

**SOCIO-COGNITIVE FOUNDATIONS OF ENTREPRENEURIAL VENTURING**

by

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## **DEDICATION**

*To my family, wife Angela and children Robert and Catherine,  
for their support and patience.*

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Many of the best things in life seem to be the result of extraordinary good fortune or some kind of wonderful fate. This is certainly the case with my PhD program – I came to Case Western with a wide range of interests but no clear research focus. I began searching for a core topic and advisers with whom I could share interests which led to a series of fortuitous events that were turning points in my doctoral experience. Everyone in my cohort wrote a paper for Richard Boyatzis during our first semester about our personal vision and goals for pursuing a PhD. Richard’s comments on my paper pointed out (several times) that I would be crazy not to incorporate my interest in creativity and the arts into my research program. This was a major shift in my thinking; away from trying to do something properly “academic” that might have a valuable impact on knowledge to doing something fun and interesting. The best advice I received early on was to make sure the research topic fascinated me sufficiently to sustain interest through the trials and tribulations of doctoral research. I would like to thank Richard for his early

guidance and support during this critical early phase of defining and focusing my research.

The second important event came while surveying literature related to creativity and innovation. I was surprised at how little had been published about the creative process within entrepreneurship but I did see a few papers linking David Kolb's experiential learning theory to entrepreneurial innovation and was intrigued with what I read. Meeting Dave was a huge turning point in my search for a research focus and my relationship with him has been a major high point for me, not just within this program, but for my life in general. Working with Dave as an advisor and committee chair has been an incredible stroke of good fortune and I cannot imagine a more supportive, professional and engaging research advisor. I will be forever grateful for Dave's help and guidance.

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# Socio-Cognitive Foundations of Entrepreneurial Venturing

Abstract

by

ROBERT M. GEMMELL

This dissertation employs a mixed methods approach to explore cognitive and social dimensions of entrepreneurial creativity and innovation. I interviewed 32 technology entrepreneurs to generate a grounded theory about how technology entrepreneurs use social behaviors, techniques and cognitive processes to attain, develop, refine, validate and filter (for usefulness) creative ideas for successful new products, processes or services. The results reveal a complex, cyclical and recursive multi-level social process with emphasis on iterative active and social experimentation. Successful entrepreneurs use experimentation to facilitate and accelerate learning, preferring to succeed or fail quickly. Greatest ideational productivity occurs when strong social ties interactively solve problems in an environment of trust – in particular, when “Trusted Partners” exchange and refine ideas through a form of shared cognition.

In the second study, I surveyed 172 technology entrepreneurs to determine the effects of learning style and learning flexibility on iterative decision methods and innovation decision speed, behavioral mediators hypothesized to produce entrepreneurial

innovation and success. The Kolb learning style preference for active experimentation predicted the entrepreneur's use of iterative methods to innovate and achieve success. The anticipated positive indirect influence of learning flexibility on innovation surprisingly occurred via a chain of two consecutive negative effects. Entrepreneurs with high learning flexibility move less swiftly to make key strategic innovation decisions; however, in doing so they are more innovative.

The final study explores the traits and interactions of "Trusted Partners" and their impact upon entrepreneurial learning capacity, innovativeness and firm performance. I surveyed 153 technology entrepreneurs, all of whom report having a Trusted Partner, and discovered that effective partnerships more likely develop between two individuals with broad combined expertise (high Partner Functional Breadth). However, partner expertise diversity negatively affected the ability of partners to engage in constructive learning interactions and exploratory learning. I conclude that cofounder/partners ideally need both breadth and significant expertise overlap to facilitate the shared language and vision necessary for productive collaborative learning interactions. These findings show that broad but overlapping partner/co-founder expertise, when combined with a strong sense of personal trust, leads to elevated absorptive capacity, innovation and performance within entrepreneurial firms.

**Key words:** Absorptive capacity; collaboration; cognition; creativity; entrepreneurship; experimentation; expertise; innovation; learning; partners; product development.

## CHAPTER I: INTRODUCTION

There has been surprisingly little written about creativity and entrepreneurship in spite of the fact that entrepreneurship was described early on as a process of “creative destruction” (Schumpeter, 1947). Studies of strategic innovation are commonplace but usually focus on abstract firm level processes and environmental factors, dismissing the individuals who compose organizations (Lane, Koka, & Pathak, 2006). Conversely, entrepreneurial behavior studies focus too much on the individual, framing the entrepreneur as a lone operator while losing sight of the social dimensions of creativity. The mischaracterization of entrepreneurship as a solitary practice remains prevalent in literature in spite of data showing that many new ventures would never have formed without the contributions of at least one other key supporting actor/co-founder (West, 2007).

I selected the technology industry as a compelling and appropriate setting for our study of creative cognition and behavior. Domain knowledge is a fundamental component of creativity and technology innovation requires a rare blend of expert knowledge and freedom from the biases of such knowledge in order to create new paradigms (Amabile, 1983; Frensch & Sternberg, 1989).

There is strong evidence that the analytical proclivity of an expert engineer or scientist is cognitively contrary to the more open and free thinking approach of a creative person in the arts or advertising. Kolb and Kolb’s (2005a) paper comparing learning styles of Case Western Reserve undergraduates (most of whom were majoring in engineering or business) to Case Western Reserve graduate business students and students at Cleveland Institute of Art revealed the prevalence of “northern” learning

styles among creative arts students who prefer a hands-on approach to learning with emphasis on divergent thinking versus the “southern” predominantly convergent and analytical styles of business and engineering students. Creativity leading to innovative new products is a messy, risky and non-linear process that is antithetical to the well-developed analytical capabilities of technical domain experts (Pinard & Allio, 2005).

I had, over the course of a 30 year career as a senior executive in the technology industry, observed first-hand the plight of visionary domain experts struggling to become successful and innovative entrepreneurs. This phenomenon is so prevalent within the technology industry that brilliant engineers are commonly presumed a priori to be good company founders but rarely good CEOs. The difference between the inventor and the successful leader entrepreneur is often attributed to introversion or underdeveloped social skills—which might be the case—but I suspected the gap might also originate from cognitive traits common to domain experts i.e. relatively inflexible schemas, biases and proclivity to over-analyze (Dane, 2010).

The inventor who launches a technology start-up company is usually replaced at some point by a CEO deemed by investors to possess a more balanced set of cognitive and social traits – however, this new CEO probably has advanced training in engineering and business and is almost certainly an expert in the relevant technologies and markets. The expertise that qualifies someone to manage such an enterprise also makes them vulnerable to biases and cognitive entrenchment exemplified by an inability to flexibly engage in the highly dynamic learning process of creativity and innovation (Dane, 2010). In spite of the challenges posed by high level expertise, some entrepreneurs seem to

easily navigate the ever changing minefield, abandoning old paradigms and creating entirely new innovative solutions.

The goal of this research has been to gain a better understanding of the unique cognitive and social traits and behaviors of entrepreneurial and innovative domain experts in the technology industry. The research program maintained fluid continuity throughout the three studies by virtue of solid research design and by building upon the rich findings of the first qualitative study. The research focus remained steady and unwavering throughout while each of the studies unveiled new insights, refinement and clarity to the problem and phenomenon being examined.

### **Research Design and Dissertation Structure**

This research was designed from the outset as a mixed methods program blending qualitative and quantitative empirical methods. The first study is a grounded theory exploration of how innovative technology entrepreneurs attain and develop creative ideas for new products. The findings of this first qualitative study provided the framework and research model for two follow-on quantitative empirical studies examining different facets of the model (Morse & Neihaus, 2009; Nastasi et al., 2007). This mixed methods approach blends the advantages of qualitative research (rich, multi-dimensional and colorful insight) with the granularity and statistical precision of structural equation modeling. The three studies are situated within chapters 3, 4 and 5 and readers can, if they wish, examine each chapter individually as a stand-alone exposition of that particular study.

Chapters 3, 4 and 5 include literature reviews relevant to the particular study and we include a broad review of the literature within our domain of study as a prologue in

Chapter 2. Chapter 6 serves as an integrative discussion section, reflecting upon the full breadth of all three studies while looking forward to potential future follow-on research.

## **CHAPTER II: BACKGROUND LITERATURE REVIEW: ENTREPRENUERIAL LEARNING AND INNOVATION**

### **Introduction**

Crossan and Apaydin (2010) point out in their recent review of organizational innovation that only a small percentage of articles have been written on the individual or team level (11%) and suggest that studies of entrepreneurial innovation provide a useful context for examining the leadership and managerial levers portion of their model, i.e. the segments that depend most on individual or team agency. Crossan's leadership and management levers components reflect the "upper echelon theory" perspective whereby the innovation of a firm is driven by traits and actions of the CEO or top management or founding team who use strategies, structures, resource allocations, organizational learning processes and organizational cultures to support and facilitate firm level innovation.

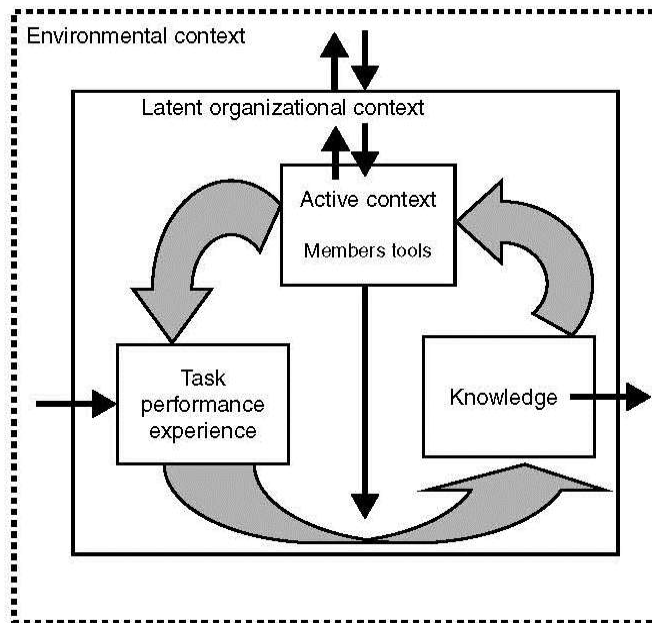
Organizational learning, defined as "the change in the organization that occurs as the organization acquires experience" (Argote & Miron-Spektor, 2011: 1124) through processes of exploratory and exploitative innovation (March, 1991; Van de Ven, 1999), has played an especially prominent role in studies of innovation.

Learning is multi-level knowledge acquisition process situated within the environmental context of the organization (Hutchins 1991; Lave & Wenger, 1990). Argote's learning cycle (see Figure 1 below) approaches organizational learning from a strongly task oriented operational perspective and includes the sub-processes of knowledge creation from direct experience, knowledge transfer from others and knowledge retention by virtue of knowledge flowing into active context (Argote &



Miron-Spektor, 2011). These sub-processes function within the organizations learning context while interacting with the extra-firm environment.

**FIGURE 1**  
**Theoretical Framework for OL**  
(Argote & Miron-Spektor, 2011)



Knowledge is complex, multi-dimensional and can be either explicit (easily communicated) or tacit which is less tangible and more difficult to transfer (Nonaka, 1994). Other knowledge dimensions include content (tasks, interactions), spatial (geographic by nature), temporal (frequency, pace, timing and rarity) and mindfulness. Heterogeneity of experiences (experience variety across dimensions) has been shown to enhance learning (Schilling, Vidal, Ployhart, & Marangoni, 2003), a finding that contradicts the intuitive advantages of specialization.

Some (especially exploratory) knowledge creation processes such as analogical reasoning are more mindful and therefore demand greater attention (Weick & Sutcliffe,

2006) while other learning processes are more routinized and therefore require less attention (Levinthal & Rerup, 2006). Organizations that successfully balance both mindful and routinized learning processes achieve an ambidexterity that saves cognitive capacity for high demand activities. Knowledge retention can also be more or less mindful – some routines are retained and recalled by rote while others involve more reflection and potential for adaptation (Williams, 2007).

Researchers struggle to consolidate various theories of innovation and organizational learning into a unified theory that transcends context, purpose, methods and disciplinary perspective (Crossan, Maurer, & White, 2011; Easterby-Smith, Snell, & Gherardi, 1998). There are four primary dimensions of divergence among organizational learning thought leaders: (1) purpose of organizational learning (Teleology), (2) definition of organizational learning (Ontology), (3) preference for different research methods (Epistemology) and (4) operationalization and interventional techniques (Easterby-Smith et al., 1998). Not surprisingly, researchers from different disciplines approach organizational learning differently – psychologists are most interested in the cognitive human development aspects of learning while strategists focus on the influence of interactions between organizations or the organization and its environment on competitiveness. Information scientists view learning through a data processing lens and operations specialists focus on learning as a means to improved productivity.

Organizational theory development stems from widely varying theoretical orientations such as behaviorism (stimuli-response mechanisms), cognitivism (cognition as a separate process from behavior), humanism (human values) and social pedagogy

(learning through interaction with peers). While some theories straddle or combine elements of these various categories, there is no unified theory of organizational learning.

The individual has been lost in much of this innovation and learning research, a condition rooted in the false assumption that individuals are innately homogeneous by nature and therefore exhibit collective behaviors and actions that can be modeled accurately with firm-level constructs (Felin & Zenger, 2009). Felin points out that in spite of a recent organizational capabilities trend in strategic innovation research, theorists have struggled to define even basic concepts such as “routines” and “capabilities” and little has been done to link these concepts to action. Felin and Crossan suggest that entrepreneurial ventures provide a useful setting to examine the micro-foundations of innovation and organizational learning through the actions and behaviors of company founders.

### **Experiential Learning**

A core theory utilized in our research is the Kolb Experiential Learning Theory (ELT) (Kolb, 1984). The Kolb experiential learning theory has been applied to the real world issues of problem solving, entrepreneurial innovation and organizational learning in a variety of domains including entrepreneurship. The principles of experiential learning permeate other similar theories of learning, demonstrating the vast impact of experiential learning on scholars.

According to Kolb, learners have a preference for certain learning modes of grasping and transforming experience into understanding which he defines as “learning style.” Learning style can be correlated to career choices, i.e. learners with a diverging style are often interested in the arts while convergent learners tend to be specialists in

technical fields. Assimilative learners are usually interested in theory and abstract problem solving while accommodative learners gravitate toward action oriented careers such as marketing and sales. Learners may also have a balanced or flexible style that allows them to adapt their learning on a situational basis (Kolb & Kolb, 2005a; Sharma & Kolb, 2009).

### **Team Learning**

Researchers have struggled to define the “entrepreneurial team” – some have chosen a strict definition that includes only the founders who are also major shareholders while others have taken a somewhat broader view of the team to include non-founding senior managers (Cooney, 2005). Most firms start with a small team organized based upon interpersonal relationships (familiarity and homophily) (Ruef, Aldrich, & Carter, 2003) and later expand for pragmatic reasons, i.e. to add needed expertise to the team (Forbes, Borchert, Zellmer-Bruhn, & Sapienza, 2006). Start-ups with narrowly focused top management teams (TMT) struggle later to fill out the team as needed to support company growth (Beckman & Burton, 2008). University start-ups particularly struggle with starting team homogeneity and commonly suffer from a lack of diversity and constructive conflict necessary for higher performance (Ensley & Hmieleski, 2005).

According to upper echelon theory, the performance of the TMT is intertwined with the firm performance. Firms with stronger teams are more likely to perform well and the performance of the firm reflects on the quality of the TMT (Hambrick & Mason, 1984). TMTs struggle to balance the cohesion necessary for convergent decision making with the conflict that is a natural by-product of team diversity to attain innovation (Ensley, Pearson, & Amason, 2002). Top management team cohesion leads to improved

firm performance through two mediators: cognitive conflict and affective conflict. Cohesive teams are more likely to engage predominantly in cognitive conflict, thus resulting in improved firm performance both directly from cognitive debate and indirectly by avoiding the negative effects of affective conflict (Ensley et al., 2002). Entrepreneurs are often characterized as optimistic by nature; however, a recent study has shown that entrepreneurial optimism is negatively related to firm performance, particularly in highly dynamic industries (Hmieleski & Baron, 2009). Team cohesion, cognitive conflict and realism are key elements of entrepreneurial innovation and performance.

Entrepreneurial firms struggle to align limited resources to either exploit “old certainties” (March, 1991: 71) or explore new possibilities, knowing they lack the resources to do both and realizing that exploration could offer higher growth but exploitation lower risk (March, 1991). Top management team (TMT) composition in a start-up firm has been shown to influence the firm’s pursuit of exploitation or exploration as a successful strategy (Beckman, 2006). Founding teams with a diverse work history (coming from different companies) are more likely to pursue an exploratory strategy because they bring different ideas and network ties into the firm. Conversely, teams formed by individuals who all worked together at their previous company are more likely to pursue an exploitative strategy because they have already established shared mental models and more likely bring mature organizational routines and procedures from their previous company that allows them to quickly exploit known opportunities.

Kolb experiential learning theory has been applied to team level learning (Kayes, Kayes, & Kolb, 2005), a natural extension of Kurt Lewin’s early concepts of

conversational space for teams to reflect on shared experience (Lewin, 1948). Kayes et al. utilized Mills' (1967) team development theory, a five stage progression toward increasingly more sophisticated team goals and purpose: immediate gratification, sustained gratification through greater learning efforts, identification and pursuit of a collective goal, self-determination through conscious directed effort to achieve collective goals and growth to achieve multiple increasingly complex goals requiring higher levels of innovation.

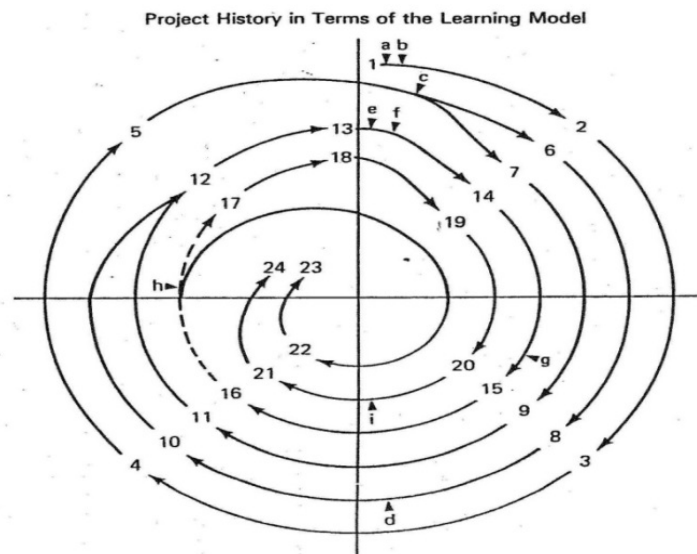
According to Kayes et al., shared purpose is the defining moment when the team begins to operate as a learning unit rather than simply a collection of individuals. Optimal team size is a balance between sufficient size to be effective without being too large to function and communicate and coordinate activities. Trust and a sense of safety, especially when expressing ideas to the group, are important to team performance (Edmondson, 1999; Kayes et al., 2005).

Teams composed of individuals with learning style preferences covering the complete learning cycle will more easily function through the complete learning role taxonomy (Kayes et al., 2005). A balanced team can be difficult to attain, especially since individuals are often attracted to certain career fields based upon their learning style (Kolb & Kolb, 2005a). It is desirable, although sometimes difficult, to allocate team work by matching each project stage with someone whose style matches the demands of that stage (Kayes et al., 2005).

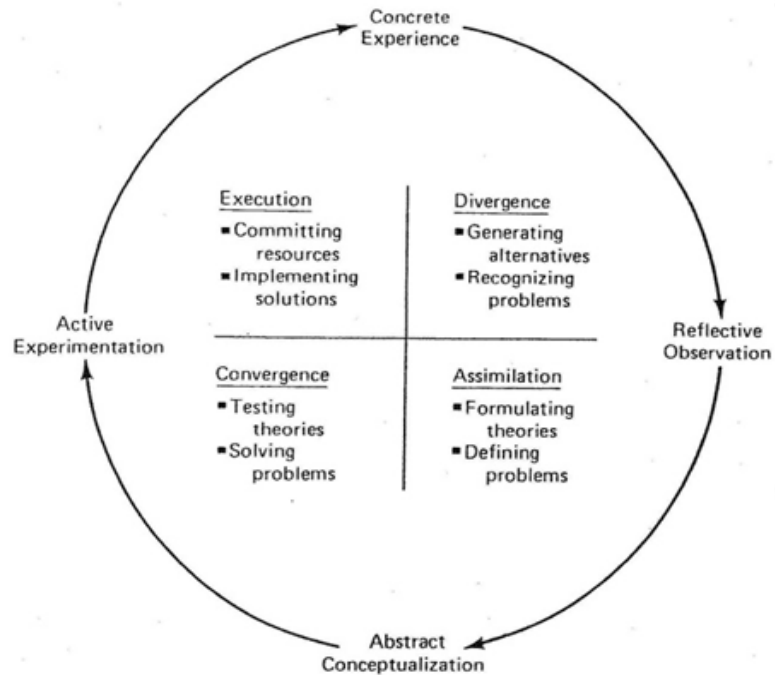
Kolb's experiential learning theory has been used to study the processes of team innovation within an R&D setting (Carlsson, Keane, & Martin, 1976). The research team in this study analyzed bi-weekly reports written by members of the corporate R&D teams

in order to map activities into the Kolb experiential learning space. Research activities generally followed the clockwise sequence of stages within the experiential learning space with minimal deviation (see Figure 2). Managers “looked ahead” one or two stages in order to anticipate upcoming challenges and addressed issues of entrenchment (Dane, 2010) by becoming more directly involved when a team became “stuck” at a particular stage. The researchers found that project team work could be improved by allocating work by matching learning style of the individual with the learning stage orientation of the particular task (see Figure 3 below). Effective managers resisted the temptation to jump across stages to accelerate projects and employed interventional techniques to address problems based upon the stage of the project.

**FIGURE 2**  
**R&D Activities Mapped Into the Experiential Learning Space**  
 (Carlsson, Keane, & Martin, 1976)



**FIGURE 3**  
**Task Orientation Mapped Into Experiential Learning Space**  
 (Carlsson, Keane, & Martin, 1976)



A meta-review of team learning models by Knapp (2010) compared the Kayes, Kolb team learning model to three other models by Edmonson (1999), McCarthy and Garavan (2008) and Van den Bossche, Gijsselaers, Segers, and Kirschner (2006) as summarized in the Table 1 below.



**TABLE 1**  
**Summary of Team Learning Models**  
(Knapp, 2010)

Team Learning Model Summary

Author(s)	Conceptualization of Collective Learning	Learning Process Model	Method/Context	Key Findings
Edmondson (1999)	Team learning as a process of reflection and adaptation influenced by psychological safety	I-P-O model of antecedents, behaviors, learning, and performance	Mixed method study of a single manufacturing company; small groups and work teams	Engaging in learning behavior in a team is highly dependent on team psychological safety
Kayes, Kayes, & Kolb (2005)	Learning in teams as a process of knowledge creation through the transformation of the group experience	Team learning as an IMOI model and process of altering roles and contexts	Meta-analysis of three contexts in the management research literature; applies to small group or teams	Team leader behavior, learning goals, tasks, and composition influence learning and are moderated by climate
McCarthy & Garavan (2008)	Team learning conceptualized as collective metacognition and reflexivity based on social cognitive theory.	Team learning IMOI model as a process of identification, diffusion, integration, and action	Literature review and conceptual model development; HRD research and practice on work team learning	Propose that team metacognitive processes can enhance a team's understanding of their context
Van den Bossche et al. (2006)	View collaborative learning as a social process of reaching mutually shared cognition	Use I-P-O model of interpersonal, sociocognitive, and mutually shared cognition	Survey of student teams in collaborative learning environments	Mutually shared cognition mediates between team learning and performance

Each model is based on either the “input-process-output” (IPO) or “input-mediator-output-input” (IMOI) process structure. Each model has certain unique elements, i.e. Edmondson focuses on the need for team members to feel safe expressing ideas to the team (analogous to Kolb’s vision of a learning space), McCarthy emphasizes the meta-cognitive aspects of team learning (another perspective) while Van den Bossche perceives team learning as a process of shared cognition.

## Other Prominent Learning Theories

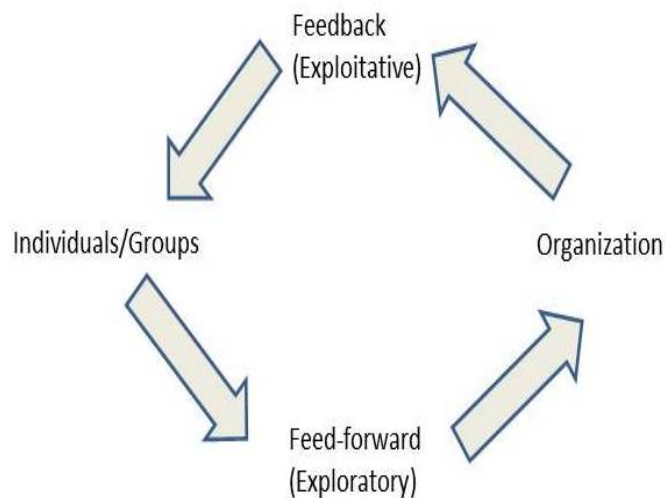
Crossan, Lane, and White's (1999) 4I framework of organizational learning sought to advance the development of an overarching theory of organizational learning and was recognized by AOM as the most cited paper of the decade. There are similarities between 4I and experiential learning theory (see Figure 4 below) with strong parallels between Crossan's intuiting, interpreting and integrating sub-processes and Kolb's divergent, assimilative and convergent stages. Institutionalization is (from the cognitivist perspective) the coding of shared mental models and can be viewed as analogous to Kolb's Accommodation on an organizational level.

**FIGURE 4**  
**Learning Model Summary**  
 (Crossan, Lane, & White, 1999)

<b>Learning/Renewal in Organizations: Four Processes Through Three Levels</b>		
Level	Process	Inputs/Outcomes
Individual	Intuiting	Experiences Images Metaphors
	Interpreting	Language Cognitive map Conversation/dialogue
Group	Integrating	Shared understandings Mutual adjustment Interactive systems
Organization	Institutionalizing	Routines Diagnostic systems Rules and procedures

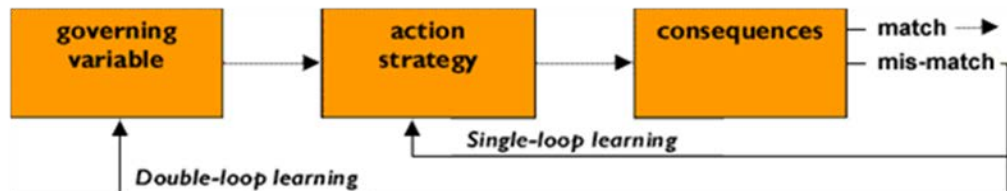
Crossan et al. (1999) envisions institutionalization as a process of feedback and feed forward (see Figure 5 below) that is analogous to exploratory-exploitative learning. Individual learning feeds forward from individuals and groups, however, the organization may have limited capacity to absorb the new learning in which case it “stockpiles” unless the individuals become frustrated and leave the firm (Cohen & Levinthal, 1990). Individuals endeavor to diffuse their exploratory learning into the organization simultaneously to the organization pushing exploitative innovations back to individuals through procedures intended to improve repeatability and efficiency. Institutionalization does not necessarily occur through dictated mandates but can also materialize organically through a set of shared perspectives or guidelines established by precedent (Eisenhardt & Sull, 2001). Balancing exploitative and exploratory processes has been shown to provide entrepreneurial firms with their best opportunity for rapid growth (Beckman, 2006).

**FIGURE 5**  
**Cycles of Exploratory and Exploitative Multi-Level Learning**  
(Crossan et al., 1999)



Argyris and Schön (1978) view learning as a form of error correction through iterative cyclical loops of reflection and action. Single-loop learning (SLL) is the repeated attempt at the same problem, with no variation of method and without ever questioning the goal. Double-loop learning (DLL) posits that an individual, organization or entity, having attempted to achieve a goal on different occasions, can question, modify or even reject the goal in light of experience. Triple Loop Learning involves an additional loop for the learners to question whether the right goal is being addressed by raising the question: are we learning the right things? The values that learners reflect upon and question implicitly within Kolb's experiential learning are explicit within double and triple loop learning.

**FIGURE 6**  
**Single/Double Loop Learning**  
 (Argyris & Schön, 1978)

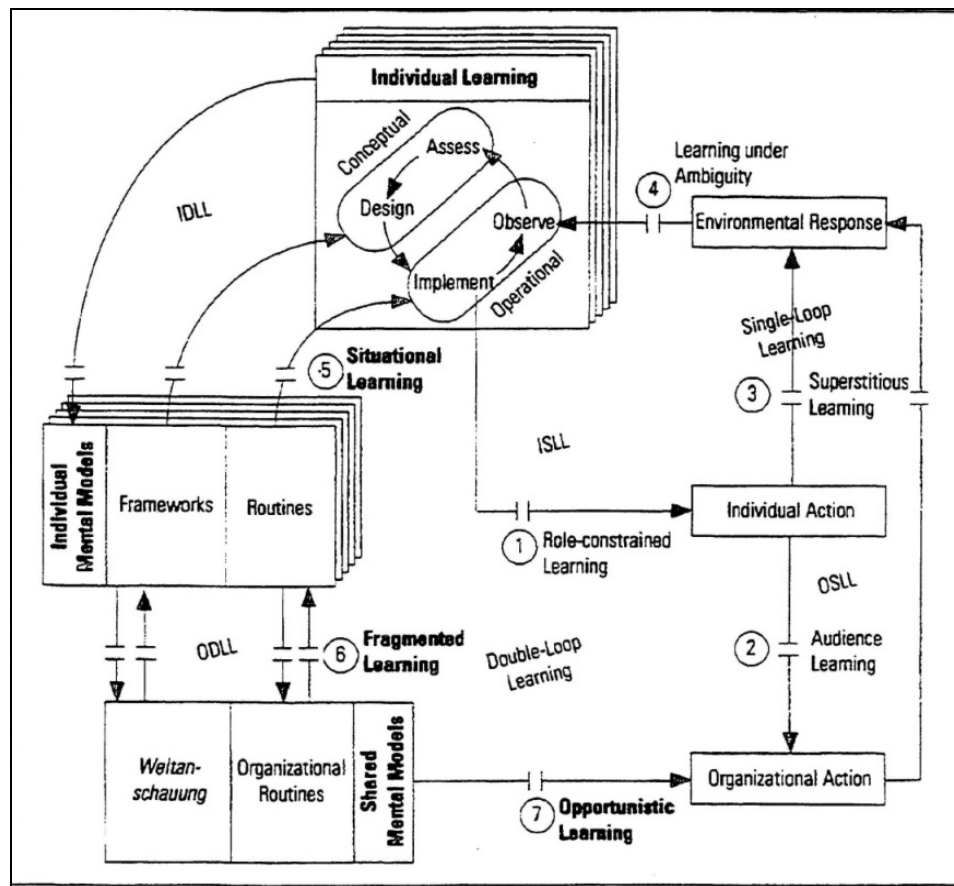


Learning through reflection on experience is at the core of both Kolb's theory and single/double loop learning as developed by Argyris and Schön (1978). Most notable learning theories include some aspect of processing experience through reflection (Prange, 1997) and the origins of reflectivity can be found much earlier in the writings of John Dewey (1922). Kolb's theory is based upon transformation of experience through reflection and action and envisions a spiral course toward understanding that incorporates

all aspects of human experience and development – cognition, emotional, physical and social.

Kim’s integrated model (1993) includes “organizational memory” in the form of shared mental models and organizational routines that are fed by loops of learning between individuals and the organization (see Figure 7 below).

**FIGURE 7**  
**Integrated Model of Organizational Learning**  
 (Kim, 1993)



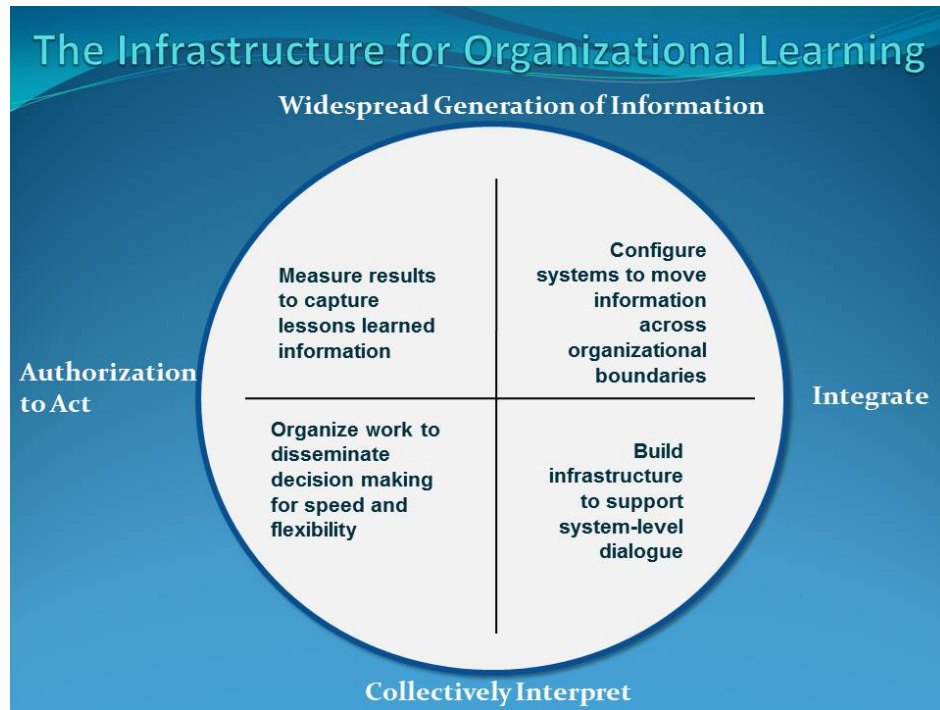
Dixon (1999) extended experiential learning cycles to the organizational level, taking a relatively path independent view of learning as constant construction and reconstruction of meaning and as such, the initial conditions of knowledge are less

important than the process. Dixon's model includes a framework for collective organizational learning mechanisms such as structured procedures for managerial decision making on behalf of the firm, delegating decision making authority within the firm and defining boundaries between the firm and the outside world.

Dixon envisions an ideal meaning structure with three concentric layers: collective meanings (norms and assumptions) at the core, a middle layer of accessible meanings and an outer layer of private meaning. Dixon posits that organizational learning capacity is based on the prominence of accessible meanings because they can be shaped and exchanged between private and collective.

