 and interrater reliability is .72.

Control Variables

Industry. Because industry membership has been shown to exert an influence on emerging firm performance (e.g., Baum et al., 2001) we included dummy variables to account for industry group. In the raw data we asked respondents to describe their major product or service. These were grouped by the authors into four groups: manufacturing, retail, business service, and other. In regression analysis it is customary to define a number of dummy variables equal to the number of categories and then to enter n – 1 of the dummy variables into the regression. This accounts for all of the variance in the dependent variable (venture performance) that is explained by the independent variables (industry membership) (Back & Winsborough, 1966). We entered manufacturing, retail, and business service as dummy variables.

Company Age. Venture performance is influenced by the age of the company (Chandler & Hanks, 1993). Company age in this research is controlled by sampling procedures.

Analyses

We used hierarchical regression analysis to test our first three hypotheses. The dependent variable (venture performance) is a continuous variable. Dummy variables are used as industry controls. The remaining variables are continuous or scaled variables. To test the moderating effects proposed in hypotheses 4 through 7, we used complementary moderated regression analysis (Venkatraman, 1989). This method of testing moderation is a time-honored and robust method (Aiken & West, 1991; Baron & Kenny, 1986). Research has shown that the multiplicative effect may result in high levels of multicollinearity; however, Southwood (1978) demonstrated that a simple scale of origin transformation reduces the multicollinearity. After the transformation, the *t*-score associated with the interaction term is a valid estimator of the significance of the interaction term (Venkatraman).

Results

In this section of the article we report the results of our study. Table 2 reports the Pearson's correlations among all variables. The correlation between independent variables is relatively small (.40 or less). In a univariate sense, our vicarious/search-and-notice variable is more strongly correlated with venture performance (sales growth) than any of the other measures. Also of interest is the finding that level of education is significantly correlated with involvement in knowledge-acquisition activities. Hence, individuals with higher levels of education are more likely to be engaged in ongoing knowledge-acquisition activities. In addition, the number of team members added is significantly correlated with vicarious/search-and-notice knowledge-acquisition activities, yet not significantly correlated with venture performance.

Results of the regression analysis are displayed in Table 3. Our first hypothesis tested the relationship between two measures of congenital learning and venture performance.

Table 2

Descriptive Statistics and Correlations

Variable	Mean	SD	1	2	3	4	5	6	7	8
1. Manufacturing	.19									
2. Retail	.13		−.19*							
3. Business service	.53		−.52**	−.41**						
4. Education	8.29	5.21	−.03	−.00	−.07					
5. Industry experience	25.46	24.90	.13	−.15	−.04	.43***				
6. Dynamism	3.61	.75	.11	.06	−.04	.10	−.02			
7. Added team members	.75	1.33	−.04	.11	−.01	.22**	−.13	.10		
8. Vicarious/search and notice	3.02	5.92	−.07	−.00	.04	.19*	.04	.22*	.40***	
9. Venture performance	.05	.20	−.08	.14	−.04	.20*	.18*	.18*	.15	.37***

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.
n = 124.

Table 3

Results of Hierarchical Regression Analyses Testing Hypotheses 1–7 (H1–H7)

	H1, H2, H3 congenital vicarious grafting	H4 interaction education	H5 interaction experience	H6 interaction vicarious	H7 interaction grafting
First block (controls)					
Manufacturing	−.10	−.10	−.10	−.10	−.10
Retail	.09	.09	.09	.09	.09
Business service	−.08	−.08	−.08	−.08	−.08
Second block (independents)					
Team education	.01	.17*			
Team industry experience	.19*		.21*		
Vicarious/search and notice	.23***			.21*	
Grafting	−.04				−.03
Dynamism		.21*	.21**	.18*	.22*
Change R-square	.10***	.08***	.09**	.09**	.05*
Third block (interactions)					
Team education × dynamism		.26***			
Team experience × dynamism			−.08		
Vicarious/search and notice × dynamism				.38*	
Grafting × dynamism					.27**
Change R-square		.07***	.01	.03**	.07**
Total R-square	.13	.17	.12	.15	.14
Total adjusted R-square	.11	.13	.08	.11	.10
Total F	2.51*	4.11***	2.79*	3.43**	3.34**

* $p < .05$, ** $p < .01$, *** $p < .001$.
n = 124.
Dependent, Venture performance.

The control variables were entered in the first block, followed by the independent variables in the second block. Industry experience is significant in a positive direction. Education level is significantly correlated with venture performance in the correlation matrix, but that relationship disappears in the multivariate analysis due to some level of multicollinearity. However, the combined results provide support for our first hypothesis that congenital learning is related to venture performance.

Hypotheses 2 and 3 were also tested using regression. Participation in vicarious/search-and-notice knowledge-acquisition activities is strongly and significantly related to venture performance, while grafting is not significant. This suggests that participation in vicarious and search-and-notice knowledge-acquisition activities does result in learning for the team, and that the learning is distributed, interpreted, and applied in the organization (Huber, 1991). In contrast, grafting team members either does not add knowledge, or alternatively, the knowledge acquired in such a manner is not distributed, interpreted, and applied effectively (Huber). Hence, hypothesis 2 is supported, but hypothesis 3 is not supported.

Our final group of hypotheses (hypotheses 4–7) specified that environmental dynamism would be a significant positive moderator of the relationship between knowledge-acquisition activities and venture performance. The control variables were first entered in a base model. In the second step we included the main variables, and the third step included the moderating variables. The results (also displayed in Table 3) indicate that task environment dynamism is a positive moderator of the relationship between (1) educational level and venture performance, (2) vicarious/search-and-notice knowledge-acquisition activities and venture performance, and (3) grafting and venture performance. Task environment dynamism does not moderate the relationship between experience and venture performance, thus providing support for hypotheses 4, 6, and 7, but not for hypothesis 5.

Discussion

This is the first article in the entrepreneurship literature to demonstrate empirically that participation of new venture management team members in vicarious/search-and-notice knowledge-acquisition activities after venture start-up is significantly related to venture performance. This contributes to a recently emerging stream of research extending our understanding of how ongoing knowledge-acquisition activities are related to new venture emergence (Honig, 2001; Lichtenstein et al., 2003; Minniti & Bygrave, 2001; Ravasi & Turati, 2001). Although we measured only participation in knowledge-acquisition activities, and did not attempt to measure knowledge dissemination and application within the firm, we did demonstrate that such involvement is linked with venture performance. Hence, the results provide encouragement for continued development of this research stream.

Congenital Learning

Several researchers (e.g., Baum et al., 2001; Cooper et al., 1994; Davidsson & Honig, 2003; Honig, 2001; Reuber & Fischer, 1994) have focused on what Huber (1991) refers to as congenital learning. Congruent with the already existing body of research, our research provides evidence that congenital learning as measured by years of industry experience is a significant correlate of performance in emerging ventures. Thus, this

finding strengthens the support already found in the literature that suggests that preownership experience in a similar industry is a positive predictor of venture performance.

The empirical evidence supporting education as a predictor of venture performance is not reported as consistently in the existing literature. One review reported that 10 of 17 studies found positive relationships between prior level of education and venture performance (Cooper et al., 1994). As displayed by the correlation matrix in Table 2, preownership educational level is significantly correlated with venture performance in our sample. However, the relationship does not hold in the multivariate model in Table 3. There is significant correlation between education and experience, and between education and vicarious/search-and-notice knowledge-acquisition activities. When all three are in the model, education becomes insignificant. This may explain why the relationship between educational level and venture performance has not been entirely consistent in previous research (e.g., Cooper et al.). Although multicollinearity may obfuscate the relationship between education and venture performance, an emerging body of research provides evidence that education specifically related to entrepreneurial activity does impact performance (i.e., Charney & Libecap, 2003). Therefore, the type of education, as well as the level of education, has been shown to influence performance. Thus, inconsistent results in the literature may occur because of differences in the mix of types of education in different samples.