As companies grow and expand into divisions or business units, the corporate collective meaning structure often fragments into multiple collective and accessible meaning structures (one per division). Dysfunctional companies operate in extremes – a tradition bound company will form a very large collective meaning space leaving a reduced private space while an independent worker company exhibits the opposite characteristics, i.e. a small collective space and very large private.

**FIGURE 8**  
**OL Model Based on Experiential Learning Theory**  
(Dixon, 1999)



### **Metacognitive Learning**

Metacognition refers to “the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in service of some concrete goal or objective” (Flavell, 1976: 232). Flavell further defines meta-cognition as having four dimensions: (1) knowledge or awareness of personal learning traits; (2) experiences or affective senses during learning; (3) goals; and (4) strategies or behaviors to attain goals.

Conscious regulation of learning processes requires significant self-awareness of the knowledge dimension of Flavell’s model, i.e. personal learning traits and how those traits interact with others in various social learning contexts. The Kolb Learning Style

Inventory (Kolb & Kolb, 2005b) measures an individual's learning mode preference (defined as their learning style) along with contextual adaptability, i.e. learning flexibility (Sharma & Kolb, 2009). The Kolb assessment includes useful interpretative reports that help learners understand their learning preferences and to pursue developmental exercises. For example, someone with a strong predilection for abstract analysis can consciously engage in hands-on experiential activities such as fine arts, an intervention that has been shown to be effective in the development of creativity skills for entrepreneurship students (Pinard & Allio, 2005). Argyris also incorporates reflective meta-cognitive learning concepts - double and triple loop learners consciously adjust mental models by examining learning motives, values, principles under dynamic conditions (Argyris & Schön, 1978).

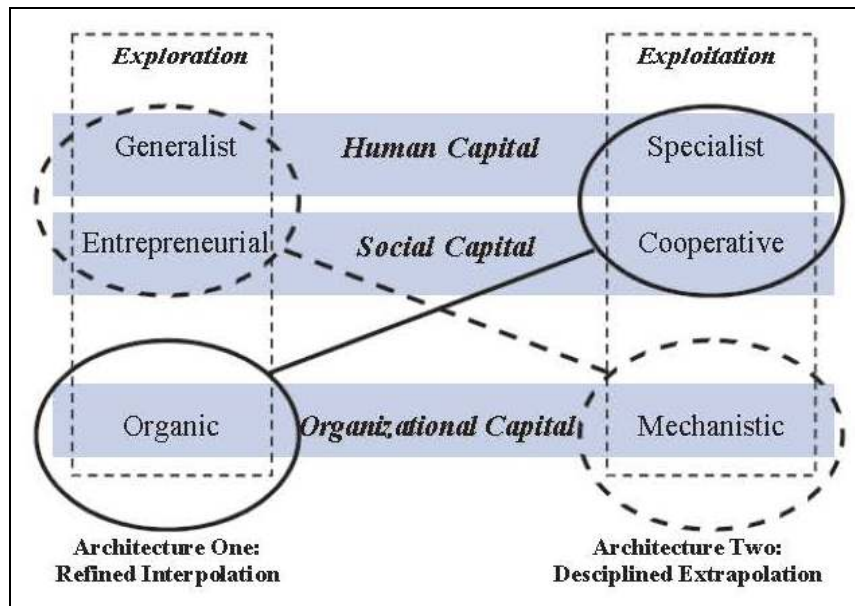
### **Organizational Structures for Learning and Innovation**

Kang and Snell (2009) suggests two organizational architectures for balancing exploitative and exploratory learning, each having three components that address the nature of human, social and organizational capital and blend elements of exploration (divergence) and exploitation (convergence). The first is a combination of specialist human capital, with the associated challenges to bridge convergent silos of knowledge and facilitate integration, combined with cooperative social capital, defined as “as a tightly coupled social system that includes strong and dense network connections, generalized or institutional trust based on membership in the social unit and shared understanding of how knowledge can be combined” (Kang & Snell, 2009: 69). The third component to Kang's first architecture is organic organizational capital which is, by nature, more typically entrepreneurial and exploratory oriented.



Kang’s second architecture combines generalist human capital and entrepreneurial social capital (loose networks, much of which is extra-firm) both of which are divergent – combined with a convergent “mechanistic” organizational capital structure. Kang points out that there are three dimensions to feedback and feed-forward: (1) the nature of the people involved, (2) the nature of how these people interact and network and (3) the nature of how the organization institutionalizes knowledge – either organically/loosely or mechanistically/formally. Balancing exploratory and exploitative learning and innovation requires a proper mix of personnel, organizational structure and network facilitation and formalization of processes.

**FIGURE 9**  
**Ambidextrous Organizational Structures**  
 (Kang & Snell, 2009)



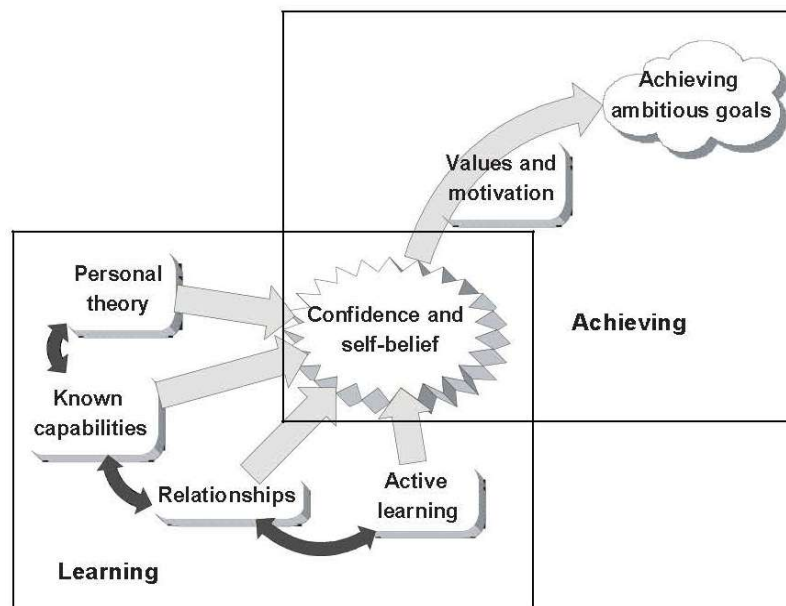
**Entrepreneurial Experiential Learning**

Organization learning has been framed as the key engine of creativity and innovation, thereby playing an especially strong role in the development of theories of

entrepreneurial innovation (Minniti & Bygrave, 2001). Learning theory has benefited entrepreneurship research by introducing a more dynamic framework to improve upon previously unsuccessful models linking static traits to entrepreneurial success (Gartner, 1988).

Researchers have re-conceptualized entrepreneurial preparation as a learning process whereby entrepreneurs accumulate the experience and knowledge needed to start a firm (Reuber & Fischer, 1999). This perspective further reinforces the path dependent view of learning wherein knowledge is cumulative, building upon “a subjective stock of knowledge accumulated on the basis of past experiences” that both influences and potentially constrains future activities (Minniti & Bygrave, 2001: 5). Preparatory entrepreneurial learning has been framed as a journey leading to the confidence, self-belief, values and motivation to start a new business (Rae & Carswell, 2001).

**FIGURE 10**  
**Learning Journey of the Entrepreneur**  
 (Rae & Carswell, 2001)

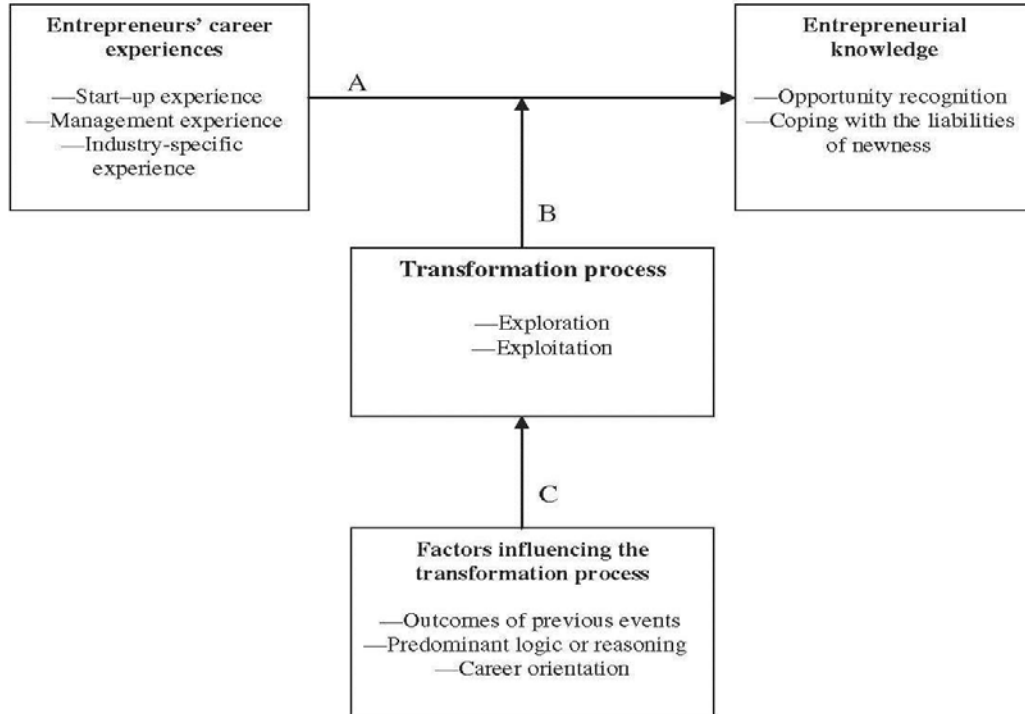


Many theories of entrepreneurial learning borrow from experiential learning theory by emphasizing “learning by doing” (Cope & Watts, 2000). Researchers generally agree there are two types of knowledge employed by successful entrepreneurs: (1) technology or market-specific domain knowledge and (2) more general tacit knowledge of “how to be an entrepreneur” (Minniti & Bygrave, 2001). Entrepreneurs develop tacit knowledge experientially by monitoring the outcomes of experiments that test competing hypotheses, both directly (experientially) and vicariously through indirect observation of the actions and results achieved by others (Holcomb, Ireland, Holmes, & Hitt, 2009; Minniti & Bygrave, 2001).

Politis (2005) extended March’s theories of exploration and exploitation into the domain of the individual entrepreneur by modeling the two forms of learning as transformational processes that shape the entrepreneur’s experiences into entrepreneurial knowledge (see Figure 11).

**FIGURE 11**  
**Entrepreneurial Learning as an Experiential Learning Process**  
(Politis, 2005)

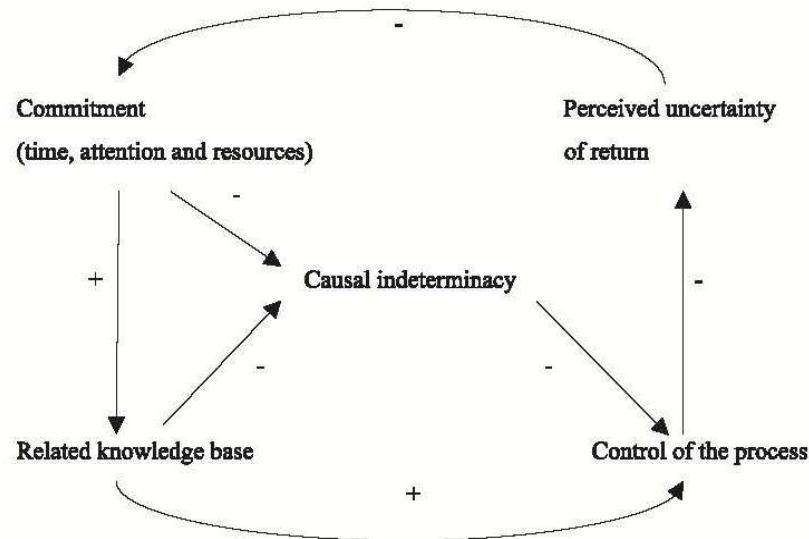
A conceptual framework of entrepreneurial learning as an experiential process



Entrepreneurs learn both experientially and vicariously (Holcomb et al., 2009) and as the firm transitions from the start-up phase and grow into maturity, one can argue that learning becomes increasingly vicarious in nature. The engineer in a start-up firm who routinely meets many of the company's early customers gradually becomes more and more isolated from such engagements and ultimately senses customer feedback about new products in the form of marketing reports and an occasional sales meeting. Such vicarious experiences are less likely to take on the characteristics of "critical experiences" which are attributed to more deeply felt and highly formative events that are most influential in the lives of entrepreneurs (Cope & Watts, 2000).

Entrepreneurial learning has been framed as episodic in nature, with periods of transformational intensity, often stemming from a business failure (Rae & Carswell, 2000). The critical experience perspective on learning demonstrates the role of emotions in learning – experiences have an affective dimension that greatly influence the experiential learning process (Brown, 2000). The affective impact of incremental success and failure during new business formation is heightened and amplified in a closed loop “self-reinforcing learning” system that can influence risk perception and impact the allocation of limited resource and innovation outcomes (Ravasi & Turati, 2005: 149).

**FIGURE 12**  
**Entrepreneurial Innovation as a Self-Reinforcing Learning Process**  
 (Ravasi & Turati, 2005)



Researchers have demonstrated links between Kolb’s Active Experimentation (AE) learning mode and both tacit knowledge acquisition (Armstrong & Mahmud, 2008) and higher levels of entrepreneurial opportunity recognition (Corbett, 2007). Learning style asymmetries are theorized to account for the knowledge asymmetries that explain why some entrepreneurs recognize a particular opportunity while others do not.

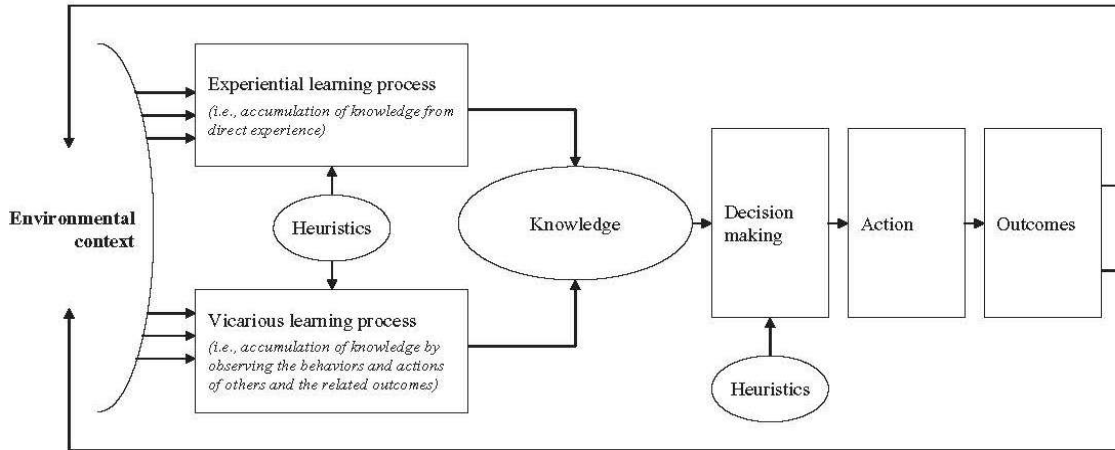
Dimov (2007) used experiential learning theory to explain the contextual influence of entrepreneurial ideas as they emerge from Crossan's process of intuiting (analogous to Kolb's concrete experience) and interpreting (analogous to Kolb's reflective observation). Learners reflect on experience based upon prior experiences and knowledge, thereby impacting the generation of new ideas.

Holcomb et al. (2009) proposed that heuristically-based knowledge structures interact with newly learned information to influence how entrepreneurs assess potential opportunities (see Figure 13). Heuristics are learned mental shortcuts used by entrepreneurs to simplify decision making and idea generation under time pressure (Busenitz & Barney, 1997; Tversky & Kahneman, 1974). One common type of heuristic is called a "representativeness heuristic" which can lead entrepreneurs to be overconfident in their association of key traits as a means of predicting a particular outcome (Busenitz & Barney, 1997; Tversky & Kahneman, 1974). Another common bias is to underestimate "regression toward the mean" or the tendency for systems to ultimately trend toward some historically normative state (Tversky & Kahneman, 1974). Entrepreneurs also appear to "rewrite history" and carry forward distorted recollections of past events ("hindsight bias") (Cassar & Craig, 2009). Decision makers also tend to use easily retrievable examples as analogies, a phenomenon known as the "availability heuristic" (Tversky & Kahneman, 1974) while tending to err on the side of being "anchored" to the analogous outcome (Tversky & Kahneman, 1974). Heuristic biases combine with new learning to affect the entrepreneur's perception of opportunity. The availability heuristic leads to amplified perception of opportunity when the available

exemplar is reinforced by new learning while heuristic anchoring biases dampen the influence of new learning (Holcomb et al., 2009).

**FIGURE 13**  
**Model of Entrepreneurial Learning**  
(Holcomb et al., 2009)

Architecture of Entrepreneurial Learning



## **CHAPTER III: THE SOCIO-COGNITIVE DIMENSIONS OF ENTREPRENEURIAL CREATIVITY AND IDEATION (STUDY I)**

### **Introduction**

The origins of innovative entrepreneurial firms can always be traced to creative new ideas (Amabile, Conti, Coon, Lazenby, & Herron, 1996). This notion of creativity as a driving force behind entrepreneurship dates back to the term “creative destruction” first authored by Schumpeter to describe economic growth through innovation (Schumpeter, 1942). Creative ideas seem commonplace, but successful entrepreneurial ideas are scarce and valuable commodities (Stevens & Burley, 1997). Furthermore, the cognitive skills and methodologies used by successful serial entrepreneurs to spawn such ideas are not well understood (Baum, Frese, & Baron, 2007).

The literature is replete with theories of creativity beginning with Wallas’ 1926 description of it as a four stage process: preparation, incubation, insight and verification (Wallas, 1926). Amabile (1983) later focused on the components of managerial creativity, i.e. domain skills, creativity skills and motivation. Researchers have more recently been interested in the influence of social networks on creative ideation suggesting weak ties offer the greatest novel influence by bringing new domain knowledge and perspectives to bear on problem solving (Perry-Smith, 2006).

However, there has been surprisingly little written about how entrepreneurs use creativity to develop new ideas for important products and processes (Baum et al., 2007). Amabile (1997) theorized entrepreneurial success is linked to a combination of intrinsic motivation and certain supportive forms of “synergistic extrinsic” motivation. There is anecdotal evidence that highly educated technology oriented entrepreneurs may lack the



cognitive flexibility to easily navigate the various stages of creativity and learning and might therefore be prone to over-analyze rather than act (Kolb & Kolb, 2005a; Pinard & Allio, 2005). Most studies have been purely theoretical—few if any entrepreneurial creativity studies have been based on field data probing the actual cognitive and behavioral patterns of successful technology entrepreneurs.

We interviewed 32 technology entrepreneurs regarding their recent ideational experiences to explore the cognitive and social processes behind entrepreneurial creativity. Informed by literature, we anticipated new insights into techniques used by entrepreneurs to generate ideas. Instead, they revealed a complex array of social interactions and experimental inquiry that contradict the prevailing image of a lone entrepreneur struck by a novel idea or positively influenced by predominantly weak social ties.

Our data shatter the traditional over-simplistic view of ideation as the first in a linear series of progressive activities to form a new business. We observed entrepreneurs consciously engaging in an ongoing complex, cyclical and recursive social process of problem solving and learning that is integral to and inseparable from a bigger cycle of innovation and new business formation. These findings illuminate methodologies and skills that nascent entrepreneurs can master, challenging conventional wisdom that only certain individuals are “born” to be entrepreneurs.

## **Literature Review**

### **Neuroscience of Creativity**

Neuroscience is important in assessing the anatomical mechanisms behind creative thought – in fact recent brain imaging studies have disproven many of the early

theories of creativity (Dietrich, 2007). For example, as observed by Dietrich (2007), creativity, earlier defined as right brain activated divergent thinking occurring in a state of defocused attention, is now known to involve either divergent or convergent thinking (or both), activated by both brain hemispheres, and sometimes occurring in a state of high arousal.

The pre-frontal cortex (PFC) is a key center of higher level “executive functions” such as working memory and creative cognition processes (Kane & Engle, 2002).

Working memory resources are crucial to creativity and are limited, both in storage and processing capacity (Dietrich, 2004). Recent studies suggest working memory and the cerebellum continuously and repetitively collaborate through an integrated neural network to produce creativity and innovation (Chávez-Eakle, Graff-Guerrero, García-Reyna, Vaugier, & Cruz-Fuentes, 2007; Vandervert, Schimpf, & Liu, 2007).

Some creative functions seem to work unconsciously through a kind of parallel processing (Dijksterhuis & Nordgren, 2006; Finke, 1996). Unconscious processes may be the result of practical limitations of the PFC to hold more than some number of concepts in short term memory (Singer, 1978). Unconscious ideation tends to be more divergent and less inhibited whereas conscious and deliberate ideation tends to have more convergent and inherently useful properties (Dijksterhuis & Nordgren, 2006).

### **Components of Entrepreneurial Creativity**

Amabile’s (1983) theory of organizational creativity focuses on three main components: domain knowledge, creativity skills and task motivation.

**FIGURE 14**  
**Amabile's Components of Creativity (Amabile, 1983)**

<p style="text-align: center;"><b><u>Domain-Relevant Skills</u></b></p> <ul style="list-style-type: none"> <li>- Domain knowledge</li> <li>- Technical skills</li> <li>- Domain specific talent</li> </ul>	<p style="text-align: center;"><b><u>Creativity-Relevant Skills</u></b></p> <ul style="list-style-type: none"> <li>- Cognitive Style</li> <li>- Heuristics for novel ideas</li> <li>- Conducive work style</li> </ul>	<p style="text-align: center;"><b><u>Task Motivation</u></b></p> <ul style="list-style-type: none"> <li>- Attitudes toward task</li> <li>- Perceptions of personal motivation</li> </ul>
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Entrepreneurs have a base of domain knowledge essential to performing creative transformational processes that lead to creative new ideas (Shane, 2000; Weisberg, 1999), however, base knowledge is a “double edged sword” and can stifle creativity through strong biases toward existing ideas and properties of familiar exemplars (Frensch & Sternberg, 1989; Runco & Chand, 1995; Smith, Ward, & Schumacher, 1993; Ward, 2004). This phenomenon is referred to as the “inverted U” theory of knowledge and creativity whereby creativity is positively correlated with knowledge until the onset of biased expert knowledge begins to limit and ultimately reduce creativity (Frensch & Sternberg, 1989). Knowledge is key to creative entrepreneurial actions such as opportunity recognition and knowledge asymmetry accounts at least in part for why entrepreneurs in the same environment do not all recognize the same opportunities (Shane, 2000).

Creativity skills include cognitive style, heuristics and ideation techniques (Amabile, 1983). Cognitive style is defined as individual preferences toward certain modes of thinking, perceiving, remembering information and problem solving (Amabile, 1983; Tennant, 1988). Amabile has explored the role of numerous cognitive styles including the ability to see new meanings in concepts or objects (“breaking the perceptual set”) or adopting a new problem solving strategy (“breaking the cognitive set”). Other

cognitive styles conducive to creativity include keeping creative production options open as long as possible (Getzels & Csikszentmihalyi, 1976) while suspending judgment (Stein, 1975). Heuristics are learned mental shortcuts used by entrepreneurs to simplify decision making and idea generation under difficult conditions, i.e. typically in the absence of sufficient time or data to use typical managerial analysis techniques (Busenitz & Barney, 1997; Tversky & Kahneman, 1974).

The third component of creativity skills and techniques, i.e. transformational processes utilized to generate creative ideas, involves the stretching and expansion of ideas, most commonly by combinations of dissimilar objects, analogical associations and problem framing/finding (Mumford, Reiter-Palmon, & Redmond, 1994; Ward, Patterson, & Sifonis, 2004). Creative combinations are achieved by merging the features or attributes of a source concept into a target concept (Mednick, 1962). Gentner's (1983) theory of analogy focuses on identifying structural similarities between target and source objects so that analogous attributes from a source concept can be mapped into a target to produce a new concept.

Creative combinations and analogical thinking can both be subject to the "path of least resistance" tendency to retrieve known, familiar and relevant exemplars, sometimes leading to less original ideation (Finke, Ward, & Smith, 1992). Manipulating problems, i.e. framing or viewing the basic nature of a problem through a different lens, can lead to novel ideas and solutions (Runco & Chand, 1995). Another generational technique, described by Mumford et al. (1994) is "problem finding/definition." Solutions with different novel properties, the authors suggest, tend to emerge depending on how a problem is identified and framed.

Amabile (1983: 365, 1996) describes intrinsic motivation as “a motivational state generated by the individual’s reaction to intrinsic properties of the task and not generated by extrinsic properties.” Amabile (1996) also defined a third type of motivation she calls ‘synergistic motivation’ as extrinsic factors that positively influence creative performance, usually during stages that depend less on novelty and more on timely execution of certain tedious operations such as validation and communication of ideas. Amabile (1993, 1997) describes intrinsic motivation as a common state and/or trait of highly creative entrepreneurs especially when combined with synergistic extrinsic motivation.

Perseverance, a key by-product of intrinsic motivation, is a crucial trait for achieving high level creative insights that require a protracted effort through multiple recursive cycles (Csikszentmihalyi, 1996). Perseverance in pursuit of novelty requires attention, a scarce cognitive resource that must be channeled to areas of greatest interest and carefully protected against intrusions from the outside world (Csikszentmihalyi, 1996). Neuroscientists have demonstrated that humans have only limited working memory in the pre-frontal cortex region and accurate retrieval from long-term memory is difficult, if not impossible, in the presence of the usual distractions in a typical managerial work environment (Kane & Engle, 2002).

### **Cycle of Learning and Creativity**

Learning is the means for adding to base knowledge and can also, by itself, directly lead to new ideas (Kolb, 1984). Experiential learning (Kolb, 1984) is the most appropriate theory for entrepreneurial learning because it focuses on the process of learning from experience versus learning outcomes (Corbett, 2005). Kolb defines

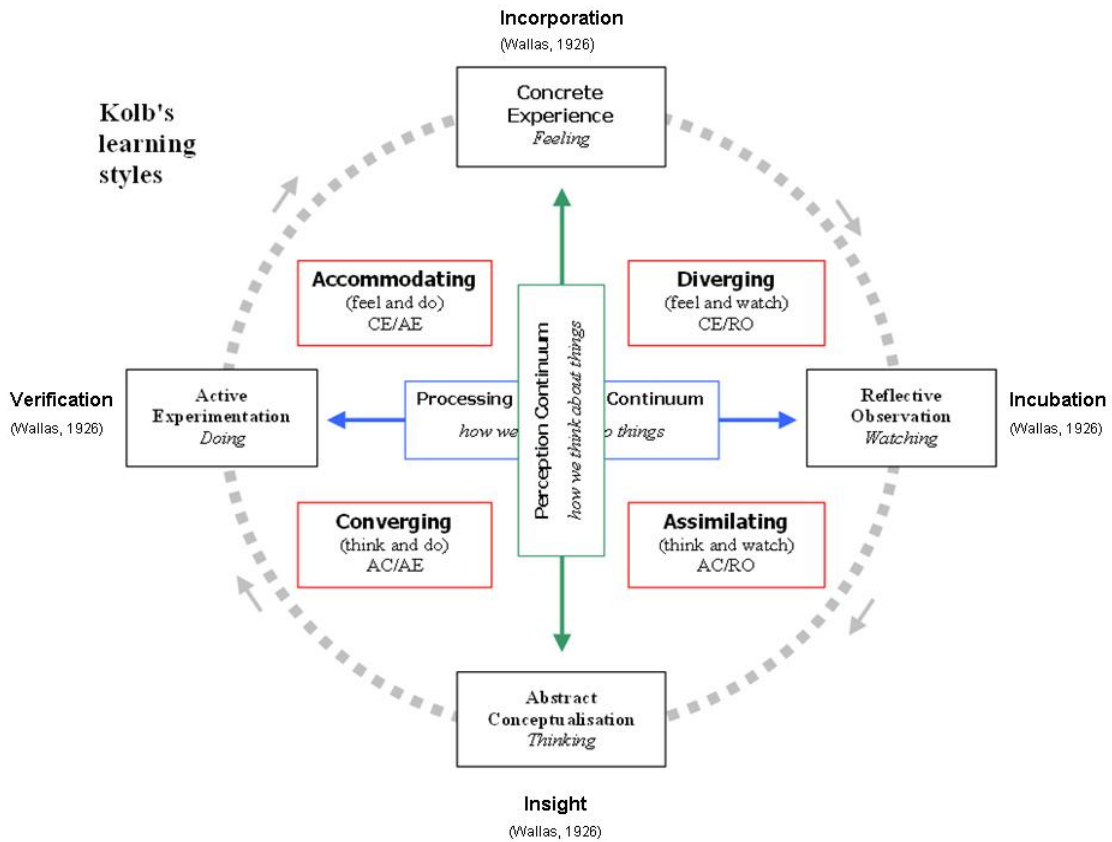
learning as the process whereby knowledge is created from the combination of grasping and transforming experience (Kolb, 1984). The learning experience is grasped through either abstract comprehension or concrete apprehension and then processed through reflective observation (RO) or active experimentation (AE).

According to Kolb, learners tend to prefer certain learning styles and by doing so exhibit various cognitive strengths and weaknesses. Learners with a diverging style, he argues, tend to be great at brainstorming and are often interested in the arts. Divergent thinking is strongly associated with creative thought and learners with this style are able to naturally generate ideas. Assimilative learners, Kolb contends, tend to be interested in theory and abstract problem solving; learners with a converging style are analytically oriented and tend to be specialists in technical fields. Accommodative learners tend to prefer relatively social and action-oriented careers such as marketing and sales. A smaller percentage of learners exhibit a balanced style and are able to adapt their learning style on a situational basis (Kolb & Kolb, 2005a; Sharma & Kolb, 2009).

Creativity has been described by Wallas (1926) and Csikszentmihalyi (1996) as a time domain process that utilizes the same fundamental stages and cognitive processes as learning. Merging the classical stages of creativity (Csikszentmihalyi, 1996; Wallas, 1926) with Kolb's Experiential Learning model (Kolb, 1984) yields a useful and richly descriptive conceptual framework we call the "Cycle of Learning and Creativity" (see Figure 15). Creativity and experiential learning are both recursive and cyclical phenomenon that share a common cognitive flow as individuals move through four primary stages: (1) studying and incorporating oneself into a subject area; (2) stepping away to reflect and incubate ideas; (3) experiencing an "insight" or an epiphany as novel

abstract concepts emerge; and (4) verifying abstract concepts as an active experiment (Csikszentmihalyi, 1996; Wallas, 1926). This process can repeat multiple times in a recursive spiraling fashion with each successive repetition converging toward a better solution or idea.

**FIGURE 15**  
**Cycle of Learning and Creativity (Superimposition of Wallas' Stages of Creativity on Kolb's Learning Styles)**



Csikszentmihalyi (1996) warns that his model of creativity is not to be taken too literally but rather as a useful conceptual tool. Field studies have shown that certain steps may be either skipped or be practically indiscernible or may occur out of sequence (Csikszentmihalyi, 1996). However, the model is a useful tool for understanding the time

domain of creativity and the cognitive resources needed at different points in time (Corbett, 2005; Csikszentmihalyi, 1996).

### **Social Environment**

Although there have been relatively few empirical studies of the social network impact on entrepreneurial creativity, researchers (Perry-Smith, 2006) have recently applied Granovetter's (1973) network theory to creativity, demonstrating that weak social ties benefit creativity by providing valuable information that is unique and less repetitive. Conversely, strong ties tend to have only a neutral impact by distributing similar information over localized redundant paths. Another study demonstrated that mentors, industry networks and professional forums all make a positive impact on entrepreneurial opportunity recognition (Ozgen & Baron, 2007). The researchers found this was especially true when the entrepreneur possessed both strong self-efficacy and relevant schemas (i.e. mental frameworks) for interpreting and acting upon information gained through social contacts.

## **Methods**

### **Methodology**

The aim of this study was to learn about successful entrepreneurial ideation, a research endeavor we deemed best served by qualitative methods (Ward, 2007). Qualitative research is a particularly strong method for exploring meanings, contexts, processes and unanticipated phenomena and to induce credible causal explanations that extend existing managerial practice (Maxwell, 2005). Ward (2007) specifically advocates open-ended discussions in the form of semi-structured interviews to elicit detailed narratives about actual entrepreneurial experiences of creating novel new



products and processes. Accordingly, we adopted a grounded theory approach to systematically collect and analyze qualitative field data (Strauss & Corbin, 1990).

Our method was shaped by two basic principles of grounded theory: constant comparison and theoretical sampling (Strauss & Corbin, 1990). Constant comparison refers to the simultaneous collection and analysis of data using rigorous coding techniques to identify emergent themes that influence subsequent data collection. Ongoing analysis directs the forward selection of respondents and the study progresses until theoretical saturation is reached, i.e. the point at which no new ideas emerge (Strauss & Corbin, 1990).

### **Sample**

Our sample consisted of 32 entrepreneurs, all founders and/or senior executives in one or more technology start-up businesses. All respondents were based in the U.S., most (23) in the Southeast region and others in the Midwest (7), Northeast (1) and West (1). The study achieved considerable industry diversity by including participants from varied sectors including software, internet/e-commerce, hardware/software systems, biotechnology, telecommunications, electronics and medical devices. A concerted effort was made to achieve gender diversity; however, the study reflects the male-dominated nature of the industry with only 2 female participants versus 30 males.

Participants were contacted initially by email to solicit their participation. The first interviews were conducted with close professional contacts and a “snowball” technique was used to generate referrals and subsequent participants.

Most of the participants (78%) were either highly successful, defined as having founded at least one company with revenues exceeding \$10M annually; and/or serial

entrepreneurs, defined as having founded multiple new businesses, at least one of which had achieved >\$2M in annual revenues. However, a contrasting group of participants (22%) were either first time entrepreneurs in the early stages of new business formation or entrepreneurs whose experience was limited to smaller scale ventures. Four participants (12%) also had significant corporate intrapreneurial experience at some point in their professional careers. Participants ranged in age from 27 to 60 years with an average of 47. All participants had attended some college or trade school and 50% had earned graduate or professional degrees (Table 2).

**TABLE 2**  
**Summary of Participant Demographics**

<b><u>Industry Sector</u></b>	<b><u># of Participants</u></b>	<b><u>% of Total</u></b>
Software	13	40%
Internet/e-commerce	8	25%
HW/SW Systems	4	13%
Biotech	3	10%
Telecomm	2	6%
Electronics	1	3%
Medical Devices	1	3%
<b><u>Intrapreneurial Experience</u></b>	4	13%
<b><u>Education</u></b>		
Engineering/science	22	69%
Business/Liberal Arts	10	31%
Some College/trade school	2	6%
Bachelor's Degree	14	44%
Master's Degree	12	37%
Doctorate	4	13%
<b><u>Location/Region</u></b>		
- Southeast	23	72%
- Midwest	7	22%
- Northeast	1	3%
- West	1	3%

## **Data Collection**

Data was collected during a two month period from mid-April to mid-June 2010 and consisted of face-to-face interviews with 28 participants and four telephone interviews. The approximately one-hour interviews were recorded and transcribed by a professional service and transcriptions were later carefully reviewed by the researcher to confirm data accuracy.

The interview protocol (see Appendix A) was designed to elicit lengthy narratives detailing participants' actions, thoughts, feelings and social interactions at the inception of ideas for new products or processes. Narratives included ensuing actions taken to further socialize, develop and filter ideas from a raw state into useful, novel new products and processes. Special effort was made to trigger vivid recollection of ideational experiences that had occurred within only days or weeks prior to the interview. Each interview consisted of the same four core questions; however, probes were varied and tailored in response to the particular interview situation. Probes were informed by literature reviews and pilot interviews and were primarily used to source more finely detailed information by encouraging the participants to relive and relate their ideational experiences through different lenses, i.e. their thoughts, feelings, actions and interactions with others. Respondents were asked not only about successful ideas but also failed ideas and ideas consciously filtered but not pursued. Interview notes and post-interview memos were also produced for each interview

## **Data Analysis**

The audio recording for each interview was reviewed multiple times and each transcript read repeatedly. Interviews were first coded using "open coding" techniques

recommended by Strauss and Corbin (1990). This involved rigorous line-by-line examination of every transcript to identify “codable moments,” or segments of text with potential research significance (Strauss & Corbin, 1990). Open coding, which began immediately after the first interview and continued throughout data collection, resulted in the identification of 1683 fragments of text which were sorted on the basis of similarity into 21 initial categories.

During a second analytical phase called “axial coding” (Strauss & Corbin, 1990) the original categories were examined and refined in alignment with common themes that emerged from the data. This involved systematic reassessment of coding categories based upon unfolding discovery and reinterpretation of data patterns. Thematic analysis during axial coding resulted in a reduction from the 21 original categories to 7 key data categories that became the focus of our study. Examination of key emergent themes prompted a return to the literature for comparison of data and existing literature. A third and final phase of “selective coding” reduced the data to a final set of 4 predominant data categories supporting our key findings.

### **Findings**

Technology entrepreneurs utilize a variety of behaviors, techniques and thought processes to develop, refine, validate and filter (for usefulness) creative ideas; however, our data presents strong evidence of three key ideational processes common to all technology entrepreneurs. First, all of them utilize complex and sophisticated social networks as sources of ideas and to test, refine and validate trial ideas. Secondly, technology entrepreneurs exhibit extraordinary domain specificity of entrepreneurial practice by filtering ideas outside specific markets and technologies. Finally, they

actively experiment and iterate ideas rather than engaging in protracted conceptual analysis.

**Finding 1: Technology entrepreneurs rely heavily on the strength of their strongest ties and maximum ideational productivity occurs when a small select “Inner Group” including a “Trusted Partner” is engaged in search of a solution.**

1.1. Successful technology entrepreneurs form a strong and select “Inner Group” that drives ideational productivity. This Inner Group encompasses a diverse set of experiences, personalities and cognitive styles while sharing certain core common traits.

All 32 interview participants described an “inner group” typically consisting of the entrepreneur and two or three select colleagues who interact frequently and intensely with the entrepreneur as a sounding board and source of ideas. Entrepreneurs socialize ideas with both weak and strong ties; however, this inner group represented the entrepreneurs’ most consistently productive social capital. Fifteen of the twenty-six serial entrepreneurs teamed with inner group members for multiple ventures and in at least five cases the team repeated ventures within the same market and technology.

All respondents who provided detailed insight into the composition of the inner group described common traits such as a shared vision, a common language and shared domain experiences and knowledge. Participants described their ability to have rigorous but constructive arguments among inner group members to refine their ideas.

Respondents noted that group “chemistry” allowed them to brainstorm freely and more productively within their exclusive group. However, they noted that this chemistry was usually lost when outsiders were included.

Inner group members shared many traits but were otherwise highly diverse. They assumed different roles within the company and pooled various functional expertise, personalities and cognitive traits (including preferences for different media and techniques to develop ideas).

**FIGURE 16**  
**Inner Group Composition**

<p>"We all bring different backgrounds to the business which are mostly pretty complimentary. We all know each other well enough that we can sit and argue and shout and scream over the boardroom table and still drink beer afterwards. There is no one person. A lot of companies run that way and we kind of don't like it where you end up with one God-like being who, if they don't get it right, you're all screwed." I11:5_4_10</p>
<p>"The good thing is that my two partners are very complimentary. (One) is very marketing oriented, so customer focused...the third partner, the chief technology officer, was more focused on what could be." I18:5_20_10</p>
<p>"Since they have an engineering background and I have a business background, they look at things backwards. Of course, they say I look at things backwards. But the reality is we do attack business problems differently, which I think has really helped all of us. I think it's really enhanced our ability to come up with different ideas." I1:3_30_10</p>
<p>"I'm a little bit more on the, I'll say, on the building side, or making something happen. (2<sup>nd</sup> team member) is...probably the most visionary out of the group. (3<sup>rd</sup> team member) has always been in business development, so he really understands selling and stuff like that." I8:4_29_10</p>
<p>"I ended up with a group of people on a discussion forum. I realized that when I contacted those people that one of those two guys was my existing customer...he had known me for about eight years. And that's how it all started...we jointly got together, formed the same company. They had more technical know-how as to how to develop. And I knew what to develop." I30:6_16_10</p>
<p>"Describing the problem. That's the way they all set up. I'm analytics. One of the partners is technology. One of the partners is strategy. Generally, we'll describe what...the challenge is, and then the person that's kind of working on it directly will start adding some flavor, and then we'll just start working our way around the table. People start to throw out their interpretation of what the problem is. You know, "I think it's like this," or, "I think it's like that." I would draw pictures. There are a couple of other guys that are very visual that will start drawing pictures. Other people aren't; they just start laying out examples. Some people will use metaphors. Just, you know, it's just kind of going around the table. We've gotten to the point where we don't want to leave that room without something resolved or at least the next step laid out "</p> <p>I23:5_24_10</p>
<p>"It's led by different people...It's all who comes up with the idea. But the key behind our group...is respect. We respect each other. We're all very good listeners, very good listeners, where some of the other new startups I'm involved with, they're very poor listeners." I7:4_29_10</p>
<p>"We're very open with each other. There's no fear of criticism between the three of us, and I think that that helps a lot. So there's no - like I said, I could ask a question that's a very silly question to a biologist or a biochemist, but there's no fear of being scientifically ridiculed for having asked a question that someone thinks is silly. And so I think a lot of our conversations are, just because they're open and easy communication, it makes it easy to come up with these other ideas." I29:6_14_10</p>
<p>"All these guys fit. They get it. They fit. Our personalities fit. They're creative guys. When we get together, we kick ideas off of each other. It's a brainstorming session every time we get together. When we're meeting with a larger group, and with those meetings, we're mostly in listening mode. We're kind of picking their brains, and so it doesn't flow as well because we're kind of seeing where they go. I'd say the ones between (just) the three of us tend to be - they tend to flow better." I19:5_20_10</p>

1.2. Successful entrepreneurs commonly described a single “trusted partner” from the inner group as their most crucial ideational resource.

Seventeen out of the thirty two interview respondents described a key relationship with one member of the inner group that was particularly productive and crucial to their success. The respondents told stories of intense interactions with trusted partners that yielded critical and timely ideas, often under extreme time pressure. Eleven of these seventeen serial entrepreneurs worked with the same trusted partner in multiple start-up ventures. There were no reports of “divorce” among these serial entrepreneurs i.e. trusted partners who were abandoned and replaced by new trusted partners in subsequent ventures. Participants described a symbiotic relationship with trusted partners based upon respect, trust, comfort, excitement, encouragement, passion and open, easy communication. Trusted partners had heated frank discussions but ultimately agreed on a solution and remained friends. The frankness of communication between partners can sometimes be misinterpreted by others as open hostility.

**FIGURE 17**  
**Trusted Partner Relationship**

<p>"It's kind of like - you hear about how musicians work and jam together, and he and I just have a very good way of knowing how to lead the other one. And when it gets beyond my technical ability, I become the note-taker, and I'm happy with that role. And when it becomes kind of figuring out what the market opportunity is, then I become the leader in that, and he becomes the note-taker." I20:5_20_10</p>
<p>"We have very similar mindsets, but incredibly dissimilar approach. And I think that, from his standpoint, he's a very good person to bounce ideas off of because he has an entirely different thinking process than I do. And he can actually put on the more procedural questioning, the more results-oriented questioning, and can help vet the idea further." I3:4_15_10</p>
<p>"(My partner) and I are more to the point. We're more working-out-the-process and the ideas, so we tend to be a lot more productive with just the two of us." I19:5_20_10</p>
<p>"It's important though that we respect each other and respect each other's ideas, listen to each other's ideas. And I think what it's done is it's helped each of us individually because when we come up with ideas and we talk through the ideas, the resulting idea is better than what we could do individually." I1:3_30_10</p>
<p>"And so I've got a good relationship with a partner that we really can have drag-out meetings and conversations about things, but it helps both of us really think about it and go back and try to think it through. He's really kind of unique...basically came from the construction industry, very much more so externally focused. He has computer science background, mine being in industrial engineer but we're both built similar, again from very strong IT backgrounds. In a lot of the group meetings, we'll be very strong and very opinionated. You've got to be careful sometimes on how you do communicate when you're in a much larger group meeting because of that because you may have constituents in the room that don't see us working the way we work all the time, and they may be taken aback, or they may hush up because of that." I28:6_9_10</p>
<p>"She is my number-one critic. She's a partner in the company, and she plays just as big a role as I do because she's a female. She knows what females want in the marketplace, and they tend to be the biggest users of our products." I26:6_4_10</p>

**Finding 2: Technology entrepreneurs generate many ideas in a variety of domains; however, they nearly exclusively pursue ideas within their core domain.**

Technology entrepreneurs are highly ideational in a variety of markets and disciplines; however, they selectively elaborate creative ideas within a specific core domain defined as their primary area of technology and/or market specialization.

Our interview protocol did not probe for non-core domain ideas; however, fifteen interview participants described serious consideration of ideas outside their core domain. For example, one seasoned entrepreneur (with no background in human resources) was pursuing his second start-up in the marketing analytics industry, but he had nearly started a business based on his idea for a human resources Internet solution. Another



entrepreneur spent substantial time developing a business simulation product, only to abandon it for his second software start-up in the same vertical market.

Nine participants told stories of extensively socializing and prototyping trial elaborations of non-core domain ideas and five launched side businesses based on non-core domain ideas. However, with only one exception, all participants rejected opportunities to pursue non-core domain ideas as their main full-time business and pursued ideas strictly within their core domain. The one exception was a finance oriented IT professional who partnered with a family member (who is a medical domain expert) to launch a consumer medical products company. Seven interviewees described multiple repeat ventures within specialized core domains and one participant created very similar ventures a total of three times.

Participants described a self-awareness of the role of domain knowledge in their selectivity of which ideas they would pursue; some even expressed regret about decisions to pursue certain ideas in unfamiliar domains. The following quote is from a successful entrepreneur who was convinced by a venture capitalist (who had the idea for the business) to go outside his comfort zone, becoming CEO of a social-networking start-up company.

“It was a (failed) idea conceived by a business person not by an industry - it wasn't born out of an industry frustration. It's very rare that some smart guy who knows nothing about a certain industry comes up with a solution for an industry. We didn't get it at all, right? And in fact, there still is no business model for Twitter, right? who cares if I can sign up to see if Ashton Kutcher wants to tell me that he's having cheeseburger, or he's stuck in line at Starbucks or any of the stupid things that people put out over tweets, right? I didn't get it, right? Didn't get it at all.” I32:6\_21\_10

**FIGURE 18**  
**Domain Diversity and Selectivity of Ideas**

<p>"I thought about an idea for a company I call IReceipt.com. So I was flying back from a business trip. You know I had a pocket full of receipts" I15:5_6_10</p>
<p>"One of the things I thought about and I got pretty serious about it, was in the HR space... And I was real serious about it, so I spent a lot of time talking with different people, I don't know why I abandoned that, but it was right about the time that we started this, and I just realized that I needed to go all in" &lt;Entrepreneur pursuing second start-up in marketing analytics industry&gt; I23:5_24_10</p>
<p>"I have friends that come to me with ideas all the time because they know I'm an entrepreneur. Everybody has ideas. It's just they don't research them, and you know, they almost all sound good right away." I4:4_27_10</p>
<p>"We started having these thoughts and ideas that we kind of put into a little bucket, but we didn't do anything with it because in the pressure of trying to produce the results and raise money and...we kind of stuck to executing Story No. 1" I32:6_21_10</p>
<p>"A buddy of mine and I came up with one of our first ideas we were thinking about a business was a keg-cuzzi. And we actually did research on this, and So we came up with a plan to build...and put college sports logos on them and travel around and sell those." I6:4_28_10</p>
<p>"We were thinking about this Wayne Gretzky Marguerita machine, and so for a myriad of reasons, it never went anywhere... So I think what will always haunt me is that we had an idea" I14:5_6_10</p>
<p>So I had this concept of building this game...which I still think today would be extremely successful because it's not taught anywhere, but I don't have the resources. I'm not from that industry, so I tried to tap into the gaming industry. To me it was more of a timing thing. It just became, you know, these other things started taking off, and so this kind of took more of a backseat. It has been extremely educational for me to step outside the box, and come at things from a different perspective and see how things are done in different industries. I28:6_9_10</p>

**Finding 3: Active Experimentation: Technology entrepreneurs move quickly from research and conceptual analysis into an active experimentation in order to concretely validate and develop important ideas.**

All respondents told stories of how they moved quickly from conceptualizing and evaluating ideas to socially and actively experimenting as an iterative means of either validating and perfecting ideas or quickly abandoning them. These experiments generally took the form of complex sophisticated social interactions, pilot projects or trial launches of a new product or service, sometimes before the product or service was fully developed. Respondents often viewed experimentation as a learning process and cited their inability to effectively analyze the complex array of possible features and customer requirements, preferring to quickly learn by testing a concrete trial solution with a goal to

either succeed or “fail quickly.” Several respondents described experimentation as an entrepreneurial competitive advantage against established larger players – a failed small scale entrepreneurial experiment does little or no damage to the reputation or future prospects of a start-up venture.

**FIGURE 19**  
**Experimentation and Iteration**

<p>“We basically test something out in small area with very few funds. If it works, great, we’ll put more money into it to kind of make it successful, but as an entrepreneur, you wake up every single day, you make decisions, and you move on. And a lot of times your decisions are right, a lot of times they’re wrong, but you learn from them, and you just continue to plow forward.” I28:6_9_10</p>
<p>“Well, let’s go down this path. Oh, that’s not working. Let’s go down this path. Oh, that seems better.” We sort of just sort of took this path sort of like the, you know, mouse who’s, you know, sort of scattered to find their cheese, you know? We just actually just kind of scattered and found it within a short period of time.” I7:4_29_10</p>
<p>“Once we had the capital, we said you can’t really go after it until you experiment, until you try, until you listen, until you talk to customers, until you actually just get your hands dirty, and - before you could actually step it up and put it as a kind of a business line that you could count on. So some of our guys said well, you know, I see those bins around. Like why couldn’t we do our own bins and so forth? So we said, hmm. That might be worth piloting...we’re still learning... we’re going to just kind of sit down and do a full brain dump probably in July and say what’s everything we learned? How do we take it up to the next level?” I17:5_17_10</p>
<p>“So the initial phase, I was talking with a co-worker and a developer that could actually create the product. While we had this meeting and said, “Okay, let’s go do this,” the developer went off and created it, created a prototype, right? I mean, the thing was, “Show to me that you can make this. Just show me.” You know? I don’t care what it looks like, just show me.” I1:3_31_10</p>
<p>“Okay, so all we’ve done so far is announce it. We’ve put up a webpage to take reservations for it just to see what kind of traction it would get in the industry. We’re going to let the registration page run for five or six weeks. Then take stock of how many people actually are signing up for it and whether or not it’s worthwhile in putting in the final touches.” I27:6_9_10</p>
<p>“I kind of have a fail fast mentality that I try to instill in people around here, so when I have an idea like that I want to very quickly get to the point where it’s if it’s going to fail, I want it to happen very quickly, before I sink a lot of money and time into it.” I23:5_24_10</p>
<p>“Before (my partner) started really prototyping, I started getting down on him a little bit or critiquing him a little saying, “You’re in your office. You’re in your basement office, and you’re just sitting there thinking of things, but you’re not going out to the field and learning about what’s the actual application...we have got to get out there more. We’re not a Black and Decker, where a failure, is visible. Black and Decker launches a new product, they get - they don’t launch until Wal-Mart’s on board, Target’s on board. They make shelf space for it. If it’s a failure, it’s a big deal.” I20:5_20_10</p>
<p>“If this is really something that the marketers want, then I’m going to go test this. And I’m also going to try to determine how big it’s going to be...and so we had to kind of test. Even if we build it, will they come?” I18:5_20_10</p>

**Discussion**

An emerging perspective in the entrepreneurship literature frames the entrepreneur, not as a sole actor, but as a team leader or partner in a complex multi-level

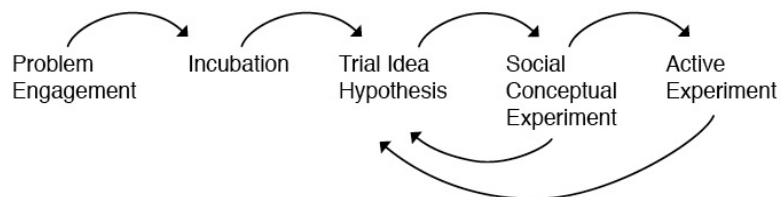
social environment (West, 2007) and our data greatly expands our understanding of this social phenomenon.

The entrepreneurs we interviewed gave us insight into the complex, highly social recursive process of ideation that we now perceive as tantamount to a holistic model of innovation and new business formation. Our process stands in strong contrast to established theories of opportunity recognition and serial/linear entrepreneurial business development. Entrepreneurs recognize problems and work as partners or in teams to solve these problems through complex but well-defined social interactions as part of a cycle of learning and experimentation. Furthermore, our data indicate that the benefits of trust, shared language and shared vision among strong social ties far outweigh the theoretical benefits of weak ties on entrepreneurial creativity.

### **Entrepreneurial Ideation Process (EIP)**

Entrepreneurial teams follow a deliberate, methodical process to develop ideas and solve problems within a domain. We mapped that process in the narratives of 32 technology entrepreneurs (Figure 20) to illustrate ideation progression through five (typically recursive) phases. These phases, constituting what we call the “Entrepreneurial Ideation Process” (EIP), involve a variety of firm and extra-firm actors engaged in both social/conceptual and active experimentation.

**FIGURE 20**  
**Entrepreneurial Ideational Process (EIP)**



The EIP describes how an entrepreneurial team incubates ideas in response to problems, often for days, weeks or months, before generating a “trial idea and hypothesis.” The EIP Hypothesis encapsulates the entrepreneurial team’s perspective and understanding of both the problem and its environment and typically encompasses the presumed roles and perceptions of potential funding sources, key partners, customers and market influences. It reflects their unique “perspective strategy” described by Mintzberg as the “collective mind -- individuals united by common thinking and behavior” (Mintzberg, 1987: 17). Perspective strategy is different from “position strategy” which articulates a competitive position within a market, product or technology space. Perspective strategy is a visionary, adaptable and entrepreneurial form of sense-making to interpret events against the backdrop of what is known and assumed about the environment (Mintzberg, Ahlstrand, & Lampel, 2005). Our EIP Hypothesis is essentially a perspective strategy statement that acts as a lens for interpreting experimentation results.

While entrepreneurial experimentation is typically described as a concrete trial for purposes of risk management (Sull, 2004), our data suggest social and conceptual experimentation always precedes physical experimentation. Social experimentation requires both an idea and a set of assumptions and perspectives (the EIP Hypothesis) which get tested for validity and refinement or ultimately discarded as useless. Social conceptual experimentation builds social capital in the form of a useful pool of participants for future experiments and some participants are even ultimately recruited as team members. Our data support previous observations that experimentation is too expensive for large corporations who cannot afford highly visible failures (Sull, 2004).

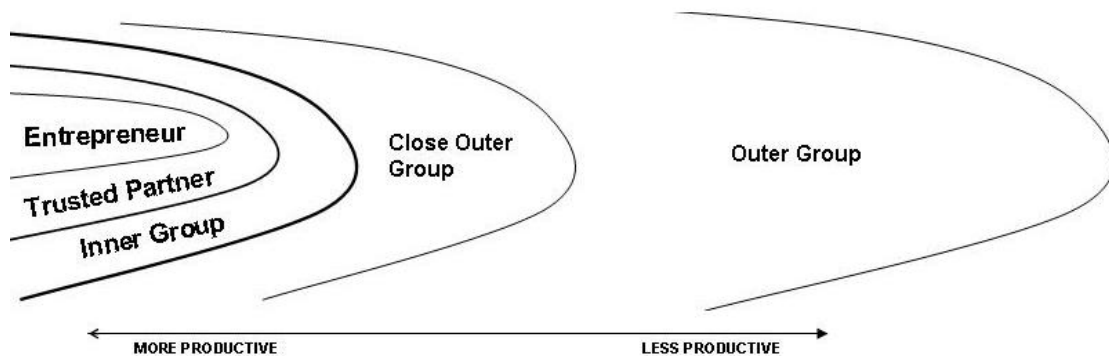
This makes experimentation a defining and unique entrepreneurial methodology. We interviewed intrapreneurs who later became entrepreneurs and provided insightful contrast between corporate and entrepreneurial social experimentation methodologies. Corporate intrapreneurs tend to maintain an inward focus, carefully socializing ideas within the firm to secure funding and political support from key stakeholders, whereas entrepreneurs primarily socialize ideas outside the firm:

I still believe in keeping it stealth, but I can't remember the last time I signed a NDA with somebody... We've socialized (our startup) ...far more than I would have socialized it inside a corporation...(and) without fear of pissing off a current customer. Since I have none, I go straight to potential buyers of the service...in the corporate setting, you know, you're always dancing the fine line of how do you talk to your customer... without either leaking - something, or biasing their opinion about something. My experience is that inside a corporation when the stakes are high, individual group heads compete more so than collaborate.

### **Social Strata of Ideation**

We view entrepreneurial social networks (for purposes of ideation) as concentric rings of decreasingly intense social capital. At the core, this social system consists of the entrepreneur and an “Inner Group” who share common language, experience, vision and cognition – but individually possess diverse problem solving styles and functional knowledge. The Inner Group is crucial to ideational productivity and most of the processing of feedback from experiments (both social/conceptual and active/concrete) occurs at this level.

**FIGURE 21**  
**Social Levels of Ideation**



Roughly half of our respondents described a unique one-on-one relationship with a member of the Inner Group – a “Trusted Partner.” Similar dyadic relationships have been described by researchers in other domains (Farrell, 2003), however, to our knowledge this “soul mate” phenomenon has not appeared in the entrepreneurship literature. Dyadic and Inner Group ideational dynamics are similar; however Trusted Partners share ideas openly with no fear of judgment or concern about the agenda or motives of their partners. As expressed in the quote below, Trusted Partners described intensely focused sessions of shared cognition in which partners interactively exchanged and translated symbols between media, i.e. from verbal or written words to graphical images and back to words, at different levels of granularity.

(He) will say...a story or something, and that just triggers something. He actually used the word \_\_\_\_ but I didn't know what that was. I mean, I interpreted in my mind – I knew that he wasn't thinking this. As soon as he said that...I saw the three boxes in my mind. We do a lot of that where he'll say something. I don't know what he means, but maybe I'll put a twist on it, my interpretation. I'll say something. He'll come back and say, "Hey, I like that." It seems to be more prevalent when it's just the two of us.

The core idea gains novelty and usefulness through each interactive exchange while the shared understanding of their idea grows. Distributed ideational cognition requires an extraordinary connection between Trusted Partners that was reported as unattainable in any other setting. The Inner Group was highly productive but Trusted Partners described inhibitions and concerns regarding how their thoughts might be judged in a group setting and would reflect badly on them personally.

I know for me personally, I won't throw things out quite so on a whim. Maybe I wait until I think it's a much better idea. So I might throw out a little sillier idea if it's just (my partner) and I. I actually feel that I've been more creative when it's... just the energy from the two of us, and not from the whole group.

Our interview protocol was not designed to specifically probe for details about the formation of the Inner Group, however, there is evidence of an informal “auditioning” process that allows entrepreneurs to attain the familiarity and trust necessary for inclusion into this highly selective social space:

It's very important that they fit. So everyone who has come in, we started out by bouncing ideas off of them and getting feedback in terms of either they get it or they don't. If they don't get it, then okay, it's not a good fit.

A “Close Outer Group,” operating just beyond the “Inner Group,” consists of extra-firm actors, i.e. key partners, customers, support groups (such as entrepreneurs' organizations) and a collection of individuals constituting what one entrepreneur called his “personal board of directors.” Contact with members of the Close Outer Group is much less intimate and familiar than with the Inner Group but frequent enough to maintain a close relationship. Most social experimentation occurs within this Close Outer Group and its members often represent key actors in the Ideational Hypothesis.



The final layer revealed by our data is the “Outer Group” consisting of the weakest ties to the firm. Encounters with the Outer Group are either by chance or intentional with highly strategic intent.

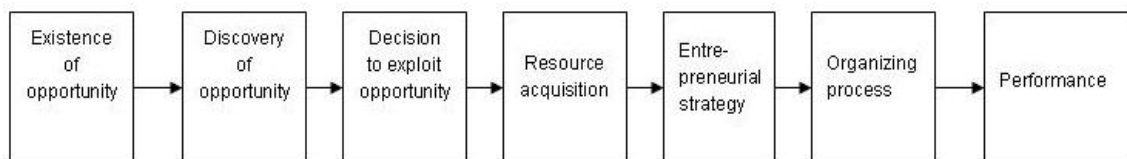
So I always start with the CEO. I normally find the contact details through press releases. Got his name. Normally there are three variances on email addresses that you can work on to get in contact with them. Sent him an email. I normally get a reply same day from CEOs. I was bounced around to three or four people, but he kept in contact. He said have you found the person you want? I find it pretty easy to get a hold of anyone in any company if you've got something valid to talk about.

By definition, the entrepreneurs do not know members of the Outer Group very well (perhaps not at all) so unless the meeting is by chance, the entrepreneur has to state a clear specific purpose for the contact. Socializing an idea with the Outer Group has the greatest opportunity for novel and highly divergent influence; however, our data indicates the Outer Group was by far the weakest source of ideational productivity.

### **EIP versus Classical Theory of Entrepreneurship**

Entrepreneurial business development is commonly portrayed as an orderly, linear process (see Figure 22) that begins with the discovery and recognition of an opportunity followed by resource acquisition, strategy development, organization and execution (Shane, 2003). Researchers describe entrepreneurial opportunity recognition as a creative decision making process to assemble new “ends-means” frameworks (Shane, 2003: 42).

**FIGURE 22**  
**The Entrepreneurial Process (Shane 2003)**



Our findings depart sharply from this classical model and suggest that our EIM spans all stages the entrepreneurial process including resource acquisition, strategy (perspective) and performance (experimentation) and offers a vastly more realistic portrayal of the actual practice of entrepreneurship.

### **Domain Knowledge, Ideation and Metacognition**

The entrepreneurs in our study demonstrated creative ideation in many domains, including domains outside their recognized area of domain expertise; however, they consciously and exclusively selected ideas within a “home domain” for elaboration. When asked about domain selectivity, entrepreneurs cited insufficient understanding of the new domain risk factors, challenges developing new Close Outer Group network ties and issues with attaining funding in a domain where they lack a proven track record.

These entrepreneurs clearly demonstrated a meta-cognitive approach to ideation and risk management – they had sufficient knowledge to generate credible highly novel trial ideas outside their home domain, but also had self-awareness that they lacked other key assets for successful elaboration. This new understanding of the extraordinary domain specificity of entrepreneurial ideation sheds new light on the complex role of domain knowledge within the practice of entrepreneurship.

### **The Entrepreneurial Ideation Process and Learning**

Mapping the stages of our EIP into Experiential Learning Theory (Kolb, 1984) yields a useful and enlightening theoretical framework that extends Experiential Learning Theory (ELT) beyond individual creativity and learning into a broader multi-level social construct for innovation.

1. EIP Problem Engagement = ELT Concrete Experience (CE): Engaging in problem formulation is a predominantly Concrete Experiential process, however, it also involves at least one complete learning cycle to reflect, assimilate and contextualize the problem and to ultimately comprehend the problem in concrete terms.
2. EIP Incubation = ELT Reflective Observation (RO): Incubation/Reflective Observation can occur on either an individual level or jointly between Trusted Partners or the Inner Group.
3. EIP Trial Idea/Hypothesis Formulation = ELT Abstract Conceptualization (AC) and Convergence: Following an incubation period, individuals or the Inner Group conceptualize and analyze a specific idea and hypothesis.
4. EIP Social Conceptual Experimentation or Active Experimentation = ELT Active Experimentation (AE): Socializing an idea involves the Active Experimentation (AE) learning stage followed by a complete learning cycle to sense and process social feedback. Conducting a physical concrete experiment is likewise an AE activity followed by a complete cycle of learning.

Table 3 summarizes the development of an idea, tracing its Experiential Learning path as it spirals outward from individual problem engagement to different levels of social experimentation and finally to the uniquely entrepreneurial active experiment – announcing an unfinished product to gauge customer interest.

**TABLE 3**

**Case Study: Stages of Entrepreneurial Ideation/Experiential Learning Theory Map**

Kolb ELT Map	Stage of Entrepreneurial Ideation
	<p><b>1. Problem Engagement (Individual):</b> “I tend to write things down because it just kept it top of mind for me. I’ve got a note in a notebook somewhere where I wrote a note that says we need to have something we can sell directly to independent contractors, and that was the beginning of the thought.. It was enough of a reminder.”</p>
	<p><b>2. Incubation (4-5 Months, Individual):</b> “It just kept getting moved from one to-do list to the next one to the next one, and some background process in my brain was running around. I was talking to people about it. Customers, constantly talking to people about it.”</p>
	<p><b>3. Insight (Individual):</b> “When I write things down like that, I have... these flashes. One day - it occurred to me that our technology was one weeks’ worth of effort away from being able to do something that nobody else could do. So that’s when it tripped over.”</p>
	<p><b>4. Social Experiment (Inner Group):</b> “Great idea. We can make that work. We’ll go off and get that done... the board was just like, “How is this going to make us more money?” So when I explained it to them, they were all excited.”</p>
	<p><b>5. Social Experiment (Close Outer Group):</b> “And then in a 48-hour period, I managed to scare up the two companies I wanted to partner with, get them both on the phone. I knew them, all the players there. I laid it all out and they agreed immediately.”</p>
	<p><b>6. Social Experiment (Close Outer Group):</b> “She has this idea that instead of using VARs, why don’t you talk to these companies that provide service? Without her and the guy from the employee outsourcing company - and the interesting thing about that is those relationships...are years old... the constant nurturing of these relationships is an important part of getting things done these days.”</p>
	<p><b>7. Social Experiment (Outer Group):</b> “I talked to two or three of the value added resellers that thought they might be able to help out...But they didn’t have any positive ideas. The interesting thing about that talking to that group was it was a roadblock conversation. “Hey, I’ve got this idea.” Yeah, but.”</p>
	<p><b>8. Active Experiment:</b> “We’ve put up a webpage to take reservations for it just to see what kind of traction it would get in the industry. We’re going to let the registration page run for five or six weeks. Then take stock of how many people are actually signing up for it and whether or not it’s worthwhile in putting in the final touches.”</p>

Our participant entrepreneurs displayed evidence of a cognitive style that emphasizes action and experimentation or a flexible style with fluency throughout the entire ideation cycle. Data suggests that highly educated domain experts usually favor analytical and conceptual processes ( Kolb & Kolb, 2005a; Pinard & Allio, 2005) and may be subject to “cognitive entrenchment” or problem solving fixations due to “high level stability in one’s domain schemas” (Dane, 2010: 579). The entrepreneurs in our study exhibited an extraordinary cognitive agility in avoiding such entrenchment by taking action and moving their business forward.

### **Limitations**

Our study is based upon a small non-random sample of 32 entrepreneurs with limited geographic and industry diversity. All of the participants in the study have achieved some measure of entrepreneurial success, however, most have dealt with the usual struggles of entrepreneurship and some of their behavior and methodologies may therefore not represent best practices. All of our participants were in the technology industry and we caution against generalizing our results to non-technology industries.

The principle researcher in this study is a technology entrepreneur and it is possible that the researcher’s personal experiences, thoughts and opinions could have influenced the interpretation of interview data. Data and findings were subject to careful review and oversight from a panel of advisers in order to offset personal biases and maintain objectivity.

### **Implications for Practice and Further Research**

Practitioners may benefit from our interpretation of a strongly social and experimental nature of ideation. The importance of a Trusted Partner and strong Inner

Group to our study participants cannot be overstated and serves as an encouraging model for aspiring entrepreneurs who find the traditional view of the “lone entrepreneur” dispiriting. The outward-looking social nature of entrepreneurs can be adopted and developed by nascent entrepreneurs as can the entrepreneurial predilection for experimentation.

Our findings suggest many opportunities for future research. Ethnographic and longitudinal studies could provide additional detail about how Trusted Partner dyads and Inner Groups form, function and evolve over time. Such research would provide first-hand access to the entire team, exposing a greater breadth of social perspectives.

Our data demonstrates how entrepreneurs perform iterative experimentation using a cognitive style represented by Kolb’s “Accommodating” quadrant emphasizing Active Experimentation and Concrete Experience (Kolb, 1984). However, we used the Kolb Experiential Learning Theory strictly as a descriptive framework and did not administer Kolb Learning Styles Indicator tests to participants. Quantitative studies could be conducted looking for correlations between learning style or cognitive style test instrument results and entrepreneurial performance.

Absorptive Capacity, the limitations of processing “phenomenon one can make sense of” (Nooteboom, 2000: 73) has been used to explain learning and problem solving issues between partnering firms engaged in joint R&D and technology transfer.