Vicarious and Search-and-Notice Learning

Of particular importance for this study is the learning that occurs after venture start-up. There have been very few attempts to measure empirically how emerging organizations gain knowledge after start-up. We provide evidence that involvement in vicarious/search-and-notice knowledge-acquisition activities by management team members after venture start-up is significantly correlated with new venture growth. Among the studies we reviewed, only McGee and Sawyerr (2003) empirically tested vicarious learning/search-and-notice learning. However, their dependent variable was perceived strategic uncertainty, not venture performance. Thus, our results are not directly comparable to their results, but consistent with their reasoning. Lichtenstein et al. (2003) and Zahra and Filatotchev (2004) provided a theoretical discussion of different types of learning for entrepreneurial firms. Our results are also generally consistent with their reasoning and provide empirical evidence not provided by their theoretical arguments. The verification of an empirical relationship between vicarious/search-and-notice learning and venture performance provides evidence of criterion-related validity (Messick, 1989).

The efficacy of involvement in ongoing vicarious/search-and-notice learning activities is particularly important with respect to the teaching and practice of entrepreneurship. In any new venture with significant innovation, it may be impossible to predict how the venture will develop. Thus, knowledge gained during the process of venture development may be focused more directly on relevant problems, and hence may be more valuable than congenital knowledge. This reasoning is consistent with the logic inherent in Huber's (1991) search-and-notice learning.

Grafting

Our hypothesis that focuses on grafting is not supported. There are at least three explanations for this finding. Adding team members may disrupt the social fabric of the team. Shared models and expectations do not exist for team members who are added to an

already existing team (Aldrich & Fiol, 1994). Indeed, case research (Chandler & Hanks, 1998) shows that the addition of team members can lead to affective conflict which disrupts the work of the team. There is also a possibility that emerging businesses seek team members in response to unmet performance expectations. If that is the case, any benefits of grafting may be masked for several periods of time. This may suggest a time-lagged model would be appropriate, which our current data do not give us the ability to analyze. Finally, teams may add members with similar skills to those already possessed by the team (Chandler et al., 2005) and fail to gain significant new learning by adding team members.

Task Environment Dynamism as a Moderator

Finally, above and beyond the direct relationships, our model shows that task environment dynamism is a significant moderator of the relationship between several types of knowledge-acquisition activities and venture performance. This is consistent with the observation that higher levels of environmental dynamism create greater knowledge demands for the venture team (Boeker, 1997; Sharfman & Dean, 1991; Wiersema & Bantel, 1993). In Table 2 neither education nor experience are significantly correlated with task environment dynamism. However, task environment dynamism moderates the relationship between education and performance, but not the relationship between experience and performance. This finding, coupled with a significant correlation between preownership education and ongoing involvement in knowledge-acquisition activities, suggests that teams with higher levels of education are more likely to continue to be engaged in knowledge-acquisition activities, and that the efficacy of doing so is enhanced in dynamic environments.

Experience in the industry is positively related to venture performance, but unrelated to dynamism. In contrast to education, task environment dynamism does not moderate the relationship between experience and venture performance. These findings suggest that teams with more industry experience are more likely to rely on their existing knowledge base, rather than seeking out new knowledge.

Task environment dynamism does moderate the relationship between vicarious/search-and-notice learning and venture performance. This is consistent with our hypothesis and provides support for our theoretical model. The outcome effectiveness of learning is enhanced in dynamic task environments (Boeker, 1997) presumably because the rapid change requires knowledge not formerly possessed by new venture management team members.

Although grafting new venture management team members is not directly related to venture performance, task environment dynamism does significantly influence the relationship between adding team members and venture performance. Hence, adding team members is more efficacious in highly dynamic task environments, and less efficacious in static environments. Once again this is consistent with the theoretical reasoning of our hypothesis (Boeker, 1997).

Suggestions for Future Research

We outline four productive ideas for new research based on the concepts developed in this article. First, although we provide evidence that involvement in knowledge-acquisition activities is correlated with venture performance, our evidence should be viewed as preliminary and should be substantiated by studies that would incorporate

longitudinal designs and more fine-grained measures of learning activities with direct input from each member of the management team.

Second, we do little to identify what the "best" knowledge-acquisition activities are. Does self-directed learning work as well as attendance at more formal seminars or workshops or enrollment in university programs? Much could be done to further explore and identify the most appropriate learning activities.