Absorptive Capacity could be explored as a team level theory to explain why, in spite of the theoretical advantages of incorporating diverse “weak tie” resources and perspectives, the Inner Group seem to audition and self-select members with similar perspectives who “get it.”

As Nooteboom points out, “sense making, understanding and agreement are more or less limited. People can collaborate without agreeing, it is more difficult to collaborate without understanding, and it is impossible to collaborate if they do not make sense to each other” (Nooteboom, 2000: 74). This Inner Group “auditioning” process could be explored as a possible self-defense mechanism that protects limited team cognitive resources from being overwhelmed by divergent influences or destructive internal debate.

## **CHAPTER IV: ENTREPRENEUR LEARNING STYLE AND FLEXIBILITY EFFECTS ON INNOVATION DECISION SPEED AND FIRM PERFORMANCE (STUDY II)**

### **Preface**

This study uses quantitative methods to further examine the Chapter 3 findings regarding individual learning traits and behaviors associated with successful entrepreneurial technology product innovation. We developed and tested a research model based upon our qualitative findings that innovative entrepreneurs prefer iterative methods over protracted analysis and exhibit a trait we described as “cognitive agility” defined as the ability to avoid a debilitating fixation on only certain stages of the learning process for innovation.

### **Introduction**

Entrepreneurs rely upon innovation to create new markets and to differentiate themselves in highly competitive markets (Amabile, 1997; Schumpeter, 1947; Shane, 2003). Innovation is the cornerstone of successful entrepreneurship within dynamic emerging markets and requires both expert level domain knowledge and the ability to acquire and apply new knowledge to solve problems (Shane, 2000). Learning is the cognitive and social process of knowledge acquisition and has recently emerged as a robust theoretical platform for studying how entrepreneurs generate innovative ideas (Armstrong & Mahmud, 2008; Baum & Bird, 2010; Baum et al., 2011; Corbett, 2007; Chandler & Lyon, 2009; Dimov, 2007; Gemmill, Boland, & Kolb, 2011).

Researchers have used experiential learning theory as a framework to theorize about the processes of research innovation, entrepreneurial opportunity recognition, ideation and knowledge acquisition (Armstrong & Mahmud, 2008; Carlsson et al., 1976;



Corbett, 2005, 2007; Kolb, 1984; Gemmell et al., 2011). The Kolb Learning Style Inventory (LSI) is the most established instrument for assessing the preferred experiential learning mode for individuals (Kolb, 1984) and now includes a Learning Flexibility Index (LFI) to measure the participant's ability to flexibly adopt different learning modes on a situational basis (Sharma & Kolb, 2009). Cognitive flexibility is key to innovation and there is evidence that technology domain experts are prone to entrenchment that inhibits their ability to innovate (Dane, 2010; Kolb & Kolb, 2005a; Pinard & Allio, 2005). Despite the conceptual and descriptive utility of experiential learning theory, there remain significant gaps in the application of Kolb's learning style and, in particular, learning flexibility as antecedents to entrepreneurial behaviors and performance.

Individual learning traits are most likely to influence firm performance through indirect or mediating processes such as strategic actions, behaviors or competencies (Rauch & Frese, 2000). Strategic decision speed and the use of "multiple iterative methods" have been shown to mediate the effects of individual cognitive traits on new venture growth within dynamic industries (Baum & Bird, 2010). Our study envisions innovation as a non-linear, recursive cyclical learning system featuring rapid cycles of iterative decision making and experimentation, we therefore adopted decision speed and experimentation as our behavior/practice mediators.

We surveyed 172 technology entrepreneurs, all either CEOs and/or founders of their current firms, to explore the relationships between individual learning style traits and entrepreneurial innovation and firm performance via behavioral mediators. Our data provides new insight into how domain experts use complex cycles of learning and experimental problem solving to innovate and succeed as entrepreneurs. These findings

yield surprising conclusions regarding the interaction of learning modes, learning flexibility, experimental practices and decision cycles within our system of entrepreneurial innovation.

## **Literature Review and Hypotheses**

### **Experiential Learning and Entrepreneurship**

Learning facilitates the development and enactment of entrepreneurial behaviors and provides perhaps the “only sustainable source of competitive advantage” (Senge, 1993: 3) for organizations (Rae & Carswell, 2000). Cognitive scientists define learning as a means of acquiring information that can be reduced, elaborated, interpreted, stored and retrieved (Huber, 1991), however, most management researchers prefer to view entrepreneurial learning as an ongoing social, behavioral and experiential cycle rather than as an outcome or goal.

David Kolb describes learning as “the process whereby knowledge is created through the transformation of experience” (Kolb, 1984: 38). According to Kolb, experiential learning is a recursive cycle of grasping and transforming experience through the resolution of “dialectic tension” or opposing means of experience acquisition and transformation. Kolb’s theory of experiential learning builds upon John Dewey’s description of learning as the “continuing reconstruction of experience” (Dewey, 1897: 79) through four learning modes: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE). Effective learning requires “touching all four bases”; however, most individuals have a preference for certain modes which constitutes their “learning style.” Our 2011 grounded theory study mapped the classical Wallas stages of creativity into the Kolb learning space

extended to encompass multi-level social interactions (Csikszentmihalyi, 1996; Gemmell et al., 2011; Wallas, 1926) (see Figure 18 below).

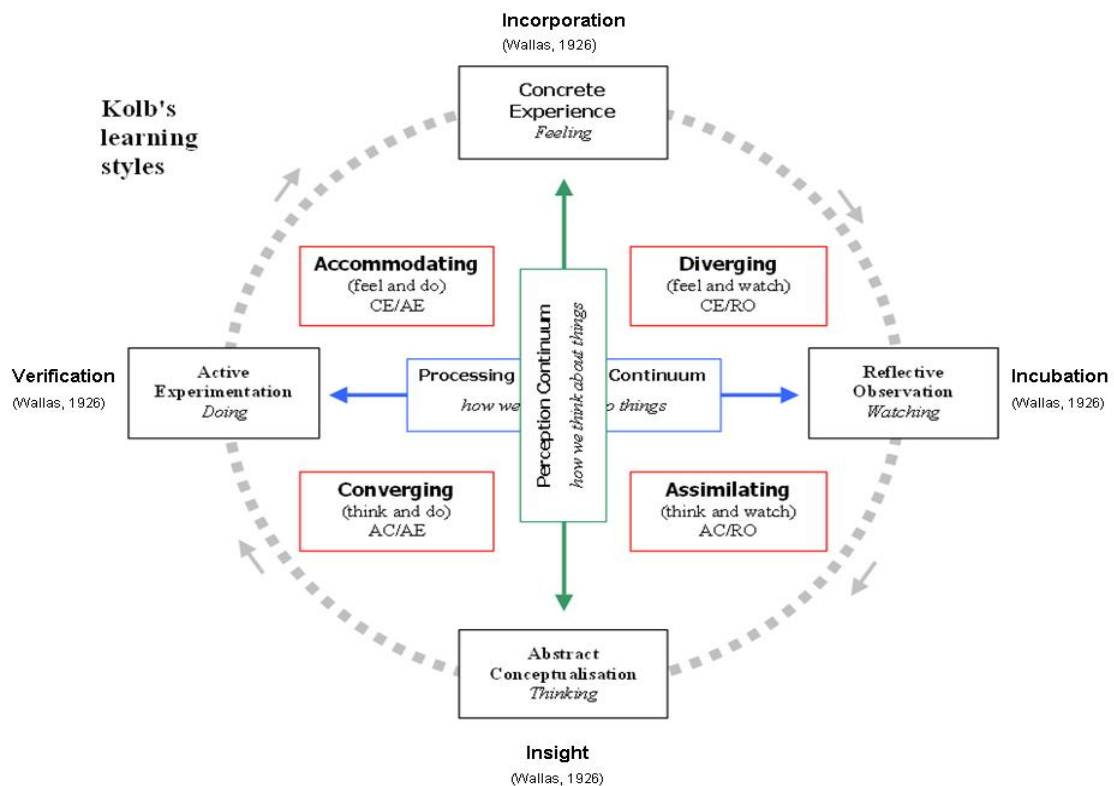
A researcher who administered a 24 item normative version of the Kolb LSI found that technology entrepreneurs who favor Kolb's Active Experimentation and Abstract Conceptualization learning modes discovered more opportunities, suggesting that learning asymmetries contribute to knowledge asymmetries that impact opportunity recognition (Corbett, 2007). Armstrong and Mahmud (2008) also used the normative form of the Kolb LSI and found that managers who favor Kolb's Active Experimentation learning mode have higher tacit knowledge acquisition.

Successful entrepreneurs learn two types of knowledge: (1) domain knowledge regarding their technology and/or market and (2) a more generalized tacit knowledge of "how to be an entrepreneur" (Minniti & Bygrave, 2001). Entrepreneurs gain tacit knowledge for opportunity recognition both through their personal concrete experiences and vicariously, i.e. through indirect observation of the actions and results achieved by others (Holcomb et al., 2009). Entrepreneurs learn experientially through two different transformational modes, either exploitation of existing knowledge by testing actions similar to earlier experiences or exploration of entirely new actions (Politis, 2005).

There is evidence that domain knowledge and tacit entrepreneurship knowledge are interwoven to create strong domain specificity of entrepreneurial practice. Technology entrepreneurs with expert level technology product and market domain knowledge develop practical and innovative new business ideas in a wide variety of domains but they almost exclusively limit their practice to a single domain (Gemmell et al., 2011).

Positive experiential outcomes are often subject to numerous heuristic biases including the representativeness bias, i.e. the tendency to overestimate the frequency, relevance and predictive reliability of previous experiences as they relate to solving new problems, the “availability heuristic,” the tendency to use information that most easily comes to mind (usually based upon the timing or emotionality of the information) and the “anchoring heuristic,” the tendency to move slowly and incrementally from an initial estimated solution (Busenitz & Barney, 1997; Minniti & Bygrave, 2001; Tversky & Kahneman, 1974).

**FIGURE 23**  
**Cycle of Learning and Creativity (Gemmell et al., 2011)**



## **Iteration, Expertise and Flexibility**

Entrepreneurship researchers have defined experimentation as a conscious goal-driven search for improvement through iterative revision while monitoring for results (Baum & Bird, 2010; Thomke, 2003), a process that has been demonstrated to enhance the performance of entrepreneurial businesses (Gemmell et al., 2011; Nicholls-Nixon, Cooper, & Woo, 2000). Entrepreneurs routinely experiment by demonstrating partially developed prototypes to assess market reaction, validate new product designs and identify new customers (Thomke, 2003). Baum and Bird (2010) demonstrated how decision speed and use of iterative experimental actions mediate the effect of Sternberg's Successful Intelligence (Sternberg, 1999) on new venture growth. Experimentation is a predominantly beneficial entrepreneurial practice; however, it can also lead to faulty decision making through biased overestimation of the prevalence of an event based upon only a few data points (Hmieleski & Corbett, 2006; Miner, 2001).

Domain expertise is a key factor in both innovation and entrepreneurial performance (Amabile, 1997; Shane, 2000). However, expertise is a double-edged sword that can induce loss of flexibility and creativity in problem solving (Dane, 2010). Experts change their mental representations of tasks less often than novices (Anzai & Yokoyama, 1984) and consequently struggle to adapt problem solving methods to new environments (Cañas, Quesada, Antolí, & Fajardo, 2003). Domain expertise is generally the product of well established, complex and relatively fixed schemas that are prone to becoming "brittle" and ineffective by changes in circumstance (Lewandowsky & Thomas, 2009: 13).

Experience and expertise benefits the entrepreneur's sensitivity and awareness of patterns (Dimov, 2007) but it also leads to heavily biased and heuristic based decision making (Tversky & Kahneman, 1974; Holcomb et al., 2009). The entrepreneur might, under the pressure of time and circumstance, tend to overestimate the similarities between a current problem and one solved in the past and to use the same solution rather than engaging the new problem as a learning experience.

Prior related knowledge can interact with biased risk/return perceptions to influence the allocation of limited entrepreneurial resources (Garnsey, 1998; Ravasi & Turati, 2005). Managers facing a forced choice decision between two projects might either "starve" or inappropriately escalate resources to one project based upon recent related experience and biased interpretations of perceived risk (Staw, 1976; Staw & Fox, 1977).

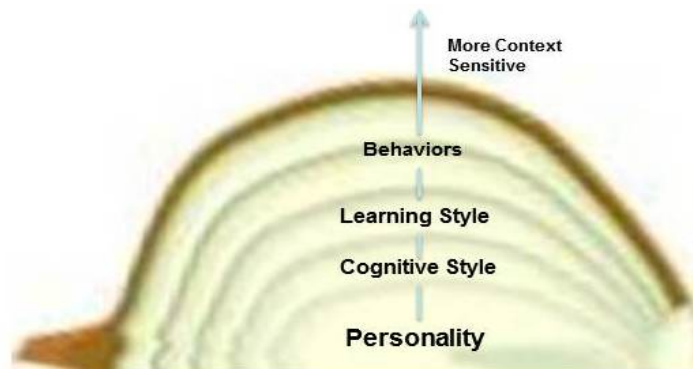
Parker's (2006) study found that entrepreneurs adjust expectations based on experiential feedback only 16% of the time suggesting that entrepreneurs place much greater weight on previous information and experience than on learning opportunities from new information. The accumulation of experience can also impact cognitive entrenchment. Parker found older and more experienced entrepreneurs only adjusted beliefs 14% of the time while younger and less experienced entrepreneurs exhibited much greater sensitivity to new information by responding at the rate of 21%.

Learning style has been demonstrated to influence career interests and areas of domain expertise development (Kolb & Kolb, 2005a). For example, the study of engineering relies upon "formism" as an underlying philosophy of knowledge that is most likely to attract someone with a converging learning style whereas the study of

marketing and sales would be more likely based upon contextualism or pragmatism which would likely attract an accommodating style (Willcoxson & Prosser, 1996).

Sadler-Smith compared and contrasted personality, cognitive style (defined as preferred ways of organizing and processing information) and learning style as key traits for management studies. Human traits can be visualized as analogous to layers of an onion (see Figure 24) with personality at the core wrapped by the cognitive style layer followed by an outer learning style layer (Curry, 1983). The personality core represents a relatively fixed and non-varying trait while each subsequent layer becomes increasingly more context sensitive.

**FIGURE 24**  
**Traits as Layers of an Onion (Curry, 1983)**



Learning style is intrinsically context sensitive and learning mode preferences can vary on a situational basis (Mainemelis, Boyatzis, & Kolb, 2002; Sadler-Smith, 2001). Systematic variability of cognitive traits on a conscious level is indicative of higher order integrative development as evidenced by metacognitive processes and decision rules (Kolb & Kolb, 2009). Such metacognitive traits are conducive to the learning of entrepreneurial expertise (Mitchell, Shepherd, & Sharfman, 2011) suggesting that any

study of entrepreneurial learning style traits should also examine learning flexibility in order to factor in the wide variety of learning contexts encountered by entrepreneurs.

Entrepreneurs in our 2011 qualitative study exhibited what we described as “learning agility” or the ability to solve complex problems while avoiding becoming stuck in a single learning mode. Learning agility is a trait we have hypothesized to be closely related to learning flexibility and innovation decision speed (Gemmell et al., 2011).

### **Innovation and Strategic Decision Speed**

Eisenhardt (1989) found that executive teams composed of fast decision makers in the microcomputer industry exhibited superior performance while using more information to develop more alternative trial ideas than did slow decision makers. A study by Judge and Miller (1991) showed that biotech industry executives who considered more decision alternatives, made decisions faster with a positive impact on financial performance. Another study of small/medium sized companies demonstrated how rapid decision making improved firm revenue growth but not profits among companies in dynamic industries (Baum & Wally, 2003).

Other studies of strategic decision speed and firm results have yielded mixed results. Extrinsic pressures to make rapid decisions have been shown in several studies to have a negative effect on innovation (Amabile, 1983, 1993; Baer & Oldham, 2006). Kessler and Chakrabarti (1996) demonstrated the negative effect of domain expertise on the decision speed of new technology product developers. Functional experts were found to inhibit decision making processes due to their lack of diverse frames of reference and inability to contribute to diverse functional aspects of product development (Purser,



1994). Older and more experienced internet entrepreneurs made faster decisions than their younger and less experienced peers but were also more likely to ultimately suffer firm closure within four years (Forbes, 2005). The pressure of funding and acquisition transactions often leads technology entrepreneurs to fail by abandoning their learning process in favor of rapid, reactive decision making (Perlow, Okhuysen, & Repping, 2002).

### **Hypotheses**

This study focuses on two dimensions of learning style preference as antecedents of behavior and performance: (1) the individual ability to flexibly engage different learning modes based upon the learning situation and (2) the preference for using the Active Experimentation learning mode rather than the Reflective Observation mode (as measured by the AE-RO score from the Kolb Learning Style Inventory).

The effects of individual traits upon firm performance are most commonly mediated by processes involving strategic actions, behaviors or competencies (Baum, 1995; Epstein & O'Brien, 1985). Even core cognitive traits such as intelligence typically account for only perhaps 20% of performance (Sternberg & Hedlund, 2002). The direct influence of traits on firm performance is likely even weaker in complex technology industries with less process orientation and higher trait variability than in task/process-oriented industries (i.e. assembly lines) with lower trait variability (Mischel, 1968).

We therefore conceptualized a high level model shown below in Figure 25 and sought behavioral mediators that (1) reflect the findings of our grounded theory study of entrepreneurial ideation and (2) have demonstrated efficacy in predicting entrepreneurial company performance. Based on these two criteria, we selected two behavioral

mediators: “Swift Action,” the speed of strategic decision making, and “Experimentation.” Our study targeted technology firms in highly dynamic industries where rapid development of creative and innovative solutions is most crucial.

**FIGURE 25**  
**High Level Conceptual Model**



Building on the preceding literature, we hypothesize that individual entrepreneurs with a preference for Active Experimentation over Reflective Observation will more likely engage in experimental practices and thereby attain greater firm level innovation.

*Hypothesis 1. The Active Experimentation learning mode (AE-RO) has a positive indirect effect on Innovation via Experimentation when controlling for firm revenue.*

We focus a great deal on the act of experimentation because of its unique and powerful role within entrepreneurial practice; however, the other stages of learning are equally important to the overall process of innovation and new business formation. Furthermore, we posit that flexible learners are less likely to suffer decision biases and entrenchment (particularly during the Assimilating phase of the learning cycle) consequently allowing them to more easily innovate.

We therefore hypothesize that entrepreneurs with greater learning flexibility will, in the process of using all learning modes, move more efficiently and quickly through the experiential learning process, resulting in more innovative ideas and higher levels of performance.

*Hypothesis 2. Learning Flexibility has a positive indirect effect on Innovation via Swift Action when controlling for firm revenue.*

Experimentation appears to be a predominantly entrepreneurial practice - the scale of investment in a typical corporate product launch and the public relations costs of a highly visible failed experiment discourage large corporations from engaging in experimentation (Gemmell et al., 2011; Sull, 2004). We therefore hypothesize that the practice of experimentation positively impacts entrepreneurial performance both directly and indirectly through the mediator Swift Action. We have hypothesized partial mediation because the literature has produced mixed/uncertain results regarding the effects of Swift Action on performance; hence, we expect the Swift Action influence to be less impactful on Innovation than the direct effects of Experimentation.

*Hypothesis 3. Swift Action positively and partially mediates the direct positive effects of Experimentation on Innovation when controlling for revenue.*

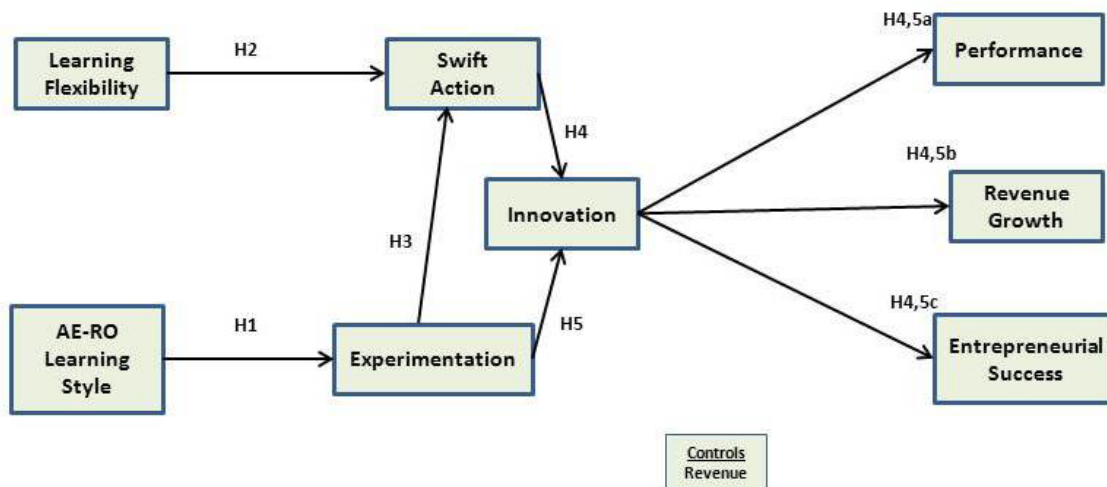
***Innovation as a mediator of swift action and experimentation.*** Numerous studies have linked product and process innovation to entrepreneurial firm performance; (Garcia & Calantone, 2002; Hitt, Hoskisson, & Kim, 1997; Schumpeter, 1947; Shan, Walker, & Kogut, 1994); we therefore expect innovation to mediate the effects of entrepreneurial behaviors and practices on firm performance and individual entrepreneurial success. Given the mixed outcomes of decision speed and firm performance studies, our hypotheses H4a, b, c only foresee indirect effects between Swift Action and our three performance direct variables. On the other hand, we anticipate strong positive effects between experimentation and firm performance and success, hence our partial mediation hypotheses H5a, b and c. These are summarized as follows:

*Hypothesis 4a, b, c. Swift Action has positive indirect effects on a) firm Performance, b) Revenue Growth and c) Entrepreneurial Success via Innovation when controlling for revenue.*

*Hypothesis 5a, b, c. Innovation positively and partially mediates the direct positive effects of Experimentation on a) firm Performance, b) Revenue Growth and c) Entrepreneurial Success when controlling for revenue.*

Building on our qualitative grounded theory study and the current base of literature and theory, we developed a model to guide our quantitative study (see Figure 26).

**FIGURE 26**  
**Conceptual Model of Learning, Innovation and Entrepreneurial Performance**



## Research Design and Methods

### Sample

We conducted this study by surveying 202 technology entrepreneurs located throughout the United States. A special effort was made to gain geographically diverse participation from all regions of the U.S. (see Table 4). We contacted active technology entrepreneurs from our personal network who are either founders and/or CEO of their current company. Responses from entrepreneurs outside our network were carefully

reviewed to ensure valid responses solely from technology entrepreneurs based upon responses to questions about the participant's history as an entrepreneur, their current title and at what stage they joined their current company.

**TABLE 4**  
**Demographic Summary**

N= 172	No. Responses	%
<u>Region</u>		
Northeast U.S.	12	7
Southeast U.S.	44	26
Midwest U.S.	21	12
Southwest U.S.	9	5
Western U.S.	21	12
Not reported	65	38
<u>Industry</u>		
Hardware/software systems	41	24
Software	34	20
Internet/e-commerce	53	31
Electronics	12	7
Biotechnology	4	2
Clean Energy	4	2
Telecom	3	2
Medical Devices	5	3
Other Technology	16	9
<u>Joined Current Firm As</u>		
Founder	132	77
Principal/Officer and early employee (first 25)	23	13
Early employee (first 2(5)	17	10
<u>Position in Current Firm</u>		
CEO	106	62
CFO/CTO/CIO	12	7
VP/SVP/EVP/Director	54	31
<u>Education</u>		
High School	11	6
Some College	46	27
College Degree	58	34
Master's Degree	39	23
Doctoral Degree/Professional Degree (JD, MD)	13	8
Not reported	5	3

### Data Collection

Data was collected over a three month period from May to July, 2011 via an online survey using Qualtrics with participants recruited either directly from entrepreneurs within the principle researcher's professional network or by referrals from investors or start-up company support networks such as university incubators.

The survey instrument totaled 46 items (including demographic data items) and was organized in sections by factor (not randomized), starting with a mix of both exogenous and endogenous factors and ending with the 20 items for the Kolb Learning Style Inventory.

Wherever possible, items were carefully adopted from extant literature, based upon their theoretical relevance and demonstrated causal predictive efficacy, with minimal or no changes. However, one construct—Swift Action—had to be composed and tailored specifically for the technology industry. We also created an “Entrepreneurial Success” construct from four items: current firm revenue growth, current firm position (with CEO as the highest score), status upon joining the current firm (founder as the highest score), number of start-ups (serial entrepreneurialism), number of strategic exits and size of largest strategic exit.

## **Measures**

***AE-RO.*** The Kolb Learning Style Inventory (LSI) v.3.1 is composed of twenty forced choice questions asking the participant to rank four choices of their preferred learning method (4=most like me, 1=least like me). Each choice represents one of four learning modes and the ranked score for each mode over the first twelve questions is summed to create four raw Learning Style scores. AE-RO is the Active Experimentation raw score minus the Reflective Observation raw score.

Some researchers contend the four learning modes should be measured using normative rather than ipsative (forced choice) scales (Geiger, Boyle, & Pinto, 1993) and question Kolb’s basic premise of dialectic tension between opposing learning modes. Learning involves not only thoughts but also higher level integration of the five senses,

behaviors, emotions, experiences and social interactions through a dialectical process of acquisition and transformation (Akrivou, 2008; Kolb, 1984). The dialectic nature of Kolb's experiential learning requires forced choice questions to resolve the tension and preference for polar opposite modes. It should be further noted that while the four learning mode scales are ipsative, the AE-RO combination score is not ipsative (Kolb & Kolb, 2005b).

While there has been considerable debate about the ipsative versus normative analysis of learning orientation, our position is that this research project is best served by utilizing the forced ranking nature of the traditional test to gain sharper resolution of the entrepreneur's preference for Active Experimentation. Furthermore, the ipsative test provides necessary contrast to measure the situational variances that are foundational to the LFI measure. Learning flexibility has not been validated as a normative construct and would likely result in an impractically long survey.

***Learning Flexibility Index (LFI).*** The final eight items in the Kolb LSI v3.1 query learning preferences in different settings. Learning flexibility is defined as  $LFI = 1 - W$  where  $W$  is the Kendall's Coefficient of Concordance (Legendre, 2005).  $W$  is calculated as follows:

$$W = (12s - 3p^2n(n + 1)^2)/p^2 (n^3 - n)$$

$$\text{Where, } s = \sum_{i=1}^n R_i^2$$

$$p = \text{Number of learning contexts} = 8$$

$$n = \text{Number of learning modes} = 4$$

$$R = \text{Row sum of ranks}$$

The row sum of ranks is the sum of the ranking scores (from 1 to 4) for each of the four learning modes across the eight learning contexts.

*Swift action.* Swift action is an industry specific construct that has been shown in prior entrepreneurship and strategy literature to mediate the effect of individual traits on firm performance (Baum & Wally, 2003; Baum & Bird, 2010). We developed our own version of Swift Action by creating three strategic innovation decision-making scenarios relevant to any technology company and asking respondents to estimate their decision making time-frame for each scenario.

The first scenario was a “New Product Development Decision” worded as follows: “You are excited about an idea for a new product or service that could double next year’s growth rate. Your development personnel are tied up on other projects so pursuing your idea will require a reassessment of your current product roadmap. Indicate the approximate number of days it would take you to decide whether to pursue the new product.”

The second scenario was a “Strategic Partnering/Technology Licensing Decision” worded as follows: “You have identified a partner with a key technology that could unlock new markets and opportunities for your firm. You lack appropriate resources to develop the technology in-house. Additionally, resources to manage the partnership and absorb the technology are limited. Indicated the approximate number of days it would take you to decide whether to pursue the partnership.”

The third scenario was a “Target Market Decision” worded as follows: “You have identified two markets for your technology that appear to offer similar high growth opportunities; however, you cannot pursue both market opportunities with existing



resources. You have been evaluating both markets but know you need to focus on just one of them. Indicate the approximate number of days it would take you to decide which market to pursue.”

Participants responded to the “number of days to make your decision” by moving sliders across a scale from 0 days to 100 days. The responses were inverted (divided into 100) and scaled logarithmically.

***Experimentation.*** Experimentation was measured using five items based upon “Multiple Iterative Items” from Baum and Bird (2010). Typical statements were “We frequently experiment with product and process improvements” and “We regularly try to figure out how to make products better.” Each item was measured using a five point Likert scale (1=Strongly disagree, 5=Strongly agree).

***Innovation.*** Innovation was measured using three items based upon the “Performance” construct from Song, Dyer, and Thieme (2006). Questions included “Our new product development program has resulted in innovative new products”, “From an overall revenue growth standpoint our new product development program has been successful” and “Compared to our major competitors, our overall new product development program is far more successful at producing innovative products.” Each item was measured using a five point Likert scale (1=Strongly disagree, 5=Strongly agree).

***Performance.*** We chose a single broad firm performance construct from Reinartz, Krafft, and Hoyer (2004) with four items that asked participants to self-rate overall financial performance and success attaining market share, growth and profitability. Each item used a five point Likert scale (1=Poor, 5=Excellent).

***Entrepreneurial success.*** Entrepreneurial success is a new construct developed to measure the track record and career success of an individual entrepreneur calculated through a weighted sum of five factors: Position in current company, status upon joining the company (i.e., founder, early employee, officer), number of strategic exits/liquidity events, largest strategic exit/liquidity event, serial entrepreneurialism (number of start-ups). The resulting scale yielded a measure of career success that ranged for this sample from 2 to 27.

***Revenue growth.*** Revenue growth was measured with a single item per Low & Macmillan (1988), “Approximately what percentage annualized revenue growth has your company experienced over the last year?” The item was measured over a six point scale (1 = Revenue declined, 6 = 50+%).

Appendix B includes a table summarizing the definitions, items and sources of the constructs used in this study.

## **Data Analysis**

### **Data Screening**

The research model was tested using AMOS and SPSS for Windows (PASW Statistics Gradpack 18.0, 2010). Our initial data set of 202 survey responses was first screened for missing data and checked for modeling assumptions of normality, skewness, kurtosis, homoscedasticity, multi-collinearity and linearity. Independent variables LFI and AE-RO did not display multi-collinear with VIF scores of 1.000. All items yielded skewness and kurtosis scores below +/-1.00 except for Swift Action which displayed marginal kurtosis (1.09) but was deemed acceptable without transformation.

Four respondents were discarded due to incomplete Kolb LSI/LFI data. We rejected another 26 respondents who were judged to be non-technology entrepreneurs based upon responses to questions about participants' current employment, their industry and entrepreneurial experience. The remaining 172 responses had a total of five missing data points (<3%) and mean imputation (Hair, Black, Babin, & Anderson, 2010) was used to calculate these missing values. Data imputation is an acceptable technique in cases where <5% of data is missing (Tabachnick & Fidell, 2000).

Swift Action data was transformed per ex ante literature (Baum & Wally, 2003) as follows:

$$SA = \text{Imputed Factor Scores per AMOS CFA analysis}$$
$$\text{Swift Action} = \log_{10}100/SA$$

### **Learning Style Constructs**

The Kolb Learning Style Inventory is a long-standing and well-established psychometric test with high construct validity based upon numerous studies of factor analysis (Katz, 1986; Willcoxson & Prosser, 1996). A study of science students, who should possess traits similar to the technology experts in our study, found both high internal consistency (coefficient Alpha ranged from .81 to .87 – see Appendix C) and confirmation of the two bipolar learning dimensions per Kolb's theory. We therefore used the test unmodified and chose to not refactor the 20 items in the Kolb LSI.

### **Factor Analysis**

We performed Exploratory Factor Analysis (EFA) using SPSS to evaluate and reduce the 15 items associated with Innovation, Performance, Experimentation and Swift Action to a smaller number of latent variables that, if possible, coherently reflect the four

distinct a-prior theoretical constructs consistent with our research expectations. Because our goal was to identify latent constructs expected to produce scores on underlying measured variables (Tabachnick & Fidell, 2000) in the presence of non-normality (Fabrigar, Wegener, MacCallum, & Strahan, 1999) and given our exclusive interest in shared variance (Costello & Osborne, 2005) and because communalities of most variables exceed .5 (Hair et al., 2010) we also performed common factor analysis (CFA).

Our EFA was performed with Principle Axis Factoring (PAF) and Promax rotation based upon our assessment that the items are non-orthogonal and our ultimate goal of structural equation modeling. We evaluated the latent root criterion in which possible factors with an eigenvalue less than 1.0 are excluded as well as scree plot analysis to determine how many factors should be included. The initial 15 items yielded a four factor solution with eigenvalues > 1.0 and exhibited acceptable loadings exceeding .5 and minimal cross-loadings (< .2).

**TABLE 5**  
**Four Factor Pattern Matrix (Principal Axis Factoring, Promax Rotation)**

	Innovation	Performance	Experimentation	Swift Action
i1	.844			
i2	.572			
i3	.622			
p1		.876		
p2		.874		
p3		.860		
p4		.878		
exp1			.714	
exp2			.819	
exp4			.551	
sa1				.861
sa2				.861
sa3				.863

**TABLE 6**  
**KMO and Barlett's Test Results**

KMO, Barlett's Test and Total Variance Explained	
KMO Measure of Sampling Adequacy	.811
Barlett's Test of Sphericity	
Approximate Chi –Square	1099.438
Df	78
Significance	.000
Total Variance Explained	66.8%

### **Confirmatory Factor Analysis**

Confirmatory Factor Analysis (CFA) builds on shortcomings of EFA including: (1) inability to constrain some factor loadings to zero; (2) inability to correlate measurement errors; and (3) inability to specify which factors are associated (Bollen, 1989). We performed this CFA analysis using structural equation modeling (AMOS) and began by reviewing the factors and their items and established face validity. We specified the measurement model in AMOS with the four factors derived from EFA, each identified or over-identified. Each factor was hypothesized to be reflective (caused by the latent construct) and for the items to therefore move together. The latent constructs were allowed to correlate with other constructs given no evidence to the contrary. Error terms within constructs could be correlated, however, error terms across different constructs were not allowed to be correlated. Our sample size of 172 was deemed sufficient based upon Hoelter's Critical N values that indicate the model is acceptable at the .05 significance level with N=131 and at the .01 significance level with N=148.

CFA confirmed factor validity (convergent and discriminant) of the four constructs (see Tables 7 and 8). Discriminant validity was examined further by comparing the square root of AVE to the construct correlations (see Table 8) per the

recommendation that the square root of AVE should exceed the correlations of that construct and all others (Liang, Saraf, Hu, & Xue, 2007). The measurement model obtained using AMOS exhibited satisfactory fit statistics (Chi-squared = 85.1, df = 48, CMIN/df = 1.774, SRMR = .0565, CFI = .962, AGFI = .887, TLI = .947, RMSEA = .067 and PCLOSE = .111). While an ideal RMSEA score is .05 or less, a value of about .08 or below indicates a reasonable error of approximation and is therefore satisfactory (Bollen & Long, 1993). Furthermore, RMSEA is within the 10/90 percentile range and the PCLOSE of .111 > alpha = .05 and indicates acceptable fit.

**TABLE 7**  
**Factor Validity Test Results**

Factor	CR	AVE	MSV	ASV	Convergent Validity CR>AVE AVE>.5	Discriminant Validity MSV<AVE ASV<AVE
Innovation	<b>0.75</b>	<b>0.51</b>	<b>0.38</b>	<b>0.23</b>	Yes	Yes
Performance	<b>0.90</b>	<b>0.76</b>	<b>0.31</b>	<b>0.14</b>	Yes	Yes
Experimentation	<b>0.79</b>	<b>0.56</b>	<b>0.38</b>	<b>0.17</b>	Yes	Yes
Swift Action	<b>0.89</b>	<b>0.74</b>	<b>0.01</b>	<b>0.00</b>	Yes	Yes

**TABLE 8**  
**Discriminant Validity**

Factor	Innovation	Performance	Experimentation	Swift Action
Innovation	<b>.714</b>			
Performance	.558***	<b>.872</b>		
Experimentation	.616***	.343***	<b>.748</b>	
Swift Action	.085	.027	-.046	<b>.860</b>

Square root of AVE in bold on diagonals

### Common Methods Bias (CMB) Testing

An un-rotated principal component analysis with single factor extraction (Harman's single-factor test) was also conducted to explore the presence of common

method bias in our study, resulting in 31.1% of variance explained with all items loading into a single factor.

However, Podsakoff, MacKenzie, Lee, and Podsakoff (2003) characterize the Harman single-factor test as a diagnostic technique that “actually does nothing to statistically control for (or partial out) method effects” (2003: 889) and therefore does not adequately confirm the absence of CMB. We therefore also employed the marker variable technique (Lindell & Whitney, 2001) which attempts to control for CMB by including “a measure of the assumed source of method variance as a covariate in the statistical analysis” (Podsakoff et al., 2003: 889). Application of the marker variable technique requires the inclusion in the study of a variable that is theoretically unrelated to at least one of the focal variables. The correlation observed between the marker variable and the theoretically unrelated variable is interpreted as an estimate of CMB (Lindell & Whitney, 2001). Our analysis used Industry Dynamism as the marker variable and yielded a common factor loading of 4%, therefore providing satisfactory evidence of the absence of common method bias.

### **Controls**

All sample companies were small entrepreneurial firms, however, some factors could be influenced by the size and stage of the company (Perlow et al., 2002), therefore we used revenue as a control to account for variance based on company size (see Appendix F for control effects).

### **Mediation Analysis and Path Modeling**

We performed mediation analysis using causal and intervening variable methodology (Baron & Kenny 1986; MacKinnon, Lockwood, Hoffman, West, & Sheets,

2002) and techniques described by Mathieu and Taylor (2006). Mediated paths connecting independent variables to dependent variables through a mediating variable were analyzed to examine the direct, indirect, and total effects. For each of the mediation hypotheses being tested, a model was first run without the mediation paths (only direct effects). Then, the analysis was performed again using the AMOS bootstrapping option to analyze direct and indirect effects with mediation. After testing for mediation effects, we restored the full model and trimmed the insignificant paths to achieve a final path model.

### **Model Fit**

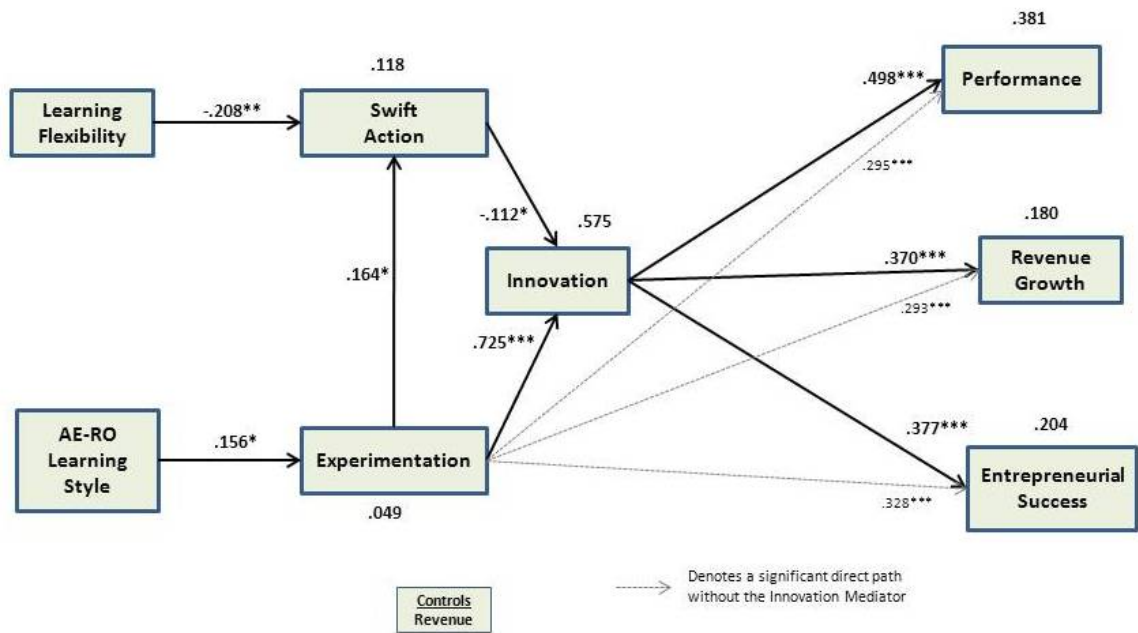
Table 9 summarizes the key model fit parameters for both the category and experience multi-group models. Our goodness of fit (GOF) analysis focused primarily on the following parameters: CMIN/df (Tabachnick & Fidell, 2000), SRMR, CFI (Hu & Bentler, 1999) and PCLOSE (Joreskog & Sorbom, 1997).

**TABLE 9**  
**Model Fit Summary for Path Model**

<b>Trimmed Category Model</b>		
<b>Key GOF Parameters</b>	<b>Criteria</b>	<b>Value</b>
CMIN/df	<2	1.068
Probability	Higher	.378
SRMR	<.05	.042
AGFI	>.90	.936
CFI	>.95	.997
RMSEA	<.05	.020
PCLOSE	>.50	.776



**FIGURE 27**  
**Final Trimmed Path Model**



## Results

Table 10 provides the means, standard deviations and bivariate correlations for the study constructs. The results of mediation testing for each of the nine hypotheses are summarized in Table 11.

Hypothesis 1 proposed that preference for the Active Experimentation learning style over Reflective Observation (AE-RO) would have an indirect positive effect on innovation via experimental practices. In accordance with previous studies of trait effects on performance we anticipated no direct effects between learning traits and firm performance; however, we did expect learning style to predict certain entrepreneurial behaviors such as propensity to solve problems through experimental methods versus protracted reflection and analysis. We also expected the effects of learning traits effects to propagate through mediators to indirectly influence firm performance. This was

indeed the case as AE-RO showed no direct through effects on innovation, either with or without experimentation as a mediator. However, the model indicated moderate and significant indirect effects ( $\beta = .120$ ,  $p < .05$ ) thus confirming our indirect effects hypothesis.

Similarly, Hypothesis 2 posited an indirect positive relationship between learning flexibility and innovation via strategic decision speed. Mediation tests resulted in a very weak but significant indirect relationship ( $\beta = .025$ ,  $p < .05$ ), thereby providing marginal support for Hypothesis 2.

Hypothesis 3 stated that decision speed would positively mediate the direct positive relationship between experimentation and innovation. Entrepreneurs who experiment are more likely to quickly choose a course of action and, in the process, achieve greater innovation. We expected a strong positive relationship between experimentation and innovation both with and without decision speed as a mediator, hence our anticipation of partial mediation. As expected, the model displayed a very strong positive relationship between experimentation and innovation both with the mediator ( $\beta = .725$ ,  $p < .001$ ) and without the mediator ( $\beta = .708$ ,  $p < .001$ ). Surprisingly, the indirect effects via swift action were negative ( $\beta = -.018$ ,  $p < .05$ ). Our hypothesis 3 of partial mediation is supported, although the mediating process is different than we expected (more details about this are in discussion).

Hypothesis 4a, b and c anticipated that strategic decision speed would indirectly positively influence our three performance outcomes: overall firm performance, revenue growth and individual success as an entrepreneur. Mediation testing confirmed weak but significant effects (H4a:  $\beta = -.068$ ,  $p < .01$ ; H4b:  $\beta = -.037$ ,  $p < .01$  and H4c:  $\beta = -$

.032,  $p < .01$ ). Once again, the hypotheses are confirmed although the effects were surprisingly reversed from what was expected (negative rather than positive).

Hypotheses 5a, b and c stated that experimentation would have strong positive effects on firm performance, revenue growth and entrepreneurial success, positively mediated by innovation. Strong positive effects in the absence of the innovation mediator were indeed observed (H5a:  $\beta = .295$ ,  $p < .001$ ; H5b:  $\beta = .293$ ,  $p < .001$ ; H5c:  $\beta = .328$ ,  $p < .001$ ), however, in the presence of innovation, all direct effects became insignificant. Indirect effects were strong (as expected) and significant (5a:  $\beta = .443$ ,  $p < .01$ ; 5b:  $\beta = .249$ ,  $p < .01$ ; 5c:  $\beta = .214$ ,  $p < .01$ ). Thus, mediation hypotheses were confirmed although in the form of full mediation rather than partial.

**TABLE 10**  
**Inter-factor Correlations, Cronbach's Alpha, Means and Standard Deviations**

N=172	Innovation	Performance	Experimentation	Swift Action	Learning Flexibility	AE-RO	Entrep. Success	Rev Growth
Mean	3.119	3.055	2.411	.820	.704	6.081	12.971	3.05
SD	.589	.935	.430	.473	.187	11.988	3.945	1.657
Innovation	<b>.754</b>							
Performance	.492***	<b>.900</b>						
Experimentation	.657***	.301**	<b>.784</b>					
Swift Action	.042	.025	-.143	<b>.895</b>				

Cronbach's Alpha in bold on diagonals.  
\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

**TABLE 11**  
**Mediation Testing Summary and Hypotheses Results**

Hypothesis	Direct beta No mediator	Direct Beta With mediator	Indirect beta With mediator	Mediation	Support
H1: AE-RO->Experimentation->Innovation	.058 ns	-.032 ns	.120*	Indirect Effects	Yes
H2: LFI->SwiftAction->Innovation	.052 ns	-.022 ns	.025*	Indirect Effects	Yes
H3: Experimentation->SwiftAction->Innovation	.708***	.725**	-.018*	Partial Mediation	Yes
H4a: SwiftAction->Innovation->Performance	.026 ns	.094 ns	-.068**	Indirect Effects	Yes
H4b: SwiftAction->Innovation->RevGrowth	.065 ns	.102 ns	-.037**	Indirect Effects	Yes
H4c: SwiftAction->Innovation->EntrepSuccess	.028 ns	.060 ns	-.032**	Indirect Effects	Yes
H5a: Experimentation->Innovation->Performance	.295***	-.144 ns	.443**	Full Mediation	Yes <sup>1</sup>
H5b: Experimentation->Innovation->RevGrowth	.293***	.054 ns	.249**	Full Mediation	Yes <sup>1</sup>
H5c: Exper->Innovation->EntSuccess	.328***	.119 ns	.214**	Full Mediation	Yes <sup>1</sup>

Note<sup>1</sup>: Mediation supported as hypothesized, although full versus partial mediation.

## Discussion

The results of this study provide support for individual learning style traits as predictive measures of entrepreneurial behaviors and practices. Learning flexibility and the learning style preference for active experimentation have modest but significant effects on the behaviors of technology entrepreneurs who develop innovative products and processes.

Our study confirms the profound role of experimental practices within our learning system of innovation. Our model suggests that an overwhelmingly large portion of the innovation performance achieved by our entrepreneurs (52%) can be explained by their hands-on, iterative approach to learning and problem solving.

The positive indirect influence of learning flexibility and innovation was confirmed as expected; however, it was unexpectedly achieved via a chain of two consecutive negative effects. Entrepreneurs with high learning flexibility were more likely to take longer to make key strategic decisions; however, in the process of doing so, they were more innovative. Our result adds to the literature of mixed results regarding the relationship between decision speed and firm results and suggests that technology entrepreneurs are slightly more innovative when taking time to more carefully consider the options for and consequences of key decisions.

Extrinsic pressure has been long understood as having a detrimental influence on creative potential (Amabile, 1983). However, some pressure can be viewed as synergistic and beneficial to the creative product, especially when it is applied during relatively convergent processes such as documentation of a creative work (Amabile, 1993). Technology entrepreneurs are usually under enormous pressure from investors,

particularly in the very early stages, to quickly produce a product and generate cash-flow. Such pressure on entrepreneurs has been shown to detrimentally influence decision cycles, especially major strategic decisions related to or influenced by investment or M&A transactions (Perlow et al., 2002).

In retrospect, the negative relationship between learning flexibility and decision speed is perhaps not so surprising. Entrepreneurs in our 2011 grounded theory qualitative study exhibited what we viewed as “learning agility,” or the ability to efficiently converge to a desired solution or decision (Gemmell et al., 2011). Agility and efficiency are not to be confused with speed: a flexible learner may take longer to traverse each learning cycle but in the process of taking the time to utilize and benefit from each phase of learning, they spiral and converge more directly toward the desired outcome. Technology entrepreneurs who are flexible learners—in spite of the enormous environmental pressures—appear to achieve greater innovation by taking slightly longer to consider more alternatives, to reflect upon those alternatives and to ultimately converge to a solution and take action.

Our study also revealed a fascinating interaction between experimentation and decision-making. Experimentation delivers two counteracting effects on innovation – a strong direct positive relationship and a weaker indirect negative relationship via decision speed as a mediator. Entrepreneurs with a proclivity to experiment appear more comfortable pushing ahead quickly with a trial solution despite the moderately detrimental effect of rapid decision speed on Innovation. However, the act of experimentation very strongly leads to new innovations and more than compensates for the loss of innovation via hasty decision making. The net effect of experimentation on

innovation is strongly positive but less so that it would be without the counteracting negative influence of decision speed.

As expected, innovation mediates the effects of both decision speed and experimentation on firm level results and entrepreneurial performance. However, we again see the two counteracting forces: experimentation as a strongly positive effect and decision speed as the mildly negative influence via innovation. Experimentation had strong positive effects on all of our DVs even without innovation as a mediator, further reinforcing the extraordinary role of conscious iterative decision practices.

### **Conclusions and Implications to Practice**

Our study reveals the interesting balance between the overwhelming benefits of experimentation – both as a preferred learning mode trait and a developed practice – and the risks of circumventing an effective learning process by rushing to experiment. Literature has demonstrated that entrepreneurial domain experts, given the pressures faced by the typical technology start-up, might be inclined to quickly adopt a heuristic solution and “give it a try.” Entrepreneurs tend to draw upon their most recent or impactful experiences (availability heuristic bias) and to be over-confident in their belief that a previous solution is applicable to a current problem (representative heuristic bias), even in the face of unsound data or statistically flawed methods such as small data samples (Busenitz & Barney, 1997; Tversky & Kahneman, 1974). Entrepreneurs make these errors in spite of evidence that the predicted and desired outcome is actually quite improbable based on historical data. Heuristic decision making helps entrepreneurs deal with day-to-day issues but it is a dangerous and flawed approach to important strategic decisions.

Experimentation can either facilitate or undermine learning. Entrepreneurs are most innovative when they utilize experimentation as a key practice without ignoring the other learning processes. Entrepreneurs will be more successful and innovative when they take some time to reflect upon multiple alternatives and to test trial ideas socially before making important decisions.

Our study shows that the practice of experimentation develops more easily among entrepreneurs with a learning preference for active experimentation; however, it is also a key entrepreneurial skill that can be developed through education, coaching and practice. Entrepreneurship education can continue to adopt experiential teaching methods to better simulate the entrepreneurial environment and to encourage and develop the skills to experiment with an idea, both socially and physically.

### **Limitations and Suggestions for Future Research**

Our study is limited to entrepreneurs within the technology industry and the results should not be generalized to apply to other businesses that are less dynamic and less reliant on innovation. Access to technology entrepreneurs for data collection is extraordinarily challenging and our study is hampered by the relatively low number of respondents in our sample.

Our findings provide interesting new insight into the role of strategic decision making within entrepreneurial innovation; however, our survey did not specifically query the entrepreneurs' decision methodology. A follow-up study could focus specifically on their decision processes to add depth and certainty to our interpretation of this study's results. Qualitative research, perhaps even an ethnographic or case study methodology,

could more deeply delve into the entrepreneurial behaviors or organizational dynamics behind this phenomenon.



**CHAPTER V: TRUSTED PARTNERS: EFFECTS OF CO-FOUNDER  
EXPERTISE, TRUST AND LEARNING INTERACTIONS ON ABSORPTIVE  
CAPACITY, INNOVATION AND START-UP FIRM PERFORMANCE  
(STUDY III)**

**Preface**

This study uses quantitative methods to focus on the Chapter 3 findings regarding tightly-coupled company co-founders with expanded learning and innovation capacities by virtue of shared cognition and highly productive collaborative interactions, a phenomenon we call “Trusted Partners.” I endeavor in this study to explore the traits and interactions of these Trusted Partners in order to better understand how successful co-founders achieve heightened firm level learning capacity and innovation.

**Introduction**

Entrepreneurship is a social practice that relies heavily upon the entrepreneur’s ability to productively interact with co-founders and other key team members (Gartner, Shaver, Gatewood, & Katz, 1994; West, 2007). There is solid circumstantial and anecdotal evidence that many prominent entrepreneurs, including Steve Jobs and Bill Gates, would have never started their companies without the influence of a key co-founder (Linzmayr, 2004; Wallace & Erickson, 1993).

Our 2011 grounded theory qualitative study revealed that 17 out of the 32 entrepreneurs interviewed described a particularly important collaborative “Trusted Partner” relationship with one co-founder or member of the senior management team (Gemmell et al., 2011). Trusted Partners develop innovative ideas through shared cognition and collaborative experiential learning interactions and are thereby more productive and innovative working together than either would have been working alone.

Subsequent research has shown that fifty-six percent of technology entrepreneurs surveyed (N>250) report having a Trusted Partner (Gemmell, Kolb, & Somers, 2012).

Learning is the means through which firms dynamically adapt to changing conditions through processes of exploratory and exploitative innovation (Van de Ven, 1999). Learning theories are often applied to studies of strategic renewal and innovation; in fact, organizational learning research has become nearly synonymous with the study of innovation (Crossan & Berdrow, 2003). Human agency is overlooked in much of this research - a meta-review of innovation by Crossan and Apaydin (2010) revealed only 6% of innovation studies have been conducted at the individual level and only 5% at the team level. Researchers have relegated key constructs such as absorptive capacity to studies of large company R&D while neglecting the roles and practices of individuals (Lane et al., 2006).

Scholars now recognize the need to bridge gaps between macro phenomenon and micro level human agency (Abell, Felin, & Foss, 2008). The entrepreneurial start-up company setting is the perfect context for this endeavor (Crossan et al., 2011) because most of a start-up company's initial assets are the social and cognitive resources possessed by the entrepreneur and the initial dyad or team. The interactions and influences of the co-founder/partner dyad on entrepreneurial practice remains one of the most underserved areas of entrepreneurship research, perhaps because dyadic research inherently poses daunting data collection and analysis challenges.

I surveyed 153 technology entrepreneurs who report having a Trusted Partner, to explore how partner traits, learning interactions and behaviors impact firm learning capacity and in doing so, influence firm level innovation and performance. Practitioners

will benefit from a greater understanding of the co-founder traits and relationships that more likely translate into superior company performance. This study fills a significant gap in entrepreneurship research by addressing the roles of co-founder partners as agents of collaborative learning and innovation. The findings also serve to build on our understanding of absorptive capacity, a theoretical construct that has suffered from excessive abstraction and isolation within the narrowly defined contexts of R&D and technology transfer (Lane et al., 2006).

## **Literature Review**

### **The Dyad as a Unique Level of Study**

Given the sparseness of dyadic innovation and entrepreneurship research, this literature review draws primarily from team level studies of collaborative learning and innovation. Team studies provide a useful backdrop to our dyadic research, however, Trusted Partner relationships are more tightly connected and intense in nature than team interactions and therefore likely to exhibit different relational dynamics and have a greater impact on start-up firm performance and survival (Gemmell et al., 2011; Parks, 1977; Watson, Ponthieu, & Critelli, 1995).

Collaborative cognition between dyads becomes more complex or breaks down completely with the addition of a third member to form a triad (Simmel, 1964). The addition of a third team member can serve to either unite the team by virtue of the third member acting as a non-partisan mediator or divide the team by taking sides in disputes. Extending team size to four can simplify group dynamics, however the expansion results in diluted relational intensity (Simmel, 1964). The dyad should therefore not be viewed

as a subset of the team but rather as a unique social structure characterized by intense and meaningful cognitive and emotional connections not found on the team level.

### **Social Structure, Dynamics and Learning**

Management teams possessing diverse but overlapping cognitive traits and who are able to engage in constructive (cognitive rather than affective) conflict can more effectively share and develop ideas through shared cognition. Diversity may be manifested in either observable “surface level” characteristics such as ethnicity, age, culture, gender, educational, and occupational diversity (Harrison, Price, Gavin, & Florey, 2002) or deep-level diversity such as differences in information, attitudes, personalities, and affective and cognitive styles (Barsade, Ward, Turner, & Sonnenfeld, 2000; Harrison et al., 2002).

Diversity is generally reported to have positive effects on team performance and learning (Richard, 2000), however, team composition is often driven by “homophily” which is the selection of similar team members on the basis of observable traits such as gender, race and age (Ruef et al., 2003). Demographically similar teams tend to report relatively higher levels of satisfaction, commitment and trust (Barsade et al., 2000) while demographically heterogeneous teams suffer from increased conflict and reduced rapport, and decreased cohesiveness and social integration, information exchange, informal communication, teamwork and cooperation (O'Reilly, Caldwell, & Barnett, 1989). Individuals prefer to collaborate with others who have complementary skills but similar demographic traits that enhance communication and trust (Casciaro & Lobo, 2008).

Homophily wields a similar impact on the formation and sustainability of dyadic relationships (Rivera, Soderstrom, & Uzzi, 2010). The dyad has been most commonly

studied in the context of marriage – the dissolution risk of racially heterophilous relationships was estimated to be more than three times greater than homophilous relationships (Felmlee, Sprecher, & Bassin, 1990).

Dahlin, Weingart, and Hinds (2005) found that educational diversity enhances information use within teams thereby leading to higher levels of absorptive capacity and innovativeness, however, national diversity (measured by examining citizenship, nation of birth, and native language) presented both positive and negative effects on information use. These puzzling results ultimately led the authors to conclude that national diversity likely promotes negative social categorization during the team's early stages; an effect that is likely overridden by the positive effects of diversity during later stages of a group's information processing.

Domain or functional expertise diversity, based on individual professional experiences of team members and/or partners, can also positively impact group performance and innovativeness (Somech & Drach-Zahavy, 2011). Collective team identification, defined as the extent to which individual members feel a sense of emotional attachment or belonging to the team, moderates the effects of expertise diversity on team learning and performance (Van Der Vegt & Bunderson, 2005). Among teams with low collective identification, expertise diversity was negatively related to team learning and performance; conversely, where team identification was high, those relationships were positive.

The effects of new venture team cohesiveness on firm performance have been examined in the literature and it can be argued that top management team cohesiveness is especially important in the new venture context because start-up teams must perform

complex and ambiguous tasks under extraordinarily uncertain conditions (Ensley et al., 2002). Cohesive top management teams usually present higher levels of stability in their routines and procedures, which enhances their decision making and execution efficiency. More importantly, cohesion has been shown to reduce affective conflict and potentially increase cognitive conflict, a combination that has proven favorable for team innovation (Ensley et al., 2002).

Researchers have argued that heterogeneous top management teams are likely to engage in more diverse environmental scanning procedures, which enhance their ability to carry out more actions, whereas homogeneous top management teams are more restrictive and routine in their processes and routines, thereby promoting greater agreement and efficiency (Hambrick, Cho, & Chen, 1996). Empirical results revealed how diverse top management teams (based on education, experience, company tenure, etc.) had both a greater tendency to execute competitive moves, and to respond to competitive moves through bolder actions and with greater magnitude while heterogeneous top management teams displayed slower and milder reactions (Hambrick et al., 1996).

Social psychologists have suggested that diversity within teams can combine with the activation of “social psychological mechanisms” to yield improved performance (Roberge & van Dick, 2010: 296). Individual level mechanisms include empathy and self-disclosure while group-level mechanisms include communication, involvement, and trust.

There is evidence that entrepreneurial team building starts with the selection of the Trusted Partner based upon personal relationships and a personal sense of connection

to the partner (Forster & Jansen, 2010; Gemmell et al., 2011). Creative individuals tend to retain Trusted Partners over time for multiple projects or ventures (Uzzi & Dunlap, 2005). Homophily is the prevalent mechanism whereby dyads are formed (McPherson, Smith-Lovin, & Cook, 2001) however entrepreneurs subsequently build their team beyond the dyad by adding additional members for pragmatic reasons, such as to fill certain necessary voids of expertise and experience (Forster & Jansen, 2010).

Founding top management team (TMT) functional expertise can influence longer term TMT functional capabilities and organizational structure (Beckman & Burton, 2008). Narrowly experienced founding teams often struggle to add functional expertise not already on the team and are less likely to develop complete functional structures (Beckman, 2006).

Teams with high levels of specialized expertise can fall into a form of biased entrenchment referred to as a “competency trap” in which historically successful routines are repeated with too little consideration of a changing environment (Liu, 2006). This organizational memory perspective of learning illuminates the path dependency of new learning processes – new learning is strongly and directly influenced by historical experiences encoded into the organization’s collective memory and shared routines.

Experiential learning theory has been used to examine team dynamics and decision making (Kayes et al., 2005). Teams learn differently in early versus later stages of development and researchers have suggested that teams can most successfully develop by consciously considering the team development milestones originally proposed by Mills (1967): a shared purpose for team cohesion and direction, roles or task division, external constraints (such as available resources), processes for achieving goals and team

composition – most notably with regards to diversity and actions to achieve the team purpose. Kayes and Kolb proposed four role categories that must be resolved to form a cohesive team – interpersonal (relationship building), informational (managing large volumes of complex information), analytical (information synthesis) demands and behavioral demands (decision making and action).

Team learning involves reflection and adaptation, by-products of effective team design combined with a sense of psychological safety and space for safe team interaction (Argyris, 1995; Edmondson, 1999; Lewin, 1948). According to Edmondson's model, teams propose questions, sense feedback from experimentation and reflection upon results with a focus on discussion of surprises. This sort of team learning interaction requires a climate of trust and respect along with team efficacy, i.e. the belief in the team's ability to succeed, as a secondary condition for success. Studies of social capital and network theory have demonstrated the importance of trust with respect to information exchange and value creation within firms (Tsai & Ghoshal, 1998). Actors engaging in trusting relationships acquire a reputation for trustworthiness that enhances their desirability as partners with whom to exchange information and resources.

Other researchers have modeled learning as a social process of constructing knowledge through shared understanding of the problem and problem solving tasks, distributed responsibility, shared expertise and negotiated construction of the final creative product through shared cognition (Roschelle, 1992; Van den Bossche et al., 2006). According to Van den Bossche, team learning behavior, defined as construction, co-construction and constructive conflict, predicts shared cognition and team effectiveness. Team learning depends not only on psychological safety, but also



interdependence to maintain open minds during discussion (Johnson & Johnson, 1996), self-efficacy or the collective belief the group will succeed (Shea & Guzzo, 1987) and team cohesion.

Metacognitive team learning processes enhance a team's reflexivity and shared team cognition (Kolb & Kolb, 2009; McCarthy & Garavan, 2008; Pawlowsky, 2001). Team learning can be viewed as a conscious cyclical process of identifying or generating new knowledge, diffusing and integrating knowledge throughout the team and using the new knowledge to modify team processes and routines to create new routines, actions and behaviors.

Cognitive strategists have endeavored to link individual and team learning theories to organizational learning models to create holistic multi-level models. Some theorists view organizational learning as a collection of individual actions based upon a set of shared mental models that shape organizational routines (Argyris & Schön, 1978). Shared mental models constitute assumptions that can more easily facilitate learning and protect the status quo but also limit new learning. Organizations typically engage in trial and error experiential learning, adopting routines based upon what works best (Levitt & March, 1988). Another such model envisions the organizational learning process as the collective beliefs, capabilities and actions of individuals (Fischer, Giaccardi, Eden, Sugimoto, & Ye, 2005; Kim, 1993) translated into organizational action and transformed by environmental response (March & Olsen, 1975).

### **Entrepreneurial Learning and Innovation**

Researchers have, over roughly the last decade, turned to learning as a metaphorical and theoretical lens for entrepreneurship and innovation with experiential

learning emerging as a dominant theory (Armstrong & Mahmud 2008; Baum & Bird, 2010; Carlsson et al., 1976; Corbett, 2005, 2007; Gemmell et al., 2011; Holcomb et al., 2009). Experiential organizational learning has been described as a trial and error process through which organizations adopt new routines and procedures based upon experiments that yield successful outcomes (Levitt & March, 1988). Such routines are stored in organizational memory which can either enhance efficiency or lead to rigidities and “competency traps” whereby organizations refine less productive procedures rather than adopt new superior ones (Levitt & March, 1988: 322).

Entrepreneurial organizations learn two types of knowledge; domain knowledge regarding their specific technology and/or market and generalized tacit knowledge of “how to be an entrepreneur” (Minniti & Bygrave, 2001). Tacit knowledge is learned experientially by monitoring the outcomes of experiments that test competing hypotheses, both directly and vicariously through indirect observation of the actions and results achieved by others (Holcomb et al., 2009; Minniti & Bygrave 2001).

According to Kolb’s experiential learning theory, effective learners traverse a learning cycle comprised of four primary learning modes: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE) (Kolb, 1984). Learners commonly exhibit a preference for certain segments of the learning cycle, a predilection that defines their “learning style.” Learning style is closely associated with chosen fields of study among university students and therefore influences career specialization and expertise development (Kolb & Kolb, 2005a).

Divergent learners grasp by feeling and transform by watching, a learning style strongly associated with creative thought and a natural ability to generate ideas.

Assimilative learners grasp experience by thinking and transform it by watching; they tend to gravitate towards theory and abstract problems. Convergent learners grasp experience by thinking and transform via doing; individuals with this style tend to be analytically oriented and specialize in technical fields. Accommodative learners grasp experience by feeling and transform by doing; these individuals also tend to prefer relatively social and action-oriented careers such as marketing and sales. Learning style is context sensitive, a phenomenon which can be measured by a new Learning Flexibility Index (Sharma & Kolb 2009). Domain experts possessing higher levels of learning flexibility are less likely to struggle with entrenchment and competency traps (Dane 2010; Levitt & March, 1988).

Recent studies have demonstrated links between the preferred learning modes of entrepreneurs and their innovation behaviors and performance. One such study linked Kolb's Active Experimentation (AE) and Abstract Conceptualization (AC) learning modes with higher levels of entrepreneurial opportunity recognition (Corbett, 2007). The AE learning mode has also been shown to enhance tacit knowledge acquisition (Armstrong & Mahmud, 2008) and to predict adoption of experimentation as a behavior and practice for entrepreneurial innovation (Gemmell et al., 2011). Learning flexibility has been shown to influence strategic innovation decision speeds and innovation – flexible learners take longer to consider and reflect upon more decision alternatives and are thereby more innovative (Gemmell et al., 2012).

March (1991) introduced the concept that organizations must dynamically balance exploration of new opportunities (termed exploratory learning) and “exploitation of old certainties” (p. 71). It has been suggested that entrepreneurs transform experience into

knowledge through either an exploitative or exploratory oriented decision process (Politis, 2005) and must balance scarce resources between the two. Exploration offers prospects of greater novelty; however, entrepreneurs who predominantly explore will find themselves awash in ideas and experiments with too few results.

### **Absorptive Capacity as a Measure of Exploratory and Exploitative Learning Capacity**

Absorptive capacity (ACAP) is the capability of firms to acquire information and build knowledge (Cohen & Levinthal, 1990) and is comprised of three dimensions: recognizing the value of new knowledge, assimilating new knowledge and applying it to solve new problems. ACAP is a path dependent capability – previous knowledge absorbed by a firm impact its ability to absorb new knowledge. ACAP differs from the classical manufacturing process learning curve in that it allows firms to do something completely different, not just do the same thing cheaper or more efficiently (Cohen & Levinthal, 1989).

ACAP was initially used primarily to research the effectiveness of technology transfer between large strategic partners (Mowery, Oxley, Silverman, 1996) and the socio-cognitive micro-foundations largely disappeared when researchers operationalized ACAP as R&D intensity measured by R&D spending. Subsequent research efforts re-conceptualized ACAP as a firm level capability attained through knowledge combined with organizational routines and process, rather than just a reflection and outcome of R&D spending (Lane et al., 2006). For example, Dyer and Singh (1998) adopted a unique “relational view” with ACAP framed as an iterative two-way collaborative learning phenomenon between firm level dyadic partners. Researchers have argued

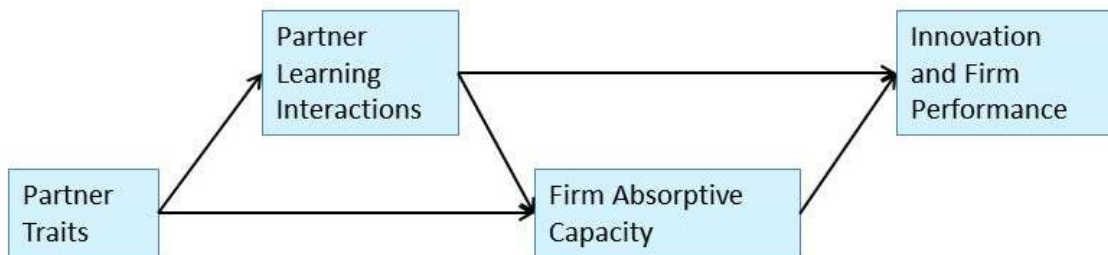
against the abstraction of ACAP which serves to separate the construct from the humans who produce it (Lane et al., 2006).