Third, future research could also investigate an appropriate sequencing of learning activities, as they relate to real-time venture development. Hanks et al. (1993) and Kazanjian and Drazin (1990) suggest that new ventures develop competencies in response to pressing organizational needs. They provide evidence that product development and sales functions precede market research, inventory control, and personnel. Thus, learning activities that match the needs of the emerging business are likely to be more efficacious than those that do not.

Fourth, we focus on knowledge-acquisition activities and have not empirically developed measures of the information dissemination processes described by Huber (1991). In other words, how does knowledge acquired by individual team members translate into beneficial organizational-level activities and outcomes in emerging ventures?

Implications for Practice

In addition to these ideas for future research, our research has strong practical implications. Consistent with the literature generated in the human resource field (e.g., Guzzo et al., 1985), ongoing involvement in knowledge-acquisition activities appears to be more successful than grafting team members to fill competence gaps. As we learn to better understand the dynamics associated with initial team composition, involvement in knowledge-acquisition activities, and performance, we will be able to provide clear guidelines about how to set up venture teams and the kinds of training that are most efficacious. In addition, we believe that replications and extensions of this study and a more fine-grained analysis (Harrigan, 1983) of the specific activities may provide valuable insights with respect to designing pedagogical materials for seminars and workshops targeted at entrepreneurs, as well as university-based entrepreneurship programs.

Limitations

The research does have some limitations. Our cross-sectional research does not substantiate the direction of causality. We cannot preclude the possibility that successful businesses have enough resources available to allow team members to participate in knowledge-acquisition activities, and hence it is success that leads to involvement in knowledge-acquisition activities rather than learning that drives success.

Second, our measures come from a single source. CEOs were asked to report knowledge-acquisition activities for themselves and other members of the management team. Even though we provided evidence of the reliability of our measurement with a small subsample of firms, that evidence is limited by sample size. The threat of same-source variance is mitigated somewhat because our measures are behavioral in nature and refer to factual and verifiable events or behaviors (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). For example, congenital learning is assessed by factual education and experience variables. Measures of knowledge acquisition (vicarious learning and search-and-notice learning) are focused on observable behaviors. Grafting asks how many team members have been added since start-up.

To help mitigate this threat, we used Harman's One-Factor Test as described by Podsakoff et al. (2003) to test for same-source variance. The first factor accounted for only 17.5% the total 77.3% variance and no single factor accounted for the majority of the covariance, suggesting that common method variance is not solely responsible for our findings. Moreover, common method bias would not explain the interactive relationships between predictor and outcome variables.

There remains some risk of recall bias in our study design (March & Sutton, 1997). According to Eisenhower, Mathiowetz, and Morganstern (1991), recall bias can be mitigated by reducing the length of time, requesting information from individuals who know the requested information, focusing on salient events, and reducing reliance on estimating. We sought to reduce recall bias by asking informants to report recent events (i.e., knowledge-acquisition activities during the past year). Also, the informants are firm founders and should be qualified to respond to questions about involvement in knowledge-acquisition activities. Conscious participation in these activities should be a salient event. Finally, we did not ask our participants to estimate how often, or how much, but only if there had been participation. In addition we showed in a small subsample that two raters recalled the information consistently. These precautions are consistent with the recommendations of Kahneman and Tversky (1973) intended to help reduce recall bias.

Conclusion

Consistent with Bird (1995), this research frames knowledge requirements in emerging ventures as dynamic and changing and therefore only partially dependent on congenital knowledge. It is the first research in the entrepreneurship arena to provide empirical evidence of a significant relationship between vicarious/search-and-notice learning and venture performance. It moves beyond the existing literature by focusing on knowledge-acquisition activities of venture team members that occur after the formation of a new venture. It integrates the organizational learning literature (Huber, 1991) with the literature on training assessment (Salas & Cannon-Bowers, 2001; Van Buren & Erskine, 2002) to provide a useful theoretical perspective. It specifically measures and analyzes four of Huber's five categories of knowledge-acquisition activities, which provides broader coverage than previous research. Perhaps heartening to those contemplating entrepreneurial activity, the evidence suggests that it is not necessary to know everything before starting a business, but that much can be learned and applied by those who engage in ongoing learning activities.