Current research continues to frame ACAP as a predominantly large company capability attained through firm level learning processes, as evidenced by recent efforts to validate a three-dimensional construct comprised of exploratory learning, transformative learning and exploitative learning (Lichtenthaler, 2009).

### Hypotheses

Our study focuses on the traits and interactions of co-founder partners as antecedents of firm level absorptive capacity, innovation and performance. The high level model below (Figure 28) portrays partner behaviors (learning interactions) mediating the effects of partner traits upon firm level learning capacity which in turn impacts innovation and firm performance.

**FIGURE 28**  
**High Level Conceptual Research Model**



Based upon previous studies demonstrating the learning and team innovation benefits of trait diversity, trust and constructive team interactions, I hypothesize Partner Functional Diversity, Partner Functional Breadth and Partner Trust to each exhibit positive effects, both direct and indirect, upon the two components of Absorptive

Capacity via the Partner Learning Interactions mediator, resulting in hypotheses H1a, b, c and H2a, b and c as follows:

*Hypothesis 1a, b, c: Partner Learning Interactions partially mediates the positive effects of (a) Partner Functional Diversity, (b) Partner Functional Breadth and (c) Trust on Exploratory Absorptive Capacity.*

*Hypothesis 2a, b, c: Partner Learning Interactions partially mediates the positive effects of (a) Partner Functional Diversity, (b) Partner Functional Breadth and (c) Trust on Exploitative Absorptive Capacity.*

One of the goals of this study is to apply absorptive capacity outside its traditional role as a measure of large company R&D capacity or ability to jointly share and transfer knowledge between partners (March 1991; Mowery et al., 1996). I reviewed most recently validated measures of absorptive capacity and selected items for our study with the greatest a priori relevance to start-up company learning and innovation. I expect these items to factor into the two dimensions most prevalent in extant literature, Exploratory ACAP and Exploitative ACAP, which we hypothesize as mediators of Partner Learning Interactions' effects upon Innovation, yielding hypotheses H3 and H4.

*Hypothesis 3: Exploratory Absorptive Capacity partially mediates the positive relationship between Partner Learning Interactions and Innovation.*

*Hypothesis 4: Exploitative Absorptive Capacity partially mediates the positive relationship between Partner Learning Interactions and Innovation.*

Absorptive Capacity (ACAP) as a measure of firm learning capacity is expected to positively impact not only innovation but also other key firm level performance measures such as overall company performance, market share, growth and profitability. We therefore posit positive effects from both dimensions of Absorptive Capacity upon overall firm Performance and Revenue Growth via Innovation as a mediator, yielding hypotheses H5a, b and H6a, b as follows:

*Hypothesis 5a, b: Innovation partially mediates the positive relationship between Exploratory Absorptive Capacity and (a) Firm Performance and (b) Revenue Growth.*

*Hypothesis 6a, b: Innovation partially mediates the positive relationship between Exploitative Absorptive Capacity and (a) Firm Performance and (b) Revenue Growth.*

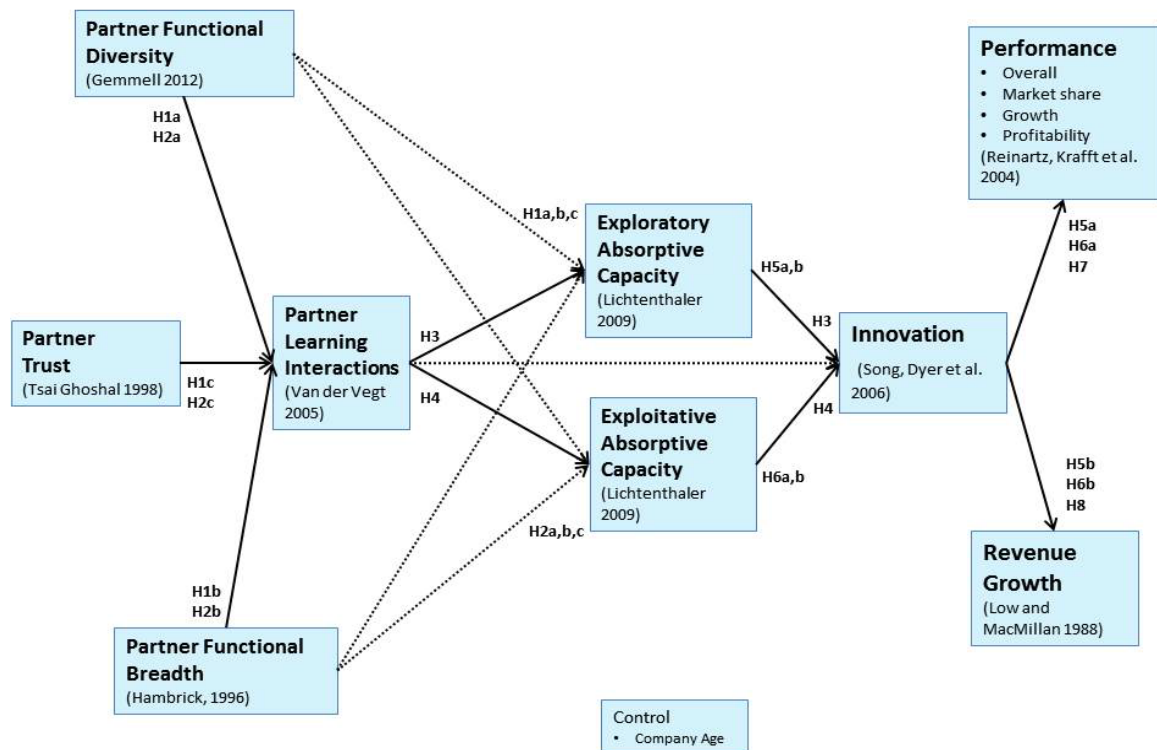
The role of innovation in the success of technology start-up companies is well established in literature which leads to our final two hypotheses:

*Hypothesis 7: Innovation will have a direct positive effect on Firm Performance.*

*Hypothesis 8: Innovation will have a direct positive effect on Revenue Growth.*

Our detailed research model is show below in Figure 29.

**FIGURE 29**  
**Detailed Partner/Co-founder Learning and Innovation Research Model**



## Research Design and Methods

### Sample and Data Collection

The study utilizes a “single informant dyadic model data set” composed of data collected from entrepreneurs who report having a “trusted partner” (N=153). Every participant responded affirmatively to the following item:

*Do you work with an individual on your management team who you would consider to be your business partner? Partner in this case means: someone who knows the intricate details of your business, someone you work and communicate with frequently (daily or several times per week), someone you rely upon to share responsibility for the business and with whom you share all important ideas and major business decisions.*

Our single informant data consists of survey responses about the traits and interactions of both the entrepreneur and their Trusted Partner, all provided by the lead entrepreneur. Studies of partner interactions using single informant data have been proven valid in dyadic research (Thompson & Walker, 1982). Participants were contacted either directly from my professional network or indirectly through survey distribution by intermediary industry organizations such as angel investor networks, venture capitalists, industry associations or business incubators. Data was collected from May, 2011 through March, 2012 via an anonymous online survey using Qualtrics.

A major effort was made to attract participants from a variety of geographic regions and technology industries as summarized in Table 12.



**TABLE 12**  
**Demographic Summary**

N= 153	No. Responses	%
<u>Region</u>		
Northeast U.S.	8	5.2
Southeast U.S.	31	20.3
Midwest U.S.	16	10.5
Southwest U.S.	5	3.3
Western U.S.	35	22.9
Not reported	58	37.8
<u>Industry</u>		
Hardware/software systems	29	19
Software	29	19
Internet/e-commerce	37	24.2
Electronics	8	5.2
Biotechnology	11	7.2
Clean Energy	5	3.3
Telecom	4	2.6
Medical Devices	6	3.9
Other Technology	24	15.6
<u>Joined Current Firm As</u>		
Founder	101	66
Principal/Officer and early employee (first 25)	27	17.6
Early employee (first 2(5))	25	16.4
<u>Position in Current Firm</u>		
CEO	78	51
CFO/CTO/CIO	17	11.1
VP/SVP/EVP/Director	58	37.9
<u>Education</u>		
High School	25	16.3
Some College	57	37.2
College Degree	43	28.1
Masters Degree	15	9.8
Doctoral Degree/Professional Degree (JD, MD)	6	3.9
Not reported	2	1.3

The survey totaled fifty four items and was organized according to the various factors (not randomized across factors) with a mix of both exogenous and endogenous constructs. Items were adopted from relevant extant literature based upon demonstrated validity and causal predictive effectiveness with minimal changes or adaptation.

### **Measures**

The measures adopted for this study have been validated in relevant studies within the learning, entrepreneurship and strategy literature and are summarized in Appendix I.

***Absorptive capacity.*** Absorptive capacity (ACAP) is a measure developed initially to study the capacity of a firm to absorb and utilize the work of a technology development partner (Cohen & Levinthal, 1990). We adopted 10 of the 25 items developed and validated by Lichtenthaler (2009) based upon their apparent relevance to start-up companies (versus the larger established partner companies of the original study). The survey included items from all three dimensions of ACAP: exploratory, transformative and exploitative. Typical questions were “We frequently scan the environment for new technologies” and “We regularly apply new technologies to new products.”

***Partner learning interactions.*** Partner learning interactions include four items from Van der Vegt and Bunderson (2005) and Edmonson (1999) that assess the ability of the two partners to constructively debate new ideas. The items query the partners’ ability to “critique each other’s work, freely challenge the assumptions underlying each other’s ideas, engage in evaluating the weak points and utilize different opinions for the sake of optimum outcomes.”

***Partner trust.*** The partner trust measure includes three dimensions of trust from Tsai and Goshal (1998): intent (“I can rely on my partner without fear that he/she will take advantage of me”), reliability (“my partner always keeps the promises made to me”) and competence (“I see little reason to doubt his/her competence”).

***Partner functional breadth and functional diversity.*** Trait diversity of trusted partners is comprised of two independent measurement dimensions: (1) Partner Functional Breadth and (2) Partner Diversity. Partner Functional Breadth captures the extent to which the two partners cover the ten areas of functional expertise measured in

our survey: General Management, Finance, Operations, Marketing, Sales, International Business, Accounting, Human Resources, New Product Development and Information Systems. Study participants moved sliders between zero and 35 years to indicate both their own experience and the experience of their trusted partner for each of the ten functional areas. The measure is calculated as shown below, based on a variation on the “Herfindahl-Hirschman Index” commonly found in literature to measure the functional breadth of top management teams (Hambrick et al., 1996).

$$\text{Partner Functional Breadth} = \text{PFB} = 1 - \sum p_i^2$$

$P_i$  = Combined experience in the  $i_{th}$  functional area/Total combined experience in all functional areas.

In the case where all of the experience for both partners is in the same functional area then  $p_1 = 1$  and all other  $p$  values would be zero, resulting in a PFB of zero which is the minimum value for Partner Functional Breadth. Even distribution across all 10 areas results in:

$\text{PFB} = 1 - \sum (.1)^2 = 1 - 10(.01) = .9$  which would be maximum Partner Functional Breadth given 10 functional areas.

Partner Functional Diversity strictly captures the functional experience differences between the trusted partners. The measure is calculated as follows: Partner Functional Diversity (PFD) =  $\text{Sqrt}(\sum \Delta E_i^2)$  where  $E_i$  = the square of the difference between the two partners experiences in each of the 10 functional areas. Both the Partner Functional Breadth and Partner Functional Diversity measures use differences or sums of partner experience, thereby negating any varying interpretations of the survey since the respondent will answer for both themselves and the partner using the same assumptions and interpretations.

***Innovation.*** The survey included an innovation measure developed and validated (using secondary data sources) by Song et al. (2006). This Innovation measure focuses on three dimensions of product development innovation performance: success of development programs to create innovative products, success in achieving revenue growth goals from new products and product development innovation relative to major competitors.

***Performance.*** Firm performance was measured using a four item construct developed by Reinartz, Krafft, and Hoyer (2004) that addresses financial performance, success attaining market share, growth and profitability.

***Revenue growth.*** Revenue was measured with one item from Low & Macmillan (1988), “Approximately what percentage annualized revenue growth has your company experienced over the last year?” The item was measured via a six point Likert Scale (1 = Revenue Declined and 6 = 50+% growth).

## **Data Analysis**

### **Data Screening**

I screened the single respondent data set for missing data and our modeling assumptions of normality, skewness, kurtosis, homoscedasticity, multi-collinearity and linearity using SPSS for Windows (PASW Statistics Gradpack 18.0, 2010). Tests confirmed heteroscedasticity ( $R^2 < .3$ ) with all but two construct pairs yielding  $R^2 < .1$ : Partner Learning-Exploitative ACAP,  $R^2 = .193$  and Partner Learning-Exploratory ACAP,  $R^2 = .149$ . I used boxplots to identify outliers and followed the recommendation of Cohen and Cohen (2002) to leave in outliers since they represented less than 2% of N and did not appear to be extreme. Multi-collinearity testing yielded very low variance

inflation factors between independent variables ( $VIF < 1.1$ ) which confirmed absence of multi-collinearity.

The data included a total of six missing data points which were calculated using mean imputation (Hair et al., 2010) which is an acceptable method in cases where  $< 5\%$  of data is missing (Tabachnick & Fidell, 2000).

All items were deemed satisfactory for modeling except for Partner Functional Breadth which was both skewed and highly kurtotic (Hair et al., 2010). I modified Partner Functional Breadth using an inverse natural logarithm transformation which reduced skewness and kurtosis to acceptable levels (-.655 and -.138 respectively).

### **Exploratory Factor Analysis**

We first performed Exploratory Factor Analysis (EFA) using SPSS to reduce the items associated with Innovation, Performance, Exploratory ACAP, Exploitative ACAP, Partner Learning Interactions and Trust to a smaller set of composite latent variables that preferably reflect our six anticipated a-priori theoretical constructs (Fabrigar et al., 1999). I used Principle Axis Factoring (PAF) and PROMAX rotation based upon our assumption that factors were non-orthogonal (correlated). I examined eigenvalues and scree plots, based upon latent root criterion whereby factors with eigenvalues less than 1.0 are excluded, to determine the optimum number of factors. I removed three of the 24 items based upon low loadings and communalities resulting in a six factor solution (see Table 13) with satisfactory item loadings with minimal cross loadings (Hair et al., 2010). The resulting Kaiser-Meyer-Olkin (KMO) value was .794 and Barlett's Test of Sphericity was significant ( $\text{Chi-Square} = 1638.3$ ,  $Df = 276$  and  $p < .001$ ) supporting our assumption of

sufficient sample size and inter-correlations to conduct factor analysis. The six factor solution explained a total variance of 57%.

**TABLE 13**  
**Six Factor Pattern Matrix (Principal Axis Factoring, Promax Rotation)**

	Innovation	Performance	Exploratory ACAP	Exploitative ACAP	Partner Learning Interactions	Trust
i1	.756					
i3	.818					
p1		.890				
p2		.859				
p3		.831				
p4		.901				
er1			.487			
er2			.846			
er3			.636			
er4			.562			
tr3				.615		
ea1				.892		
ea2				.589		
ea3				.502		
pli1					.610	
pli2					.792	
pli3					.730	
pli4					.561	
t1						.576
t2						.875
t3						.835

### Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) addresses the limitations of EFA including the inability to constrain factor loadings to zero, correlate measurement errors and specify which factors are associated (Bollen, 1989). I specified our measurement model based upon the items grouped by the six factors identified in our EFA and co-varied error terms within constructs (but not between constructs) based upon modification indices to achieve optimal model fit. The sample size of 153 was judged to be marginally sufficient based upon a Hoelter's Critical N value of 158 at the .05 significance level.

I examined factor validity (convergent and discriminant) of our measurement model. Item factor loadings greater than 0.50 suggests significance (Hair et al., 2010) and all loadings were between 0.62 and 0.96 (see Appendix D). Cronbach's Alpha measures of factor reliability were all >0.70 (ranging from .711 to .921), however, composite reliability (CR) was examined and compared to average variance explained (AVE) to address the tendency of Cronbach's Alpha to understate reliability (Hair et al., 2010). Discriminant validity was further analyzed by confirming that the square root of AVE exceeds all construct correlations (see Table 14) (Liang et al., 2007). All constructs met the CR>AVE criteria for convergent validity and all but two met the AVE>0.5 criteria (Exploratory and Exploitative ACAP factors marginally failed to meet the AVE criteria with values of 0.452 and 0.481 respectively - see Table 15). The measurement model exhibited satisfactory fit statistics: Chi-squared = 139.660, df = 118, CMIN/df = 1.184, SRMR = .052, CFI = .980, AGFI = .873, RMSEA = .035 and PCLOSE = .876.

**TABLE 14**  
**Discriminant Validity Test Results**

Factor	Innovation	Performance	Exploratory ACAP	Exploitative ACAP	Partner Learning Interactions	Trust
Innovation	<b>0.810</b>					
Performance	0.270	<b>0.865</b>				
Exploratory ACAP	0.232	0.373	<b>0.673</b>			
Exploitative ACAP	0.436	0.232	0.496	<b>0.694</b>		
Partner Learning Interactions	0.158	-0.009	0.261	0.337	<b>0.732</b>	
Trust	0.155	0.447	0.146	0.320	0.447	<b>0.788</b>

Square root of AVE in bold on diagonals

**TABLE 15**  
**Factor Validity Test Results**

Factor	CR	AVE	MSV	ASV	Convergent Validity CR>AVE AVE>.5	Discriminant Validity MSV<AVE ASV<AVE
Innovation	0.786	0.656	0.190	0.073	Yes	Yes
Performance	0.923	0.749	0.139	0.059	Yes	Yes
Exploratory ACAP	0.711	0.452	0.246	0.106	Yes Borderline	Yes
Exploitative ACAP	0.736	0.481	0.246	0.141	Yes Borderline	Yes
Partner Learning Interactions	0.772	0.535	0.200	0.081	Yes	Yes
Trust	0.829	0.621	0.200	0.076	Yes	Yes

### **Common Methods Bias (CMB) Testing**

The Harman’s single factor extraction test was performed via an un-rotated principle component analysis using SPSS resulting in only 25.6% of variance explained with all items loading into a single factor. The Harman single factor test is a useful but somewhat limited test for CMB (Podsakoff et al., 2003) so I employed a marker variable technique (Lindell & Whitney, 2001) to better control for CMB by including a marker variable that is unrelated to at least one of the measurement model variables. The marker variable analysis resulted in a common factor loading of 5.7% which satisfactorily confirms the absence of common method bias.

### **Controls**

All of the sample companies were early stage entrepreneurial new ventures, however, I control for effects of the company stage of development by using Company Age as a control variable (see Appendix L for control effects).

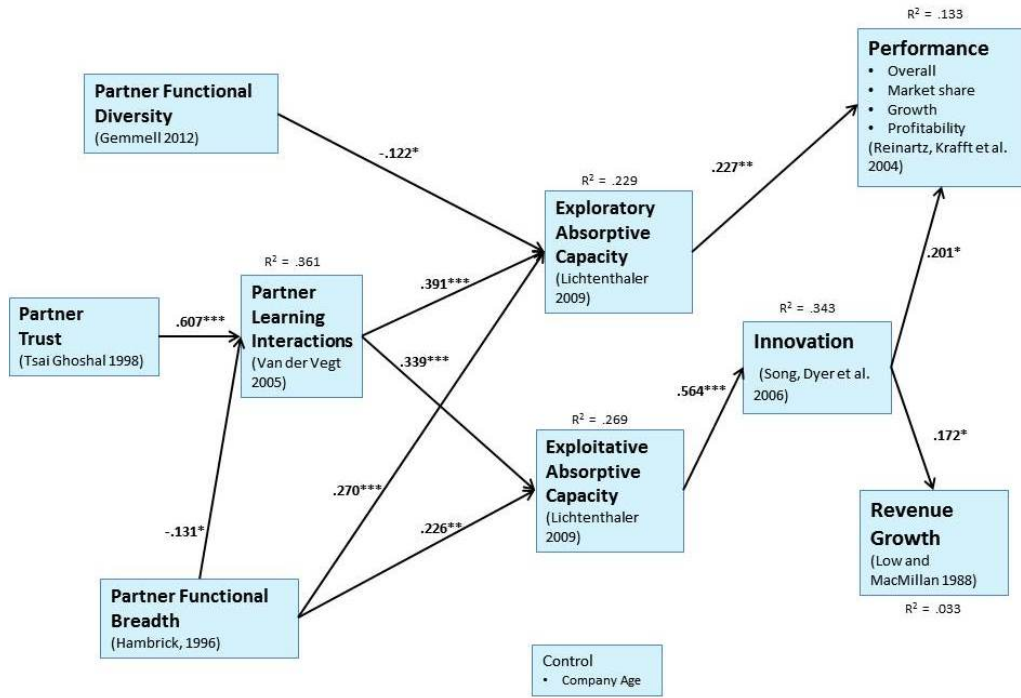


## Mediation Analysis and Path Modeling

The mediation analysis employed causal and intervening variable methodology (Baron & Kenny, 1986) and techniques described by Mathieu and Taylor (Mathieu & Taylor, 2006). The direct effects of independent variables were first measured without the mediating variable in the model. The model was then re-analyzed with the mediator in place using the AMOS bootstrapping feature to measure direct and indirect effects with mediation. Following mediation tests, the complete model was restored and insignificant paths were trimmed to arrive at the final path model.

The resulting path model fit was excellent with Chi squared = 14.924, df = 20, CMIN/df = .746 (Tabachnick & Fidell, 2000),  $p = .781$ , SRMR = .039, AGFI = .948, CFI = 1.00 (Hu & Bentler, 1999), RMSEA = .000 and PCLOSE = .957 (Joreskog & Sorbom, 1997).

**FIGURE 30**  
**Final Trimmed Model**



## Results

Table 16 shows the means, standard deviations and bivariate correlations for the study constructs. Mediation testing results are summarized for the 12 hypotheses in Table 17.

Hypotheses 1a, b and c explore the role of Partner Learning Interactions as a partial mediator of the effects of our three IVs, Partner Functional Diversity (1a), Partner Functional Breadth (1b) and Trust (1c), on Exploratory ACAP. In the case of Partner Functional Diversity (1a), analysis revealed no such mediation effects, however, our final trimmed model does include a surprising direct non-mediated negative relationship between Partner Functional Diversity and Exploratory ACAP (beta = -.122, p = .034).

**TABLE 16**  
**Inter-factor Correlations, Cronbach's Alpha, Means and Standard Deviations**

N=153	Innovation	Performance	Exploratory ACAP	Exploitative ACAP	Partner Learning Interactions	Trust	Partner Funct. Diversity	Partner Funct. Breadth
Mean	4.063	3.229	1.451	3.709	3.752	4.089	26.214	6.859
SD	.732	.954	.115	.425	.444	.612	16.308	1.790
Innovation	<b>.752</b>							
Performance	0.270**	<b>.921</b>						
Exploratory ACAP	0.232*	0.373***	<b>.711</b>					
Exploitative ACAP	0.436***	0.232*	0.496***	<b>.733</b>				
Partner Learning Interactions	0.158	-0.009	0.261*	0.337**	<b>.752</b>			
Trust	0.155	0.447*	0.146	0.320**	0.447***	<b>.816</b>		

Cronbach Alpha in bold on diagonals.

\*p<.05, \*\*p<.01, \*\*\*p<.001

Hypothesis 1b examines the mediated effects of our second function diversity measure, Partner Functional Breadth on Exploratory ACAP. Partner Learning Interactions does indeed mediate the effects of Partner Functional Breadth on Exploratory ACAP by virtue of significant direct effects with no mediator (beta = .221, p< .01),

significant indirect effects ( $\beta = -.058$ ,  $p < .05$ ) and significant direct effects with the mediator ( $\beta = .278$ ,  $p < .001$ ). However, close examination reveals the unexpected negative indirect effect of Partner Functional Breadth on Exploratory ACAP. This result means that inasmuch as Partner Functional Breadth impacts Partner Learning Interactions, part of that impact is transferring negatively to Exploratory ACAP. This finding is further substantiated by the negative final path model relationship between Partner Functional Breadth and Partner Learning Interactions ( $\beta = -.131$ ,  $p < .05$ ). The final path model also shows Partner Functional Breadth having a strong positive direct effect on Exploratory ACAP. Partner Functional Breadth therefore applies two counteracting forces upon Exploratory ACAP: a strongly positive direct effect counterbalanced with a negative effect via Partner Learning Interactions.

Hypothesis 1c addresses the mediated effects of Trust on Exploratory ACAP. H1b is supported by mediation testing which shows positive full mediation (direct  $\beta$ /no mediator =  $.179$ ,  $p < .05$  and indirect  $\beta = .261$ ,  $p < .001$ ) confirming the hypothesis that trusting partner relationships enhance the partners' ability to share constructive criticisms while exploring new technologies and markets.

Hypotheses 2a, b and c examine the mediated (via Partner Learning Interactions) effects of our three IVs on Exploitative ACAP. I found no mediation effects between Partner Functional Diversity and Exploitative ACAP so H2a was not supported. Partner Learning Interactions does partially mediate the effect of Partner Functional Breadth on Exploitative ACAP (H2b) with significant direct effects both with ( $\beta = .157$ ,  $p < .05$ ) and without the mediator ( $\beta = .200$ ,  $p < .05$ ). However, the indirect effects are significant and unexpectedly negative ( $\beta = -.042$ ,  $p < .05$ ). These results therefore

once again demonstrate a complex counter-balancing relationship, this time between Partner Functional Breadth and the exploitative dimension of absorptive capacity.

The negative effects and interactions between our two measures of partner trait diversity, partner learning interactions and both dimensions of absorptive capacity seem to contradict prevailing theories regarding the positive impact of team diversity on learning and innovation capacity. Such surprising results suggest an alternate explanatory framework of entrepreneurial partner diversity as outlined in the discussion section.

The results support hypothesis H2c which anticipated Partner Learning Interactions fully mediating the relationship between Partner Trust and Exploitative ACAP (direct beta/no mediator = .345,  $p < .001$  and indirect beta = .224,  $p < .001$ ).

**TABLE 17**  
**Hypothesis Testing Summary and Results**

Hypothesis	Direct beta No mediator	Direct Beta With mediator	Indirect beta With mediator	Mediation	Support
<b>H1a:</b> Partner Functional Diversity→Partner Learning Interactions →Exploratory ACAP	-.144*	-.133 ns	-.011 ns	No Mediation	No <sup>1</sup>
<b>H1b:</b> Partner Functional Breadth→Partner Learning Interactions→Exploratory ACAP	.221**	.279***	-.058*	Full Mediation	Yes <sup>2</sup>
<b>H1c:</b> Partner Trust→Partner Learning Interactions→Exploratory ACAP	.179*	-.083 ns	.261***	Partial Mediation	Yes
<b>H2a:</b> Partner Functional Diversity→Partner Learning Interactions→Exploitative ACAP	-.029 ns	-.019 ns	-.009 ns	No Mediation	No
<b>H2b:</b> Partner Functional Breadth→Partner Learning Interactions→Exploitative ACAP	.157*	.200*	-.042*	Partial Mediation	Yes
<b>H2c:</b> Partner Trust→Partner Learning Interactions→Exploit ACAP	.345***	.121*	.224***	Partial Mediation	Yes
<b>H3:</b> Partner Learning Interactions→Exploratory ACAP→Innovation	.298***	.195*	.104***	Partial Mediation	Yes
<b>H4:</b> Partner Learning Interactions→Exploitative ACAP→Innovation	.298***	.063 ns	.235***	Full Mediation	Yes <sup>2</sup>
<b>H5a:</b> Exploratory ACAP→ Innovation→ Performance	.195*	.205*	-.010 ns	No Mediation	No
<b>H5b:</b> Exploratory ACAP→Innovation→ Revenue Growth	-.014 ns	-.005 ns	-.009 ns	No Mediation	No
<b>H6a:</b> Exploitative ACAP →Innovation→ Performance	.166 ns	.075 ns	.091 ns <sup>3</sup>	No Mediation <sup>3</sup>	No <sup>3</sup>
<b>H6b:</b> Exploitative ACAP→Innovation→ Revenue Growth	.160 ns	.077 ns	.083 ns	No Mediation	No
<b>H7:</b> Innovation→Performance	.201*				Yes
<b>H8:</b> Innovation→Revenue Growth	.172*				Yes

Notes:

1. Partner Functional Diversity has a significant direct negative effect on Exploratory ACAP but not via Partner Learning Interactions.
2. Hypothesis of mediation supported although the mechanism proved to be full rather than partial mediation.
3. The Exploitative Absorptive Capacity indirect effect on Performance via Innovation was borderline insignificant ( $p=.063$ ).

Hypotheses 3 and 4 examine the mediating effects of our two dimensions of Absorptive Capacity on the effects of Partner Learning Interactions on Innovation. As expected, Exploratory ACAP partially mediates the effects of Partner Learning Interactions on Innovation (H3) by virtue of strong positive direct effects/no mediator (beta = .298,  $p < .001$ ), direct effects/with mediator (beta = .195,  $p < .05$ ) and positive indirect effects (beta = .104,  $p < .001$ ). Hypothesis 4 anticipated full mediation between Partner Learning Interactions and Innovation via Exploitative ACAP which was

confirmed, again with strong highly significant direct effects ( $\beta = .298, p < .001$ ) and indirect effects ( $\beta = .235, p < .001$ ).

Our hypotheses 5a, 5b, 6a and 6b examine the effects of our two dimensions of Absorptive Capacity on firm level performance and revenue growth via innovation as a mediator. The analysis revealed evidence of indirect effects between Exploitative ACAP and Performance via Innovation (indirect  $\beta = .091, p = .063$ ). Furthermore, the final trimmed model shows a significant direct effect of Exploratory ACAP on Performance ( $\beta = .229, p < .01$ ).

The final trimmed model also shows the direct significant effects of Innovation on Performance ( $\beta = .201, p < .05$ ) and on Revenue Growth ( $\beta = .172, p < .05$ ) which provides support for hypotheses 7 and 8.

## **Discussion**

### **Broad/Overlapping Expertise, Trust and Constructive Debate**

Trusted Partners with high functional breadth have combined expertise that spans at least several of the key functional areas such as sales, marketing, product development, finance and operations. Partners with expertise over most of the ten categories can be described as “generalists” while I use the term “multi-specialist” to describe someone whose expertise covers several of the ten categories. Conversely, partners with low functional breadth are specialists with narrowly focused areas of expertise – for example, one partner might be primarily a technical specialist while the other has spent most of their career in finance.

Partners with mostly non-overlapping areas of functional expertise will score more highly on the Partner Functional Diversity measure. Our two dimensions of partner

functional expertise diversity measure distinctly different phenomenon as evidenced by their low inter-factor correlation of only .027. Co- partners can fit any of four combinations of these two independent measures of diversity i.e. high/low functional breadth and diversity. Figure 31 is a Partner Trait Matrix that summarizes the nature, benefits and challenges of these four combinations.

**FIGURE 31**  
**Functional Trait Matrix**

		Partner Functional Breadth	
		Low	High
Partner Functional Diversity	High	<p><b><u>Siloed Specialists</u></b></p> <p>Experts with little expertise overlap face significant challenges:</p> <ul style="list-style-type: none"> <li>• Huge gaps in expertise</li> <li>• Gaps in shared language necessary to explore.</li> <li>• Trust and constructive interactions are key.</li> <li>• Must expand team to gain breadth</li> </ul>	<p><b><u>Non-Overlapping Multi-Specialists</u></b></p> <p>Two individuals, each having multiple non-overlapping specialties can be successful:</p> <ul style="list-style-type: none"> <li>• Can “wear many hats” in early stages.</li> <li>• Must bridge gaps in shared language and vision to explore effectively.</li> <li>• Breadth helps both exploratory and exploitative endeavors.</li> <li>• Constructive interactions and trust are key.</li> </ul>
	Low	<p><b><u>Twin Specialists</u></b></p> <p>Partners with identical specialized expertise can explore but face enormous business challenges:</p> <ul style="list-style-type: none"> <li>• Capable of exploratory R&amp;D work (if both are tech specialists).</li> <li>• Lack most areas of business expertise and unlikely to run the company by themselves.</li> <li>• Imperative to expand the team to attain breadth.</li> </ul>	<p><b><u>Overlapping Generalist+Specialist</u></b> <b>or</b> <b><u>Overlapping Multi-Specialists</u></b></p> <p>Partners who combine breadth of expertise with some expertise overlap have best chance of being successful:</p> <ul style="list-style-type: none"> <li>• Can “wear many hats” in early stages.</li> <li>• Overlap facilitates exploration.</li> <li>• Must be able to sort out leadership roles.</li> <li>• Breadth helps both exploratory and exploitative endeavors.</li> <li>• Trust is key to offset negative effects of breadth on partner learning interactions.</li> </ul>

Partner Functional Breadth displays fascinating effects on both the exploratory and exploitative dimensions of absorptive capacity. The breadth of experience between the two co-founders has a positive direct effect on Exploratory ACAP, both with and without the learning interactions mediator. Trusted Partners with broad and diverse experiences are more easily able to stay open to the possibilities of new market

opportunities and technology developments. However, the negative indirect effects attributed to troublesome learning interactions highlights the challenges partners with non-overlapping experiences face when trying to interact and debate new ideas constructively. Successful Trusted Partners not only trust each other, but they also share a common language and a vision for the business in order to communicate and collaborate productively (Gemmell et al., 2011). Siloed specialists face major challenges – for example, how likely is it for IT and accounting specialists to share common language? Partners who are unable to harness the collaborative potential of their combined expertise through constructive learning interactions could be subject to the stifling negative indirect effects that will lessen their ability to search for and identify new opportunities.

Partner Functional Breadth has an even stronger positive influence on Exploitative ACAP based upon our mediation testing results. However, harvesting the potential benefits of broad and diverse experience on the part of co-founders requires them to engage in constructive and collaborative debate; otherwise they could once again be subject to the same net negative chain of effects.

Partner Learning Interactions did not mediate the effect of Partner Functional Diversity on either type of Absorptive Capacity; however, we did see a significant negative direct effect of Partner Functional Diversity on the Exploratory ACAP dimension which is once again contrary to prevalent findings in extant literature.