REFERENCES

Adam, E. & Chell, E. (1993). *The successful international entrepreneur: A profile*. Paper presented to the 23rd European Small Business Seminar. Belfast.

Adam, P. & VandeWater, R. (1995, February). Benchmarking and the bottom line. *Industrial Engineering*, *27*(2), 24–26.

Aiken, L.S. & West, S.G. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage Publications.

Aldrich, H. & Fiol, M. (1994). Fools rush in? The institutional context of industry creation. *Academy of Management Review*, *19*, 645–670.

Argyris, C. & Schon, D.A. (1996). *Organizational learning II: Theory, method and practice*. Reading, MA: Addison-Wesley.

Ariño, A. & de la Torre, J. (1998). Learning from failure: Towards an evolutionary model of collaborative ventures. *Organization Science*, *9*(3), 306–325.

Arthur, W., Jr., Bennett, W., Jr., Edens, P.S., & Bell, S.T. (2003). Effectiveness of training in organizations: A meta-analysis of design and evaluation features. *Journal of Applied Psychology*, *88*(2), 234–245.

Back, K.W. & Winsborough, H.H. (1966). *The use of multivariate regression using dummy variables in social-psychological experiments*. Technical report, Duke University.

Barney, J.B. (2001). Is the resource-based "view" a useful perspective for strategic management research? Yes. *Academy of Management Review*, *26*(1), 41–56.

Baron, R.M. & Kenny, D.A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Applied Personality and Social Psychology*, *51*(6), 1173–1182.

Barringer, B.R. & Ireland, R.D. (2006). *Entrepreneurship: Successfully launching new ventures*. Upper Saddle River, NJ: Pearson/Prentice Hall.

Barro, R.J. & Lee, J.W. (2001). International data on educational attainment: Updates and implications. *Oxford Economic Papers*, *53*(3), 541–563.

Bartel, A.P. (1994). Productivity gains from the implementation of employee training programs. *Industrial Relations*, *33*(4), 411–425.

Bartlett, C.A. & Ghoshal, S. (1997). The myth of the generic manager: New personal competencies for new management roles. *California Management Review*, *40*(1), 92–116.

Baum, J.R. (1994). *The relationship of traits, competencies, motivation, strategy and structure to venture growth*. PhD dissertation, University of Maryland.

Baum, J.R., Locke, E.A., & Smith, K.G. (2001). A multidimensional model of venture growth. *Academy of Management Journal*, *44*(2), 292–303.

Beard, D.W. & Dess, G.G. (1988). Modeling organizational species interdependence in an ecological community: An input-output approach. *Academy of Management Review*, *13*, 362–373.

Bird, B. (1995). Towards a theory of entrepreneurial competency. In J. Kolatz (Ed.), *Advances in entrepreneurship, firm emergence and growth* (Vol. 2, pp. 51–72). Greenwich, CT: JAI Press.

Blanchard, P.N. & Thacker, J.W. (2006). *Effective training: Systems, strategies, and practices* (3rd ed.). Toronto: Pearson Education.

Boeker, W. (1997). Executive migration and strategic change: The effect of top manager movement on product-market entry. *Administrative Science Quarterly*, *42*, 213–236.

Brush, C. & Vanderwerf, P. (1992). A comparison of methods and sources for obtaining estimates of new venture performance. *Journal of Business Venturing*, *7*, 157–170.

Campbell, D.T. (1965). Variation and selective retention in socio-cultural evolution. In H.R. Barringer, G.I. Blanksten, & R.W. Mack (Eds.), *Social change in developing areas: A reinterpretation of evolutionary theory* (pp. 19–48). Cambridge, MA: Schenkman.

Castrogiovanni, G.J. (1991). Environmental munificence: A theoretical assessment. *Academy of Management Review*, *16*(3), 542–565.

Chandler, G.N. & Hanks, S.H. (1993). Measuring the performance of emerging businesses: A validation study. *Journal of Business Venturing*, *8*(5), 391–408.

Chandler, G.N. & Hanks, S.H. (1994). Market attractiveness, resource-based capabilities, venture strategies, and venture performance. *Journal of Business Venturing*, *9*(4), 331–349.

Chandler, G.N. & Hanks, S.H. (1998). An investigation of new venture teams in emerging business. In P.D. Reynolds, W.D. Bygrave, N.M. Carter, S. Manigart, C. Mason, G.D. Meyer, & K. Shaver (Eds.), *Frontiers of entrepreneurship research* (pp. 318–330). Babson Park, MA: Babson College.

Chandler, G.N., Honig, B., & Wiklund, J. (2005). Antecedents, moderators, and performance consequences of membership change in new venture teams. *Journal of Business Venturing*, *20*, 705–725.

Chandler, G.N. & Jansen, E. (1992). The founder's self-assessed competence and venture performance. *Journal of Business Venturing*, *7*(3), 223–236.

Chandler, G.N., Keller, C., & Lyon, D.W. (2000). Unraveling the determinants and consequences of an innovation-supportive culture. *Entrepreneurship Theory and Practice*, *25*(1), 43–58.

Charney, A.H. & Libecap, G.D. (2003). The contribution of entrepreneurship education: An analysis of the Berger program. *International Journal of Entrepreneurship Education*, *1*(2), 1–34.

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *Sociology*, *6*, 1–21.

Cooke, N.J., Salas, E., Cannon-Bowers, J.A., & Stout, R. (2000). Measuring team knowledge. *Human Factors*, *42*, 151–173.

Cooper, A.C., Gimeno-Gascon, F.J., & Woo, C.Y. (1994). Initial human and financial capital as predictors of new venture performance. *Journal of Business Venturing*, *9*(5), 371–396.

Cope, J. (2003). Entrepreneurial learning and critical reflection. *Management Learning*, *34*(4), 429–450.

Cyert, R.M. & March, J.G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

Davidsson, P. & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, *18*, 301–331.

Dess, G.G. & Beard, D.W. (1984). Dimensions of organizational task environments. *Administrative Science Quarterly*, *29*(1), 52–73.

Dillman, D.A. (1978). *Mail and telephone survey: The total design method*. New York: John Wiley and Sons.

Dimov, D.P. & Shepherd, D.A. (2005). Human capital theory and venture capital firms: Exploring "home runs" and "strike outs." *Journal of Business Venturing*, *20*(1), 1–21.

Durkan, P., Harrison, R., Lindsay, P., & Thompson, E. (1993). Competence and executive education and development in an SME environment. *Irish Business Administration Research*, *14*(1), 65–80.

Ebel, R.L. (1951). Estimation of the reliability of ratings. *Psychometrika*, *16*, 407–424.

Eisenhower, D., Mathiowetz, N.A., & Morganstern, D. (1991). Recall error: Sources and bias reduction techniques. In P.P. Biemer, R.M. Groves, L.E. Lyberg, N.A. Mathiowetz, & S. Sudman (Eds.), *Measurement errors in surveys* (pp. 127–144). New York: Wiley.

Gasse, Y. (1997). *Entrepreneurial-managerial competencies and practices of growing SMEs—Summary of results from an empirical study (preliminary)*. Quebec: Centre for Entrepreneurship and SME and Entrpreneiurat Laval, Universite Laval.

Gimeno, J., Folta, T.B., Cooper, A.C., & Woo, C.Y. (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly*, *42*, 750–783.

Govindarajan, V. & Trimble, C. (2004). Strategic innovation and the science of learning, MIT. *Sloan Management Review*, *45*(2), 67–75.

Guzzo, R.A., Jette, R.D., & Katzell, R.A. (1985). The effects of psychologically based intervention programs on worker productivity: A meta-analysis. *Personnel Psychology*, *38*, 275–291.

Hanks, S.H., Watson, C.J., Jansen, E., & Chandler, G.N. (1993). Tightening the life-cycle construct: A taxonomic study of growth stage configurations in high-technology organizations. *Entrepreneurship Theory and Practice*, *18*(2), 5–30.