The challenges of team diversity were highlighted in our earlier grounded theory study (Gemmell et al., 2011). Entrepreneurs exhibited what we characterized as an



auditioning process to vet degrees of cognitive and perspective diversity in order to ensure a good fit:

It's important that they fit. So everyone who has come in, we started by bouncing ideas off of them and getting feedback in terms of either they get it or they don't. If they don't get it, then okay, it's not a good fit.

Our study further reinforces earlier findings regarding homophily within the partner selection process (Forster & Jansen, 2010) and contradicts the most widely reported notion that diversity is always beneficial. Trusted partners maximize their potential to explore and exploit through breadth of expertise combined with a high degree of overlapping expertise and commonality to facilitate constructive conflict, communication and decision making:

(My partner) comes from the construction industry, very much more externally focused (than me). He has a computer science background, mine being industrial engineering but we are both built similarly, again from strong IT backgrounds. We've got a good relationship...we can have knock down drag-out meetings...but it helps us think about it and go back and try to think it through.

### **Absorptive Capacity: Not Just for Large Partner Corporations**

This study helps establish both Exploratory and Exploitative Absorptive Capacity in a new context i.e. as a measure of learning and innovation capacity for entrepreneurial firms (versus the vastly predominant large corporate joint R&D context found in literature). I selected only the most relevant of the previously validated ACAP items (Lichtenthaler, 2009) and still struggled with borderline convergent validity. The findings demonstrate the great promise of ACAP as a useful measure in entrepreneurship research but also points to the need for further development of the measure for such new settings.

Both dimensions of absorptive capacity mediated the positive effects of learning interactions on innovation with strong and generally highly significant effects. My findings provide solid evidence of the predictive efficacy of the partner learning interaction construct in a new context i.e. entrepreneurial partner/co-founder dyads (we adopted the measure from studies of teams).

It is noteworthy that Exploitative ACAP exhibited the sole direct effect on Innovation in our final trimmed model, a result that is even more interesting because of the scale and significance of the effect ( $\beta = .564, p < .001$ ). This result highlights the highly convergent and exploitative environment of the technology entrepreneur. Investors generally do not fund exploratory R&D and start-up technology companies are under tremendous pressures to achieve aggressive exploitative new product development milestones in an environment of rapidly depleting cash resources. Start-ups who successfully meet such milestones can secure additional funding and ultimately attain a stable positive cash-flow operating position. Innovation in the context of a technology start-up requires a single-minded focus on results – companies that fail to focus exploitatively are not only less innovative, they often fail completely as a business.

Exploration also plays a key role as evidenced by the significant positive direct effects of Exploratory ACAP on Performance ( $\beta = .227, p < .01$ ). Exploratory ACAP surprisingly had a slightly stronger and more significant effect on Performance than Innovation. The strong presence of both Exploitative and Exploratory learning demonstrates the degree of ambidexterity required for early stage technology companies to succeed. Technology start-up companies often evolve into a completely different

business from their start-up vision. This degree of adaptability requires agility and fluid movement between exploration and exploitation.

### **Conclusions and Implications to Practice**

This study contributes a great deal to our understanding of the partner traits and mechanisms leading to effective partner collaboration and growth of firm level learning capacities. Ideal co-founder partners combine trust with broad yet sufficiently overlapping expertise to facilitate shared language and vision. Effective co-founder partnerships lead to highly innovative learning organizations that effectively balance the dialectic tension between exploration and exploitation. Partner diversity more readily translates into exploratory capacity while breadth of experience is the key ingredient in a start-up firm's exploitation capacity. A successful start-up firm needs both – outward looking exploration to identify new opportunities, recognize threats and perceive gaps in performance combined with inwardly focused exploitation to deliver results and achieve performance milestones.

### **Limitations and Suggestions for Future Research**

This study is limited to entrepreneurs from the technology industry and the results may not be generalizable to other contexts or industries. The results prove that learning and innovation capacity of an early stage company is built largely upon the traits and interactions of co-founders, hence, a follow-on study examining the learning style traits of both co-founders could yield additional insight and add to our understanding of how entrepreneurial traits impact behaviors and performance.

## **CHAPTER VI: DISCUSSION AND FUTURE RESEARCH**

My research has expanded our knowledge and yielded significant new insights into the social and cognitive dimensions of entrepreneurial learning, creativity and innovation. The purpose of this chapter is to recapitulate and reflect upon the meaning and significance of the key findings while also pointing out interesting opportunities for future research. This chapter focuses on topics that yielded particularly interesting and impactful insights including the role of domain knowledge, the entrepreneurial ideation process, entrepreneurial hypotheses, social experimentation, trusted partner traits and vicarious indirect learning.

### **Role of Domain Knowledge**

Domain knowledge is a key component of creativity – one must usually know something about a field of knowledge in order to creatively contribute new content to that field (Amabile, 1983), however, the relationship between the domain knowledge of a creator and creative production is complex. Pre-existing knowledge increases to the likelihood of making positive contributions to a field of knowledge but such knowledge also introduces the risk of fixation on current solutions and paradigms, therefore diminishing the likelihood of novel contributions (Frensch & Sternberg, 1989).

Entrepreneurs use two categories of knowledge: (1) domain knowledge about industry specific markets, technologies, processes and business models and (2) knowledge regarding the art of entrepreneurship (referred to in the literature as “entrepreneurship”) (Minniti, 2001). The successful entrepreneur participants in our studies had the ideas, resources, skills and interests to pursue start-up businesses across a

variety of disparate fields, yet they ultimately returned to their rather narrowly defined “home domains”, often launching repeat businesses with nearly identical missions.

For example, a successful entrepreneur from the semiconductor industry may participate in a biotech start-up as an angel investor but rarely as a founder and CEO. Instances in which an entrepreneur crosses between even closely related market or technology domains appear to be extraordinarily rare. Entrepreneurs were conscious of the resources required to be successful, specifically the domain specific business models, practices and social networks. I interviewed a software executive who spent months developing a game idea but ultimately launched a repeat business almost identical to his last venture.

So I had this concept of building this game, \_\_\_\_\_ which I still think today would be extremely successful because it’s not taught anywhere, but I don’t have the resources. It’s just I just need to find the appropriate resources, which I did spend a year trying to find – I went through probably three or four different people that did not work out, and it goes back to know your knitting and what you know very well. With (his current startup) I know the people, I know the history. I know what’s going to happen in six months.

My conclusion is that the generalized non-domain specific “entrepreneurship” layer of knowledge is much thinner than previously recognized and that a great deal of the tacit knowledge regarding “entrepreneurship” is actually more domain specific than has been reported in literature.

Domain specificity of entrepreneurship is a simple concept with enormous and broad ranging implications to entrepreneurial practice, research and pedagogy. My domain knowledge finding explains why efforts to organize broad entrepreneurship networking groups struggle and successful entrepreneurship networking organizations

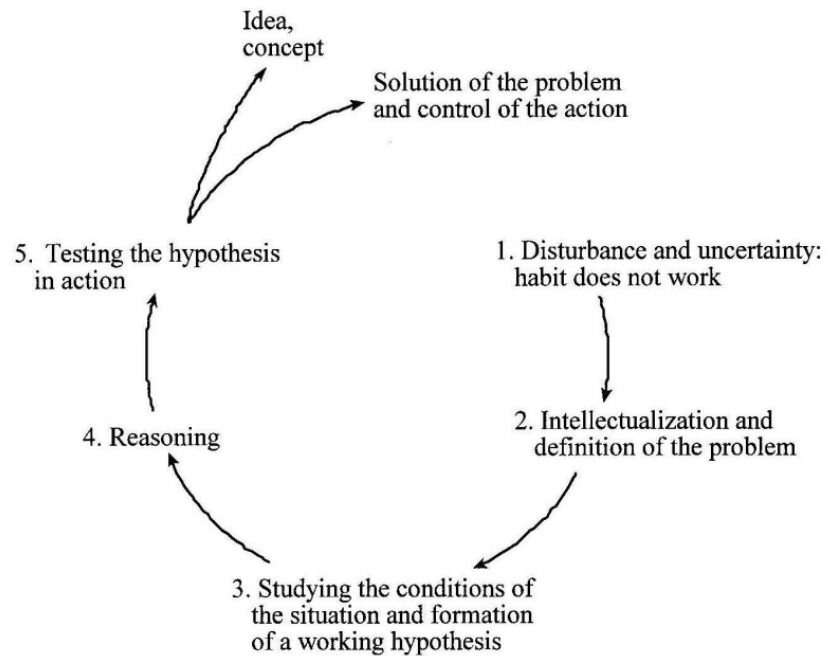
tend to become increasingly more industry specific over time. The domain knowledge needed to succeed as a real estate entrepreneur is vastly different from that of the software entrepreneur, resulting in divergent language and perspectives. Researchers seeking to build generalized entrepreneurship theories must therefore include appropriate moderators and mediators in their theoretical models to account for domain differences.

Universities offer broad survey courses on “entrepreneurship” that give students a valuable overview of entrepreneurial practice. My finding suggests that while cross pollination between domains can have enormous educational value, advanced courses can benefit by including cases studies from domains of student interest and by using experiential learning techniques such as field studies or forming student “management teams” focused on developing specific new business ideas.

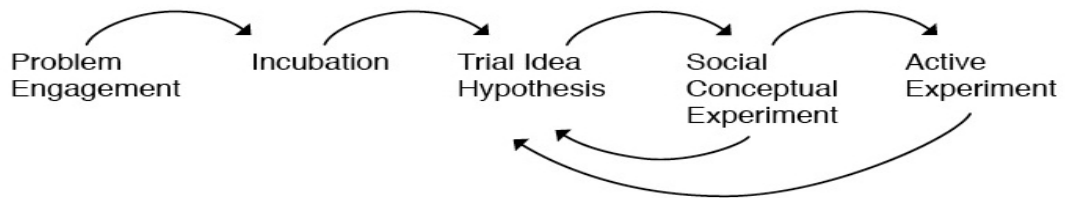
### **The Entrepreneurial Ideation Process and Dewey’s Model of Reflective Thought and Action**

My research has utilized and been greatly influenced by the Kolb Experiential Learning Theory which is built upon the philosophies of Dewey, Lewin and Piaget. However, our Entrepreneurial Ideation Process was derived independently and in a completely different context from Dewey’s work, i.e. based upon a grounded theory study of entrepreneurs developing ideas for innovative new products. It is insightful to compare and contrast the EIP to Dewey’s Model of Reflective Thought and Action (Figures 32 and 33).

**FIGURE 32**  
**Dewey's Model of Reflective Thought and Action (Dewey, 1922)**



**FIGURE 33**  
**Entrepreneurial Ideation Process (Gemmell et al., 2011)**



Dewey viewed habitual action and the resultant experiences as the routine process for most day-to-day activities and problems; a perspective strongly akin to Crossan's institutionalization stage of learning. Habitual action and experiences are inadequate to solve certain problems, triggering what Dewey called a "disturbance" or situation where rote habitual actions no longer provide a satisfactory solution, prompting Dewey's reflective experience.

The EIP is similar to both Dewey's model and the scientific method (question formulation, hypothesis, prediction, test) while sharing the problem engagement and incubation steps with Wallas' (1926) stages of creativity. Entrepreneurs displayed clear immersion in the problems they viewed as potential business opportunities, followed by extended subconscious processing - the software entrepreneur in our case study in chapter 2 subconsciously processed his problem for roughly 6 months before arriving at a trial solution.

The most unique contributions of the EIP model i.e. the concepts of hypotheses and social experimentation, strongly parallel Dewey's focus on hypothesis formulation to avoid ungrounded empiricism by virtue of having no framework against which to evaluate experience. The shared elements between our EIP and theories of Wallas and Dewey lend credibility to the EIP and make a theoretical contribution by bringing these classic theories into modern contexts of technology product innovation and new business formation.

### **Entrepreneurial Hypothesis**

The entrepreneurial hypothesis component of our Entrepreneurial Ideation Process (EIP) is a simple but crucial concept that may be difficult for students or new practitioners to grasp. I recently assigned each individual student in a class of graduate entrepreneurship students the task of writing the hypotheses associated with their new business idea. These students struggled with the assignment and in nearly all cases simply restated their idea or value proposition. Writing the hypothesis is difficult because it requires the entrepreneur to possess sophisticated and well defined perspectives and a deep understanding of their start-up business ecosystem. Useful



hypotheses are simple, testable and long-lasting frameworks that can out-last the business idea – an idea can evolve dramatically while the hypotheses remain the same.

Hypotheses can perhaps be best illustrated through an example from a real company, i.e. from my most recent venture, a wireless technology start-up. The idea and mission of the new venture was to sell modular license-free wireless technology products to original equipment manufacturers (OEMs), allowing them to easily add wireless capabilities to their systems.

The first hypothesis was that, in spite of emerging IEEE 802.11 technology standards (now referred to as Wi-Fi), there would continue to be significant demand for non-standards-based products with incrementally better reliability, security and latency times but far less data-rate capacity than Wi-Fi and at a much higher price. This was a rather astounding hypothesis – the electronics industry has exhibited a seemingly limitless appetite for data capacity along with a history of standards-based technologies sweeping up entire markets by offering “good enough” products at a fraction of the cost of proprietary solutions. OEMs strongly prefer standards based products to avoid monopoly sole sourcing scenarios, as evidenced by the enormous efforts of semiconductor firms like Intel to empower second source providers such as AMD.

Testing this first hypothesis involved constant probing of prospective customers to assess the extent to which customers could or would bend their product requirements to accommodate a standards based Wi-Fi product. The management team was aware that customers would make every effort to use Wi-Fi if possible - the firm’s proprietary products would always be a second choice.

The second hypothesis involved the nature of radio frequency (RF) circuit design – our example firm posited that in spite of rapid strides by the semiconductor industry to simplify chip level wireless circuit design, OEMs would continue to externally source turnkey modules at a 2x or more cost premium. Again, support for this hypothesis was far from intuitively obvious since industry trends favored the evolution of extremely low cost “module on a chip” solutions that required little specialized engineering expertise. Testing this hypothesis required an on-going conscious assessment of the difficulties of designing higher performance RF circuits i.e. “can our customers do this?”

While the wireless start-up management team and I did not refer to these two criteria as our “hypotheses”, we used these two simple frameworks to evaluate every key strategic product decision the company made for ten years. Hypotheses are slow moving bedrock concepts that are at the core of what Mintzberg (1987) refers to as the entrepreneurial “perspective strategy.” I propose that every new venture has, wrapped around the business idea, a set of hypotheses that should be the subject of social and active experimentation alongside the idea itself. If anything, the hypotheses are more important than the idea itself and experiments that fail to support entrepreneurial hypotheses portend grave consequences to entrepreneurs who are slow to adapt their strategies.

### **Social Experimentation**

Another key part of our Entrepreneurial Ideation Process is the act of iteratively testing and experimenting with ideas and hypotheses. Testing entrepreneurial ideas is initially cognitive or social rather than active – the entrepreneur first conducts thought experiments followed by social experiments (“socializing their ideas”). These

experiments are difficult to conduct properly and based on our data, social experimentation represents a major component within the art of entrepreneuring.

Successful entrepreneurs carefully select relevant social targets that embody different roles within the business ecosystem (potential partners, customers, suppliers, channels and financiers). The socializing process must be conducted in a way that not only tests ideas and hypotheses but also draws out new perspectives that can help evolve the entrepreneur's thinking. The entrepreneur must avoid biasing the social experiment participant by enthusiastically overselling them with their ideas. A mix of positive and counterfactual experimentation can be helpful i.e. taking an opposing position to see if the social target disagrees and argues for the idea (Roese, 1995).

Marketing focus group participants have been shown to not necessarily behave in the marketplace in accordance with feedback expressed, especially in an orchestrated group environment (Krueger, 2000) so the entrepreneur must be able to discern how key actors within their idea ecosystem might behave differently from their stated opinions and positions. Social experimentation is an inexact process and the entrepreneur's experience intuition and experience are important tools for an entrepreneur to accurately process experimental feedback.

The value of socializing ideas as a social resource building process cannot be overstated. Social experiment participants who become interested in the company idea and hypotheses can stay involved and take part in future experiments, but they might also become future employees, customers or partners. Social experimentation is a practical means for converting weak social ties into highly relevant and impactful strong ties.

## **Metacognition and Entrepreneurial Innovation**

A case study from our 2011 study of entrepreneurial ideation (Gemmell et al., 2011) shows the development of an idea from inception to product launch and offers some interesting extensions to the Kolb Experiential Learning Theory. The case study demonstrates clear meta-cognitive function or self-awareness by the entrepreneur of his innovation process. The entrepreneur in this case study consciously wrote problems and thoughts in a notebook, periodically re-copying these notes to keep the problem fresh in his sub-conscious mind.

After the idea emerged (the “aha” moment) the entrepreneur consciously and skillfully used social networks to refine the problem. The entrepreneur also used social networks to essentially institutionalize his problem solution by sharing the idea with key management team members and with his board of directors to get their thoughts and buy-in. This process of developing and maintaining shared vision is crucial to socialization and institutionalization of new learning (Pearce & Ensley, 2004). Failure to perform this social process can result in dysfunctional organizational dynamics such as “not invented here” (March & Olsen, 1975). Sharing the idea with the board of directors helps to maintain an organizational culture of psychological safety (Van den Bossche et al., 2006) since board approval means broader distribution of risk or effectively less concentration of risk on the shoulders of the CEO and management team.

### **Sources of Trial Ideas**

My research findings did not specifically address the sources of trial ideas, however, the qualitative data clearly revealed the importance of intuition, intellect, social triggers and conscious application of techniques documented in literature including

combinations, analogical reasoning, problem finding and framing. The data suggest that problem searching and immersion are especially important sensing mechanisms for entrepreneurs. Problem immersion triggers subconscious problem solving accompanied by streams of trial ideas that get processed and vetted subconsciously until a conscious trial idea emerges, often (but not always) with an accompanying sense of epiphany (Vandervert et al., 2007).

### **Agility**

The grounded theory qualitative findings included “cognitive agility” as an entrepreneurial trait, an attribute I have struggled to define and measure. Agile entrepreneurs use social and active experimentation to quickly iterate ideas, thereby combining high levels of expertise with free and open learning without strong biases or entrenchment.

Entrepreneurs under pressure to make quick decisions often experiment with heuristic solutions (Busenitz & Barney, 1997). The chapter 4 findings demonstrate how successful innovators develop ideas iteratively with a careful balance between cycles of “open” learning and “closed” convergent heuristics. Drawing exclusively from biased heuristic solutions drastically narrows the range of possible solutions resulting in a fixation on existing non-innovative paradigms. Conversely, protracted divergent thinking and reflection can lead to entrenchment through over-analysis and failure to act. Effective innovation decision-making is achieved through a balance of open and closed processes.

## **Tensions and Cycles of Convergence/Divergence**

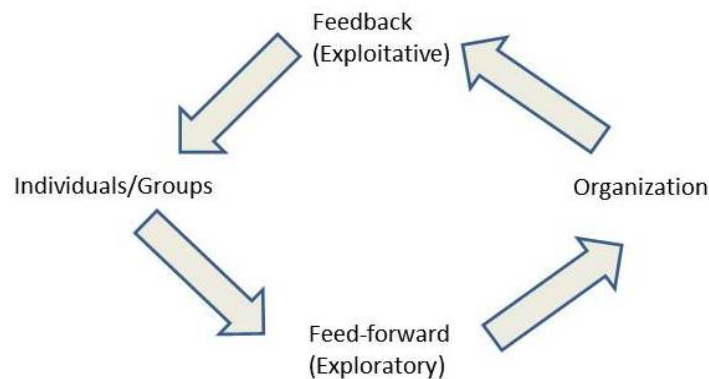
The concept of resolving one or more tensions or opposing forces (as demonstrated in the chapter 4 findings) is commonplace in theories of learning. Researchers have examined the tension between exploratory learning and exploitative learning (Crossan & Berdrow, 2003; March, 1991) within the context of “strategic renewal” or the ability of firms to perpetually reinvent themselves and thereby maintain competitiveness under highly dynamic and volatile conditions. Exploratory learning is less goal and task-oriented and allows firms to extend their current range of capabilities through a process most often described as invention or research and development to produce novel and surprising outcomes. Exploitative learning usually involves pursuing well-understood market driven opportunities or learning to attain operational efficiencies to more fully take advantage of existing lines of business (i.e. the traditional “learning curve” to attain production cost efficiencies).

Firms strive to balance exploratory learning versus exploitative learning in order to achieve strategic “ambidexterity” (Zi-Lin & Poh-Kam, 2004). Scarcity of resources, particularly within start-up firms, combined with the non-overlapping nature of exploratory and exploitative learning resources (the same person is not generally adept at doing basic engineering research and applications engineering) requires managers to make difficult choices (March, 1991). Exploration and exploitation further reflect another underlying tension between external and internal orientation – inwardly focused R&D versus outwardly oriented marketing.

Another example of the convergent/divergent dichotomy is Crossan’s model of knowledge institutionalization through what she termed feedback (imposing routines

upon individuals and groups) and feed-forward (diffusion of individual or group knowledge to change company routines). Feedback and feed-forward are terms rooted in cybernetics and control systems, however, they have found recent acceptance in the context of behavioral change (self-modeling) and learning (Dowrick, 1999).

**FIGURE 34**  
**Cycles of Exploratory and Exploitative Multi-Level Learning**  
(Crossan et al., 1999)

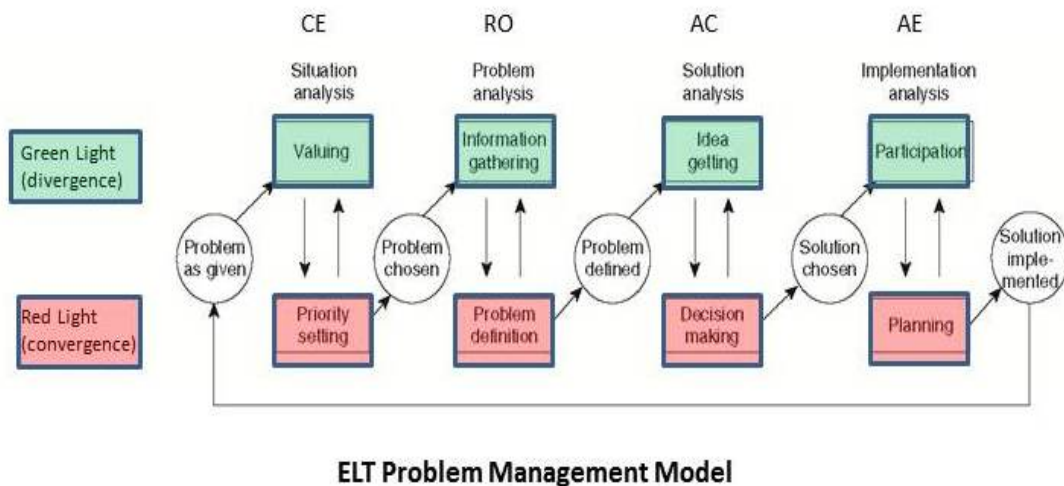


Economist Joseph Schumpeter envisioned entrepreneurial innovation as emerging from the destruction of existing supply chains as a result of market tension. If demand considerably exceeds supply, the tension for more supply rises above the edge of order, triggering a phase transition. Entrepreneurs react to inflection points described by Dewey as “disturbances” by adapting and creating new firms that, then, dissipate the tension between Supply and Demand.

A similar counterbalancing force is expressed within experiential learning theory as the “dual dialectic tensions” between modes of knowledge grasping (experience/abstraction) and transformation (action/reflection) (Kolb, 1984). Kolb and others have described innovation and creative problem solving as cycling between

divergent (“green light”) and convergent (“red light”) thinking (Kolb, 1984; Osborn, 1950; Van de Ven, 1999). Van de Ven describes these cycles as “the underlying dynamic that explains the development of corporate cultures for innovation, learning among innovation team members, leadership behaviors of top managers or investors, building relationships and joint ventures with other organizations, and developing an industrial infrastructure for innovation.” Kolb envisions problem solving as a dialectic process moving through four stages, each having alternative divergent/convergent thought processes: (1) situation analysis: valuing/priority setting, (2) problem analysis: information gathering/problem definition, (3) solution analysis: ideation/decision making and (4) implementation analysis: participation/planning (see Figure 35 below).

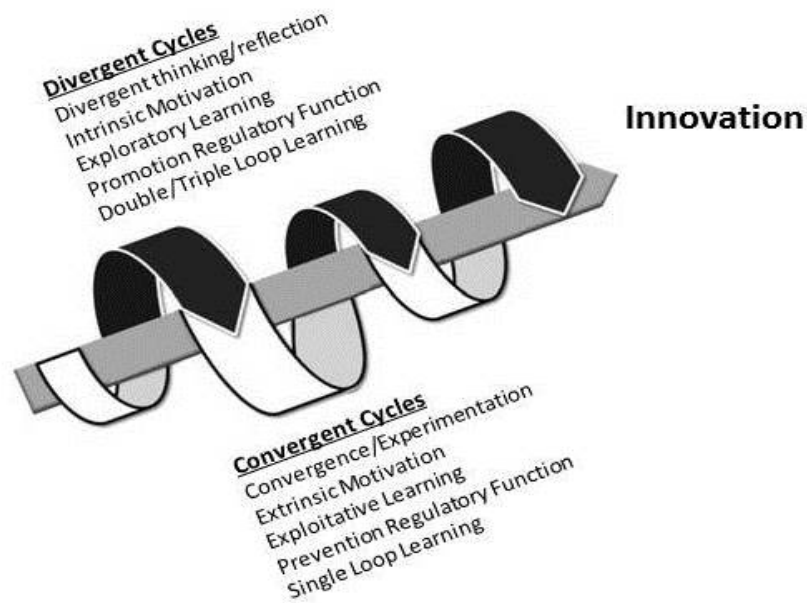
**FIGURE 35**  
**Experiential Learning Problem Solving Model (Kolb, 1982)**



It is interesting to see how various manifestations of the concept of alternating harmonic cycles of “opening up” and “closing down” permeate our understanding of innovation (see Figure 36).



**FIGURE 36**  
**Cycles of Divergence and Convergence Leading to Innovation**



### **Trusted Partners**

My findings suggest that slightly over half of all entrepreneurs would not have started their venture without the presence of a key collaborator we call their Trusted Partner. Most ventures coalesce around the Trusted Partner dyad or through a multi-partner structure whereby inner group member play different roles with the lead entrepreneur interacting with each of them on a lower intensity situational basis.

Partners with broad combined expertise have the greatest learning and innovation capacity. Broad expertise between partners is generally achieved through some diversity but this is beneficial only to a point – diversity has a negative effect on learning interactions and exploratory learning. My findings demonstrate that the ideal partnership blends some overlap of expertise with breadth of combined expertise. Trusted Partners

who share language and perspectives are more likely to have productive learning interactions and engage in cognitive rather than affective conflict.

The notion of unbounded diversity benefiting innovation only makes sense in theory - in practice it rarely if ever happens and not just because of some self-defeating hemophilic attraction to superficially similar partners. The data provided evidence that instances in which a company incorporates far flung divergent influences within the inner team are rare because the cognitive bandwidth and ACAP of the inner team is limited and can easily be overwhelmed with divergence. I witnessed interesting “auditioning” actions by inner groups to determine if the new team candidate really “gets it” i.e. whether their perspectives and beliefs were sufficiently in line with those of the core team to facilitate constructive learning interactions.

My findings demonstrate how innovation within teams of domain experts can break down when the entrepreneur and inner team get stuck on conceptual analysis rather than taking action to socialize ideas and begin conducting active experiments. Too much divergent input overwhelms the limited absorptive capacity of the inner group, making it difficult to converge on a team consensus and take action.

There are parallels between the Trusted Partner findings and research regarding what is termed “High-Quality Connections” (HQC), positive dyadic interactions between individuals theorized to offer organizational benefits including improved learning processes (Dutton & Heaphy, 2003; Stephens, Heaphy, & Dutton, 2012). HQCs yield mutually sensed positive affect and are defined by heightened emotional carrying capacity and resilience to strains under pressure, attributes that are necessary to sustain partners through the rigors of launching a new business (Carmeli, Brueller, & Dutton,

2009). Another characteristic of HQCs is what Stephens et al. describe as “openness to new ideas and influences” (2012: 5), a trait that is well aligned with our finding of expanded collaborative learning capacity between Trusted Partners. HQCs are based upon mutual development experiences, in stark contrast to most relational constructs (such as trust) which are based upon exchange theory and therefore transactional in nature.

### **Impact of the Trusted Partner**

Due to sample size constraints, I did not attempt to conduct multi-group SEM modeling analysis to compare ventures founded by entrepreneurs who reported having a Trusted Partner to those who did not. However, I did perform insightful statistical analysis comparing the mean values of key measures between the two sample groups. The difference in mean values between the two samples was highly significant for Experimentation, Innovation and Performance ( $F > 1$ ,  $p < .05$ ). The summary of the ANOVA analysis is summarized in Table 18 below.

**TABLE 18**  
**Sample Mean Testing, Trusted Partner vs. No Trusted Partner**

	Trusted Partner Sample Mean, SD N = 95	No Trusted Partner Sample Mean, SD N = 77	F Statistic, Significance	Mean Difference	Significant
Iterative Methods (Experimentation)	2.513 SD=.390	2.285 SD=.445	11.483 p=.001	.217 (9.5%)	Yes***
Innovation	3.251 SD=.626	2.957 SD=.497	11.291 p=.001	.300 (10.1%)	Yes***
Performance	3.222 SD=.962	2.849 SD=.862	6.338 p=.013	.360 (12.6%)	Yes*

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

The Trusted Partner entrepreneurs reported using Experimentation on average 9.5% more than entrepreneurs without Trusted Partners, thereby achieving 10.1% higher innovation scores and 12.6% higher Performance scores. This preliminary analysis provides strong preliminary support for our hypothesis that having a trusted partner expands the entrepreneur’s cognitive resources by amplifying learning capacity, innovation and performance.

### Entrepreneurial Learning Style

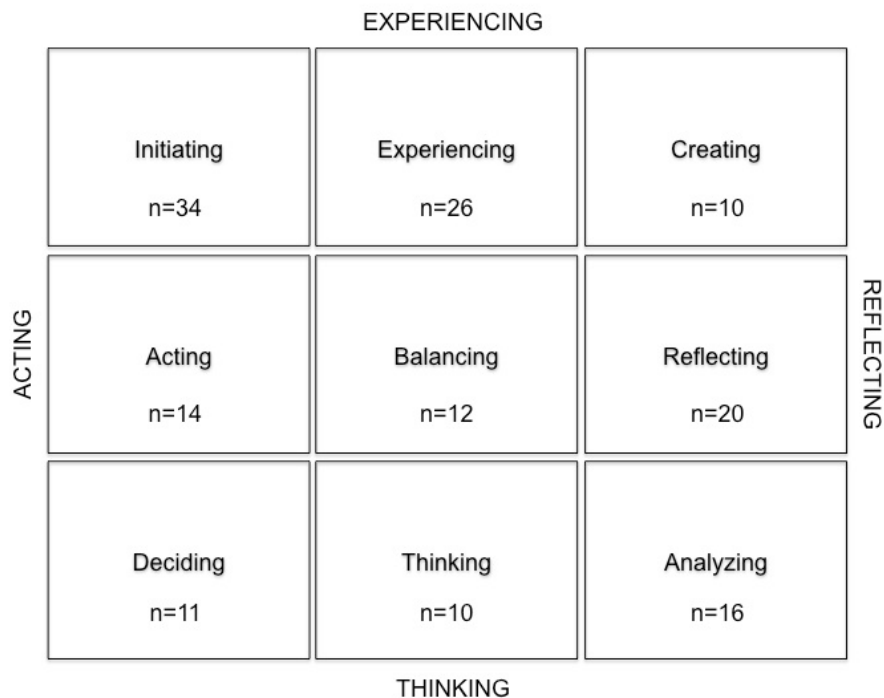
Figure 37 shows where the participants in the chapter 4 study (a mix of entrepreneurs with and without Trusted Partners) are situated within the nine learning style categories of the Kolb LSI v. 4.0. This chart illustrates the concentration of our sample toward the “northwest” Initiating and Experiencing styles with 35% of participants fitting into those two styles (out of the nine total styles).

**FIGURE 37**  
**Learning Styles of Study Participants**  
**(Mix of Both with and without Trusted Partners)**

	EXPERIENCING			
	Initiating n=30 w/partner=19 wo/partner=11	Experiencing n=29 w/partner=18 wo/partner=11	Creating n=17 w/partner=5 wo/partner=12	
ACTING	Acting n=17 w/partner=10 wo/partner=7	Balancing n=14 w/partner=6 wo/partner=8	Reflecting n=22 w/partner=15 wo/partner=7	REFLECTING
	Deciding n=10 w/partner=8 wo/partner=2	Thinking n=13 w/partner=6 wo/partner=7	Analyzing n=17 w/partner=9 wo/partner=8	
	THINKING			

Figure 38 shows a plot of the participants for the chapter 5 study of entrepreneurs with Trusted Partners (only). This plot shows a similar distribution that is even more heavily “northwest” weighted with 39% of participants situated in the Initiating and Experiencing styles. These findings are especially meaningful in light of earlier data showing a tendency for engineering and business students to favor the more southern analytical styles (Kolb & Kolb, 2005a). This learning style data supports and reinforces our qualitative research findings: entrepreneurs develop new firms through an action-oriented iterative approach that reflects an Initiating learning style. The study suggests that individual entrepreneurs possessing the Initiating and Experienced learning styles are somewhat predisposed toward effective entrepreneurial practices and behaviors.

**FIGURE 38**  
**Learning Styles of Study Participants with Trusted Partners**



## Partner Learning Breadth

While the northwestern learning style appears surprisingly prevalent and proven to be beneficial for entrepreneurs, this evidence falls far short of proving that such a style is a necessary trait. However, since individuals with the northwestern style are favorably predisposed toward productive entrepreneurial behavior, how do entrepreneurs with other styles overcome what are assumed to be unfavorable predispositions? I have developed and examined one hypothesis: individuals with reflective and analytical styles will tend to partner with someone with a northwestern style to attain the cognitive diversity, action orientation and cognitive agility to be successful.

I collected data from both Trusted Partner entrepreneurs in 31 firms (shown in Figures 39 and 40) which once again reveal entrepreneurs with every category of style but a strong concentration in the northwest Initiator and Experiencing categories.

**FIGURE 39**  
**Learning Styles of the 31 Trusted Partner Pairs (total by learning style)**

			EXPERIENCING						
			Initiating n=20	Experiencing n=7	Creating n=5				
ACTING	Acting n=7	Balancing n=5	Reflecting n=5				REFLECTING		
			Deciding n=1	Thinking n=6	Analyzing n=8				
			THINKING						

Careful examination of the data in Figure 35 revealed that 28 out of 31 companies have at least one Trusted Partner with a northwest or balancing style, lending some initial support for our hypothesis. We are collecting additional data and performing more analysis to assess possible correlations between dyadic traits and other performance measures such as functional expertise diversity, absorptive capacity, partner learning interactions and innovation. We are also interested in learning flexibility as another possible route for Trusted Partners to attain beneficial cognitive breadth.