Harrigan, K.R. (1983). Research methodologies for contingency approaches to strategy. *Academy of Management Review*, *8*, 398–405.

Hicks, W.D. & Klimoski, R.J. (1987). Entry into training programs and its effects on training outcomes: A field experiment. *The Academy of Management Journal*, *30*(3), 542–552.

Honig, B. (2001). Learning strategies and resources for entrepreneurs and intrapreneurs. *Entrepreneurship Theory and Practice*, *26*(1), 21–34.

Huber, G.P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science*, *2*(1), 88–115.

Hunt, J.M. (1998). *Toward the development of a competency model of family firm leadership*. Paper presented to the 12th Annual National Conference. United States Association for Small Business and Entrepreneurship, Clearwater, FL, January, pp. 15–18.

Ireland, R.D., Hitt, M.A., Camp, S.M., & Sexton, D.L. (2001). Integrating entrepreneurship and strategic management actions to create firm wealth. *The Academy of Management Executive*, *15*(1), 49–63.

Kahneman, D. & Tversky, A. (1973). On the psychology of prediction. *Psychological Review*, *80*, 237–251.

Kazanjian, R.K. & Drazin, R. (1990). A stage-contingent model of design and growth for technology based new ventures. *Journal of Business Venturing*, *5*(3), 137–150.

Ko, S. (2004). Bisociation and opportunity. In J.E. Butler (Ed.), *Opportunity identification and entrepreneurial behavior* (pp. 99–114). Greenwich, CT: Information Age Publishing.

Kraatz, M.S. (1998). Learning by association? Interorganizational networks and adaptation to environmental change. *The Academy of Management Journal*, *41*(6), 621–643.

Lau, T., Chan, K.F., & Man, T.W.Y. (1999). Entrepreneurial and managerial competencies: Small business owner-managers in Hong Kong. In P. Fosh, A.W. Chan, W.W.S. Chow, E. Snape, & R. Westwood (Eds.), *Hong Kong management and labour: Change and continuity* (pp. 220–236). London: Routledge.

Levitt, B. & March, J.G. (1988). Organizational learning. *Annual review of sociology*, *14*, 319–340.

Lichtenstein, B., Lumpkin, G., & Shrader, R. (2003). Organizational learning by new ventures: Concepts, strategies and applications. In J.A. Katz & D. Shepherd (Eds.), *Advances in entrepreneurship Vol 6: Cognitive approaches to entrepreneurship* (pp. 11–36). Oxford: Elsevier Science.

Man, T.W.Y., Lau, T., & Chan, K.F. (2002). The competitiveness of small and medium enterprises: A conceptualization with focus on entrepreneurial competencies. *Journal of Business Venturing*, *17*(2), 123–142.

March, J.G. (1988). *Decisions and organizations*. Oxford: Blackwell.

March, J.G. & Sutton, R.I. (1997). Organizational performance as a dependent variable. *Organization Science*, *8*, 698–706.

McClelland, D.C. (1987). Characteristics of successful entrepreneurs. *Journal of Creative Behavior*, *21*(1), 18–21.

McGee, J.E. & Sawyerr, O. (2003). Uncertainty and information search activities: A study of owner-managers of small high-technology manufacturing firms. *Journal of Small Business Management*, *41*(4), 385–401.

Messick, S. (1989). Validity. In R.L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 13–103). New York: Macmillan.

Miller, D. & Droge, C. (1986). Psychological and traditional determinants of structure. *Administrative Science Quarterly*, *31*(4), 539–560.

Miner, A.S. & Haunschild, P.R. (1995). Population level learning. In L.L. Cummings & B.M. Staw (Eds.), *Research in organizational behavior* (Vol. 17, pp. 115–166). Greenwich, CT: JAI Press.

Minniti, M. & Bygrave, W. (2001). A dynamic model of entrepreneurial learning. *Entrepreneurship Theory and Practice*, *25*(3), 5–16.

Mitton, D.G. (1989). The complete entrepreneur. *Entrepreneurship Theory and Practice*, *13*(3), 9–19.

Nunnally, J.C. (1978). *Psychometric theory*. New York: McGraw-Hill.

Phillips, J.M. & Gully, S.M. (1997). Role of goal orientation, ability, need for achievement, and locus of control in the self-efficacy and goal-setting process. *Journal of Applied Psychology*, *82*(5), 792–802.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., & Podsakoff, N.P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903.

Priem, R.L., Rasheed, A.M.A., & Kotulic, A.G. (1995). Rationality in strategic decision processes, environmental dynamism and firm performance. *Journal of Management*, *21*(5), 913–929.

Ravasi, D. & Turati, C. (2001). *Technology development and learning in entrepreneurial firms*. SDA Bocconi, Research Division Working Paper No. 01-59.

Reuber, A.R. & Fischer, E.M. (1994). Entrepreneurs' experience, expertise, and the performance of technology-based firms. *IEEE Transactions on Engineering Management*, *41*(4), 1–10.

Richman, T. & Koontz, C. (1993). How benchmarking can improve business reengineering. *Strategy and Leadership*, *21*(6), 26–55.

Royer, J.M., Cisero, C.A., & Carlo, M.S. (1993). Techniques and procedures for assessing cognitive skills. *Review of Educational Research*, *63*(2), 201–243.

Salas, E. & Cannon-Bowers, J.A. (2001). The science of training: A decade of progress. *Annual Review of Psychology*, *52*, 471–499.

Scherer, R.F., Adams, J.S., Carley, S.S., & Wiebe, F.A. (1989). Role model performance effects on development of entrepreneurial career preference. *Entrepreneurship Theory and Practice*, *13*(3), 53–71.

Sharfman, M.P. & Dean, J.W. (1991). Conceptualizing and measuring the organizational environment: A multidimensional approach; a critique and suggestions; dimensions and constructs: A response to Dess and Rasheed. *Journal of Management*, *17*(4), 681–700.

Simon, H.A. (1991). Bounded rationality and organizational learning. *Organization Science*, *2*, 125–134.

Snell, R. & Lau, A. (1994). Exploring local competencies salient for expanding small businesses. *Journal of Management Development*, *13*(4), 4–15.

Southwood, K.E. (1978). Substantive theory and statistical interaction: Five models. *American Journal of Sociology*, *83*, 1154–1203.

Trochim, W. & Donnelly, J.P. (2006). *The research methods knowledge base*, 3rd ed. Cincinnati, OH: Atomic Dog Publishing.

Tushman, M.L. & Romanelli, E. (1985). Organizational evolution: A metamorphosis model of convergence and reorientation. In L.L. Cummings & B.M. Staw (Eds.), *Research in organizational behavior* (Vol. 7, pp. 171–222). Greenwich, CT: JAI Press.

Ucbasaran, D., Lockett, A., Wright, M., & Westhead, P. (2003). Entrepreneurial founder teams: Factors associated with member entry and exit. *Entrepreneurship Theory and Practice*, *28*(2), 107–127.

Ulrich, D. (1998). A new mandate for human resources. *Harvard Business Review*, *76*(1), 124–134.

Van Buren, M.E. & Erskine, W. (2002). *The 2002 ASTD state of the industry report*. Alexandria, VA: American Society of Training and Development.

Venkatraman, N. (1989). The concept of fit in strategy research: Toward verbal and statistical correspondence. *Academy of Management Review*, *14*(3), 423–444.

Wiersema, M.F. & Bantel, K.A. (1993). Top management team turnover as an adaptation mechanism: The role of the environment. *Strategic Management Journal*, *14*(7), 485–504.

Zahra, S. & Bogne, W. (2000). Technology strategy and software new ventures' performance: Exploring the moderating effect of the competitive environment. *Journal of Business Venturing 15*(2), 135–173.

Zahra, S. & Filatotchev, I. (2004). Governance of the entrepreneurial threshold firm: A knowledge-based perspective. *Journal of Management Studies*, *41*(5), 885–897.

Gaylen N. Chandler is the Barton Distinguished Chair in Entrepreneurship at the Barton School of Business, Wichita State University.

Douglas W. Lyon is Associate Professor of Management at the School of Business Administration, Fort Lewis College.