**FIGURE 40**  
**Learning Styles of the 31 Trusted Partner Dyadic Pairs**

(Bold number = first partner, Non-Bold number = second partner)

EXPERIENCING		
Initiating 2 5 7 8 10 11 <b>14 14</b> 15 16 17 20 <b>21 22 23</b> 24 25 <b>26 27 30</b>	Experiencing 2 <b>6 12 12 21 26 31</b>	Creating 4 11 13 27 <b>31</b>
Acting <b>3 9 15 19 28 29 30</b>	Balancing <b>3 5 6 18 24</b>	Reflecting <b>1 7 17 22 26</b>
Deciding 16	Thinking 4 10 13 <b>18 20 23</b>	Analyzing <b>1 8 9 18 19 25 28 29</b>
THINKING		

ACTING REFLECTING

### Vicarious Learning

The most essential aspect of experience, especially as it relates to innovation, is whether the experience is acquired directly by the learner/innovator or indirectly from

others (Levitt & March 1988). Learning from the latter type of experience is referred to as vicarious learning (Bandura, 1977), or knowledge transfer (Argote & Ingram, 2000). Holcomb (2009) differentiates experiential learning from vicarious learning, correctly describing his concept of experiential learning as flowing from direct experience. However, vicarious learning is also experiential learning, albeit derived from indirect (rather than direct) experience. As organizations scale in size, I would argue that direct experiential learning gives way to second hand or indirect vicarious learning. Employees in bigger companies have far fewer of the kind of extra-firm high impact emotional experiences that drastically change perspectives and lead to the highest levels of strategic dynamism.

A senior engineer in a start-up company routinely meets with key customers to hear their problems and get feedback about products. This engineer often even goes into the field with customers to witness problems first-hand. However, as the company grows and a more typical corporate structure emerges, this engineer no longer has these direct experiences and relies more heavily on field reports from marketing and sales. The engineer's experiential learning process is now replaced with an indirect learning process in which a sales person has the customer interaction experience and endeavors to transfer that experience along to the senior engineer through conference calls, emails and reports.

Recent research examined the role of indirect versus direct learning on team creativity for new product development through the lens of trans-active memory theory and found that direct team experience results in more efficient division of task knowledge across team members (Gino, Argote, Miron-Spektor, & Todorova, 2010). Most knowledge transfer research has focused on firm level social network structures and inter-



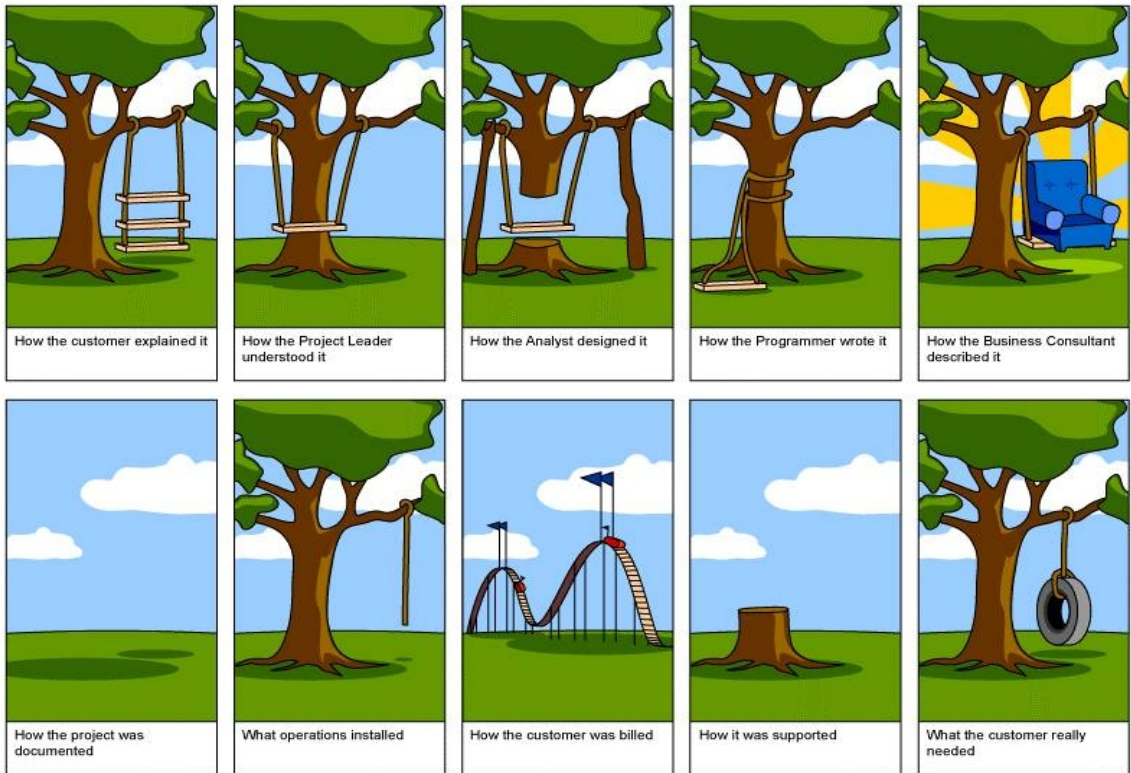
firm transfers, leaving the micro-antecedents of intra-firm knowledge transfer largely untouched (Van Wijk, Jansen, & Lyles, 2008).

I view entrepreneurial learning, especially within the context of creative new product development and innovation, as a complex process heavily influenced by emotions and interpretation. As companies grow, the emotionally charged customer interaction directly experienced by a sales person is passed on to a product developer who must then attempt to interpret and somehow grasp the original meaning and intentions of the direct experiential event in order to complete the learning cycle and take action.

Vicarious experiential learning can be viewed through the lens of Kolb's experiential learning theory as having essentially a "hand-off point" at the Abstract Concept axis of the Kolb learning cycle. The original concrete experience was reflected upon by the direct learner and processed by them into an abstract concept, i.e. a report, email or conference call presentation that embodies the perspectives, biases and sense making of the in-situ participant (the sales person who had the direct customer experience). The sales person's "abstract concept package" is delivered to and experienced by the vicarious learner, in this case the engineer who must make an interpretation, based on the knowledge available and their own sense making abilities and take action to complete the learning cycle.

The resulting poor outcome comically summarized in the classic cartoon below is commonplace and usually blamed on poor communication; however, I would argue there is a great research opportunity to examine the impact of indirect vicarious experience and interpretation on learning and innovation.

**FIGURE 41**  
**Interpretation and Indirect Vicarious Learning**  
(<http://www.projectcartoon.com>)



**APPENDIX A**  
**Study I Interview Protocol**

1. Warm-up: “Can you please give me a 5 minute bio?”
2. “Tell me about an exciting idea, for either a new product or process that you have had over the last 12-18 months.”
3. “Tell me about your most recent idea, something you are working on currently.”

Potential Probing/Clarification Questions:

- a. How and when did the idea occur to you?
  - b. What else was happening in that time-frame?
  - c. What were you thinking about and how did you feel?
  - d. Who was involved?
  - e. Who did you talk to about the idea? What were their roles?
  - f. What conscious process, if any, led to the idea?
  - g. Were you looking for an idea?
  - h. How did you know it was a good idea?
4. What is the worst idea you ever had? What happened?
  5. “What is the best idea you ever had that you did not pursue?”

**APPENDIX B**  
**Study II Construct Definitions, Items and Sources**

Construct	Definition	Items	Source
Active Experimentation Learning Mode (AE-RO)	Individual preference for the Active Experimentation learning mode over the Reflective Observation mode.	Twelve forced answer rankings.	(Kolb 1984)
Learning Flexibility	Individual adoption of different learning styles based on the situation.	Eight forced answer rankings.	(Sharma and Kolb 2009)
Swift Action	Strategic decision-making speed.	Three strategic scenarios: 1. New Product Development Decision 2. Strategic Partnering/Technology Licensing Decision 3. Target Market Allocation of Resource Decision.	(Baum and Wally 2003) modified and adapted for technology industry.
Experimentation	Practice of experimentation as an iterative approach to problem solving.	1 We frequently experiment with product and process improvements. 2. Continuous improvement in our products and processes is a priority. 3. After we decide and act, we are good at monitoring the unfolding results. 4. We regularly try to figure out how to make products work better. 5. We make repeated trials until we find a solution.	(Baum and Bird 2010)
Innovation	Firm level product innovation.	1. Our new product development program has resulted in innovative new products. 2. From an overall revenue growth standpoint our new product development program has been successful. 3. Compared to our major competitors, our overall new product development program is far more successful at producing innovative products.	(Song, Dyer et al. 2006)
Performance	Firm competitive performance.	Relative to your competitors, how does your firm perform concerning the following statements: 1. Achieving overall performance. 2. Attaining market share. 3. Attaining growth. 4. Current profitability.	(Reinartz, Krafft et al. 2004)
Entrepreneurial Success	Composite index of individual success as an entrepreneur	Weighted sum of factors: 1. Position in current company. 2. Status upon joining the company (i.e. founder, early employee, officer) 3. Number of strategic exits/liquidity events. 4. Largest strategic exit/liquidity event. 5. Serial entrepreneurialism – number of start-ups.	New Item
Revenue Growth	Current firm trailing one year revenue growth.	Approximately what percentage annualized revenue growth has your company experienced over the last year?	(Low and MacMillan 1988)
Revenue (control)	Current Revenue	What was your company's revenue last year?	(Low and MacMillan 1988)

**APPENDIX C**  
**Kolb Learning Style Inventory (LSI) Scale Reliability and Intercorrelation Matrix**  
**(Willcoxson & Prosser, 1996)**

Scale	CE	RO	AC	AE	AC-CE	AE-RO
CE	<b>.82</b>	-.24**	-.42**	-.34***	-.85***	-.08
RO		<b>.81</b>	-.17*	-.47***	.04	-.84***
AC			<b>.83</b>	-.32***	.83***	-.10
AE				<b>.87</b>	.03	.88
AC-CE						-.01

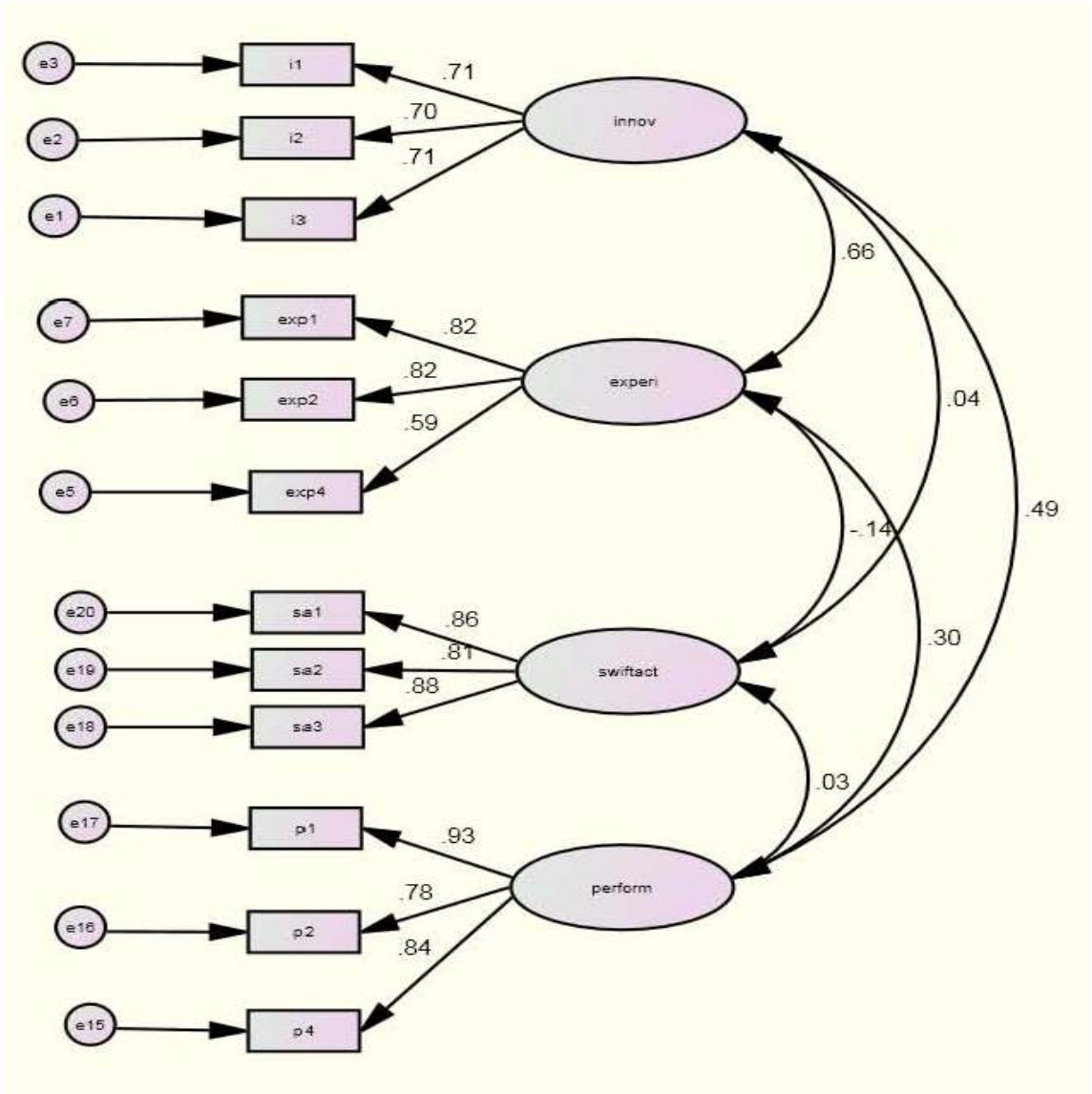
Cronbach's Alpha in bold on diagonals

\*p<.05, \*\*p<.01, \*\*\*p<.001

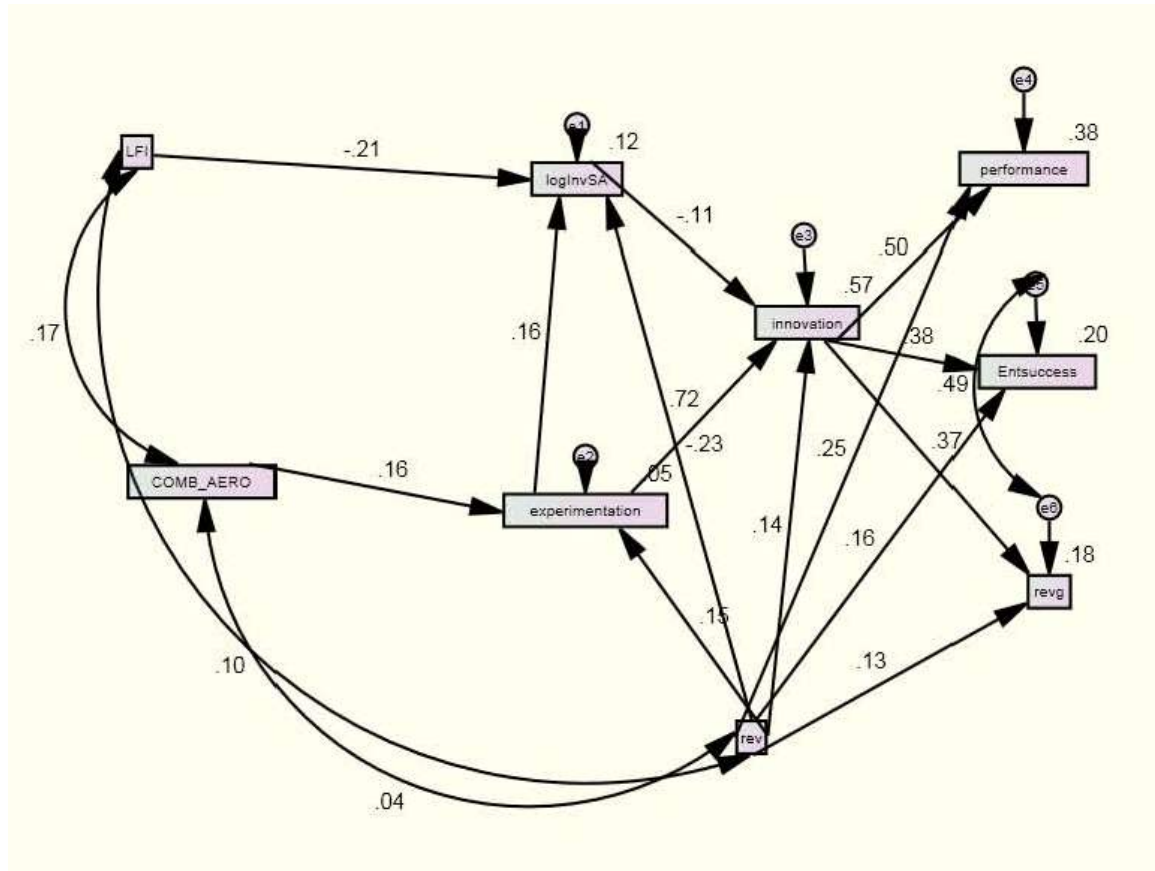
**Kolb Learning Style Inventory (LSI) Factor Loadings Demonstrating AC-CE and AE-RO Bipolar Dimensions (Willcoxson & Prosser, 1996)**

Science Student Sample N=94	Factor 1	Factor 2
Scale		
CE		-.92
AC		.79
RO	.81	
AE	-.92	

**APPENDIX D**  
**Study II Final CFA Path Loadings**



**APPENDIX E**  
**Study II Final SEM Path Diagram from AMOS**



**APPENDIX F**  
**Study II: Effects of Revenue as a Control**

	Experimentation	Swift Action	Innovation	Performance	Rev Growth	Entrepreneurial Success
Revenue	.151*	-.230**	.136**	.252***	.128 ns	.164*



**APPENDIX G**  
**Study II Model Fit Statistics**

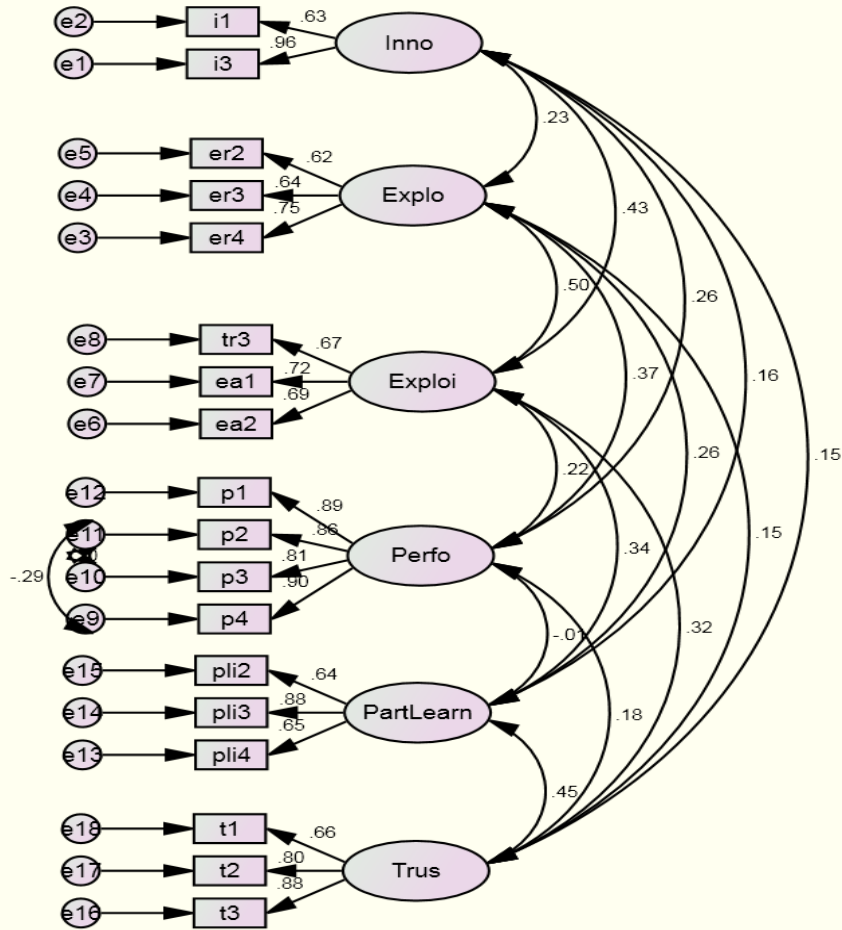
**TABLE G1**  
**CFA Model Fit Summary**

<b>Trimmed Category Model</b>		
<b>Key GOF Parameters</b>	<b>Criteria</b>	<b>Value</b>
CMIN/df	<2	1.184
Probability	Higher	.085
SRMR	<.05	.052
AGFI	>.90	.873
CFI	>.95	.980
RMSEA	<.05	.035
PCLOSE	>.50	.876

**Table G2**  
**Path Model Fit Summary**

<b>Trimmed Category Model</b>		
<b>Key GOF Parameters</b>	<b>Criteria</b>	<b>Value</b>
CMIN/df	<2	.746
Probability	Higher	.781
SRMR	<.05	.039
AGFI	>.90	.948
CFI	>.95	1.00
RMSEA	<.05	.000
PCLOSE	>.50	.957

**APPENDIX H**  
**Study III Final CFA Path Loadings**



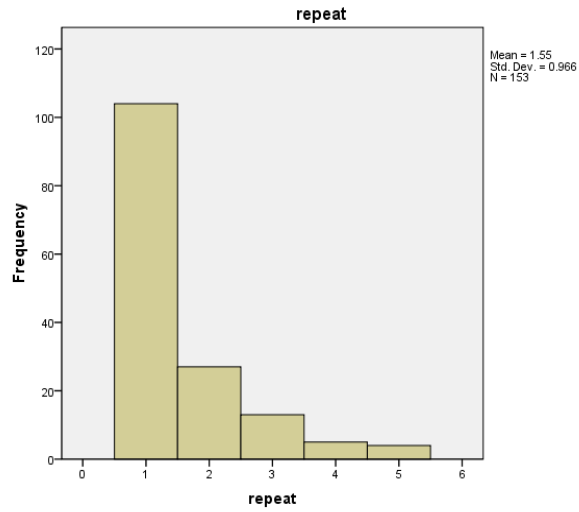
## APPENDIX I

### Study III Summary of Measures

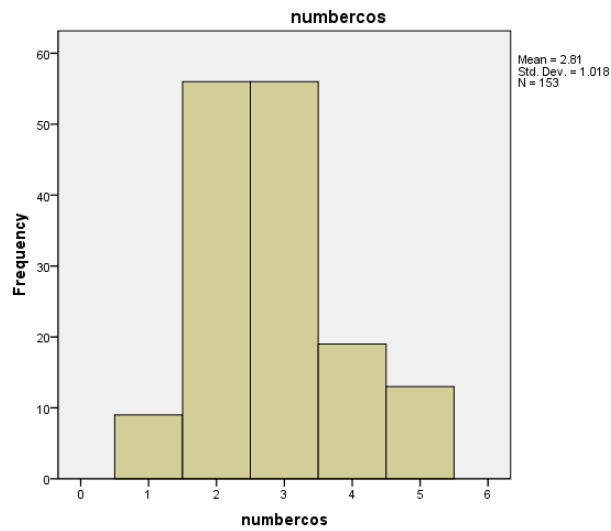
Construct	Definition	Items	Source
Learning Flexibility	Individual adoption of different learning styles based on the situation.	Eight forced rank questions.	(Sharma and Kolb 2009)
Absorptive Capacity	Ability to acquire external knowledge as a resource base for innovation.	Five point Likert scale: 1. We frequently scan the environment for new technologies. 2. We thoroughly observe technology trends. 3. We observe external sources of new technologies in detail. 4. We thoroughly collect industry information. 5. We can quickly rely on our existing knowledge when recognizing a business opportunity. 6. We are proficient at reactivating existing knowledge for new uses. 7. We quickly analyze and interpret changing market demands for our technologies. 8. We regularly apply new technologies to new products. 9. We constantly consider how to better exploit technologies. 10. We easily implement technologies in new products.	Lichtenthaler 2009
Partner Learning Interactions	Ability of trusted partners to discuss and critically evaluate ideas.	Five point Likert scale: 1. My partner and I critique each other's work in order to improve performance. 2. My partner and I freely challenge the assumptions underlying each other's ideas and perspectives. 3. My partner and I engage in evaluating the weak points of ideas to attain effectiveness. 4. My partner and I utilize different opinions for the sake of obtaining optimal outcomes.	Van der Vegt Bunderson 2005
Partner Trust	Partner trust: intent, competence and reliability.	Five point Likert scale: 1. I can rely on my partner without fear that he/she will take advantage of me, even if the opportunity arises. 2. My partner always keeps the promises made to me. 3. Given my partner's track record, I see little reason to doubt his/her competence and preparation.	Tsai Ghoshal 1998; Nahapiet Ghoshal 1998
Partner Functional Diversity	Depth of functional experience diversity between partners.	Partner Functional Diversity = $\text{Sqrt}(\sum \Delta E_i^2)$ where $\Delta E_i$ = the difference between the two partners experiences in each of the 10 functional areas.	Gemmell 2012
Partner Functional Breadth	Breadth of functional experience diversity across both partners.	Partner Functional Breadth = $FH = 1 - \sum p_i^2$ Where $P_i$ = Combined experience in the $i$ th functional area/Total combined experience in all functional areas.	Hambrick 1996
Innovation	Firm level product innovation.	Five point Likert scale: 1. Our new product development program has resulted in innovative new products. 2. From an overall revenue growth standpoint our new product development program has been successful. 3. Compared to our major competitors, our overall new product development program is far more successful at producing innovative products.	(Song, Dyer et al. 2006)
Performance	Firm competitive performance.	Five point Likert scale: Relative to your competitors, how does your firm perform concerning the following statements: 1. Achieving overall performance. 2. Attaining market share. 3. Attaining growth. 4. Current profitability.	(Reinartz, Krafft et al. 2004)
Company Age	Years co. has operated	How old is your firm? <1 year, 1-2 years, 2-5 years, 5-10 years, 10+ years	

**APPENDIX J**  
**Study III Entrepreneur and Partner History Data**

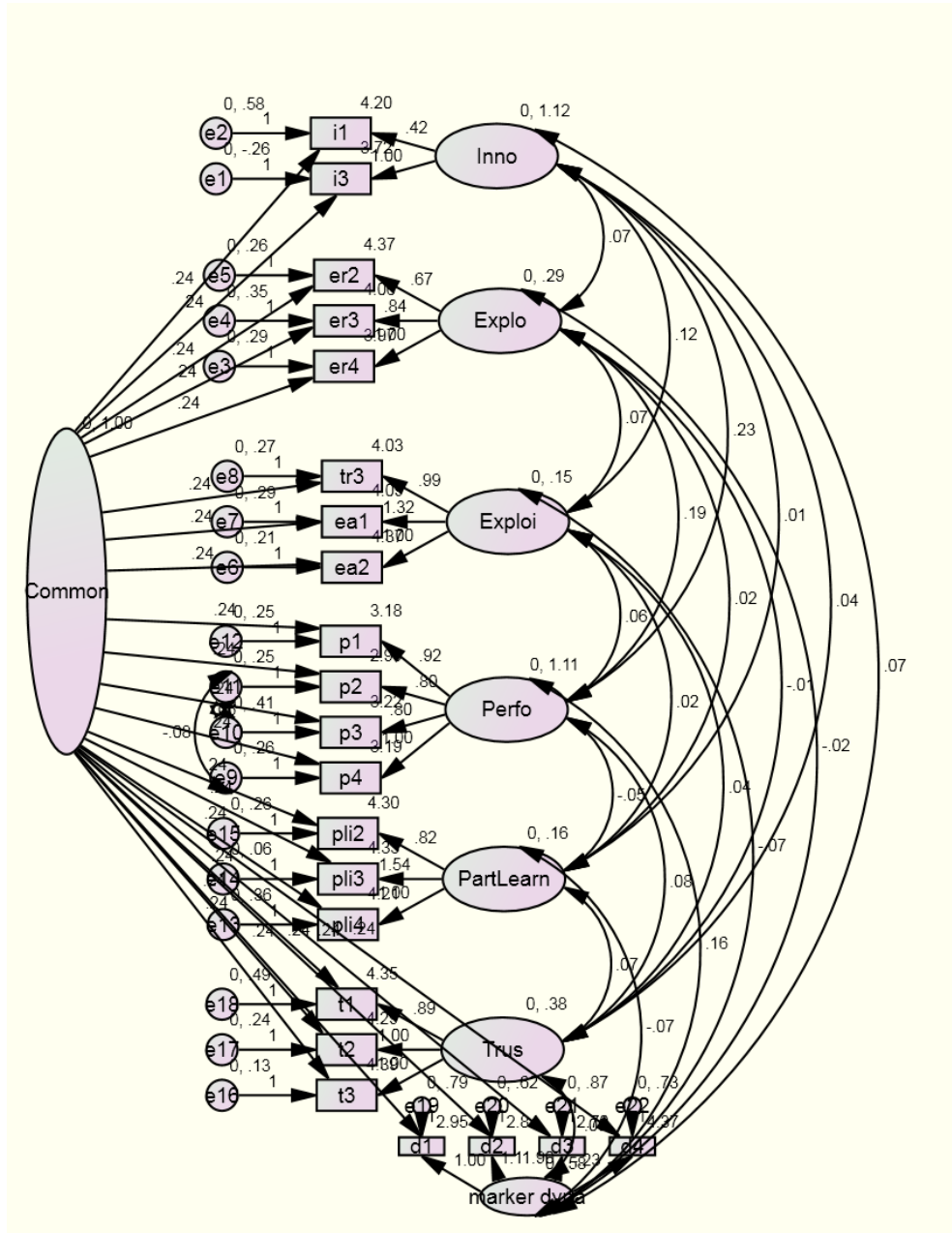
**FIGURE J1**  
**Numbers of Repeat Ventures by Trusted Partners**



**FIGURE J2**  
**Serial Entrepreneurialism (Number of Start-ups by Entrepreneur)**



**APPENDIX K**  
**Study III Common Methods Bias Test Model**



**APPENDIX L**  
**Study III Effects of Company Age as a Control**

	Innovation	Performance	Exploratory ACAP	Exploitative ACAP	Partner Learning Interactions	Revenue Growth
Age	-.158*	.104 ns	-.014 ns	-.091 ns	-.072 ns	-.034 ns

## REFERENCES

- Abell, P., Felin, T., & Foss, N. 2008. Building micro-foundations for the routines, capabilities, and performance links. *Managerial and Decision Economics*, 29(6): 489–502.
- Akrivou, K. 2008. *Differentiation and integration in adult development the influence of self complexity and integrative learning on self integration*. Doctoral dissertation, Case Western Reserve University, Cleveland, OH. Available at <http://rave.ohiolink.edu/etdc/view.cgi?acc%5Fnum=case1214318290>
- Amabile, T. 1983. The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, 45(2): 357–376.
- Amabile, T. 1993. Motivational synergy: Toward new conceptualizations of intrinsic and extrinsic motivation in the workplace. *Human Resource Management Review*, 3(3): 185–201.
- Amabile, T. 1996. *Creativity in context*. Westview Press.
- Amabile, T. 1997. Entrepreneurial creativity through motivational synergy. *Journal of Creative Behavior*, 31(1): 18–26.
- Amabile, T., Conti, R., Coon, H., Lazenby, J., & Herron, M. 1996. Assessing the work environment for creativity. *The Academy of Management Journal*, 39(5): 1154–1184.
- Anzai, Y., & Yokoyama, T. 1984. Internal models in physics problem solving. *Cognition and Instruction*, 1(4): 397–450.
- Argote, L., & Miron-Spektor, E. 2011. Organizational learning: From experience to knowledge. *Organization Science*, 22(5): 1123–1137.
- Argyris, C. 1995. Action science and organizational learning. *Journal of Managerial Psychology*, 10(6): 20–26.
- Argyris, C., & Schön, D. 1978. *Organizational learning: A theory of action perspective*. Addison-Wesley.
- Armstrong, S., & Mahmud, A. 2008. Experiential learning and the acquisition of managerial tacit knowledge. *Academy of Management Learning & Education*, 7(2): 189–208.
- Baer, M., & Oldham, G. R. 2006. The curvilinear relation between experienced creative time pressure and creativity: Moderating effects of openness to experience and support for creativity. *Journal of Applied Psychology*, 91(4): 963–970.

- Baron, R. M., & Kenny, D. A. 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6): 1173–1182.
- Barsade, S. G., Ward, A. J., Turner, J. D. F., & Sonnenfeld, J. A. 2000. To your heart's content: A model of affective diversity in top management teams. *Administrative Science Quarterly*, 45(4): 802–836.
- Baum, J. R., & Bird, B. 2010. The successful intelligence of high-growth entrepreneurs: Links to new venture growth. *Organization Science*, 21(2): 397–412.
- Baum, J. R., Bird, B. J., & Singh, S. 2011. The practical intelligence of entrepreneurs: Antecedents and a link with new venture growth. *Personnel Psychology*, 64(2): 397–425.
- Baum, J., Frese, M., & Baron, R. A. 2007. *The psychology of entrepreneurship*. Lawrence Erlbaum.
- Baum, J. R., & Wally, S. 2003. Strategic decision speed and firm performance. *Strategic Management Journal*, 24(11): 1107–1129.
- Beckman, C. M. 2006. The influence of founding team company affiliations on firm behavior. *The Academy of Management Journal*, 49(4): 741–758.
- Beckman, C. M., & Burton, M. D. 2008. Founding the future: Path dependence in the evolution of top management teams from founding to IPO. *Organization Science*, 19(1): 3–24.
- Bollen, K. A. 1989. *Structural equations with latent variables*. New York: Wiley.
- Bollen, K. A., & Long, J. S. 1993. *Testing structural equation models*. Newbury Park: Sage Publications.
- Brown, R. B. 2000. Contemplating the emotional component of learning. *Management Learning*, 31(3): 275–293.
- Busenitz, L., & Barney, J. 1997. Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of Business Venturing*, 12(1): 9–30.
- Cañas, J., Quesada, J., Antolí, A., & Fajardo, I. 2003. Cognitive flexibility and adaptability to environmental changes in dynamic complex problem-solving tasks. *Ergonomics*, 46(5): 482–501.
- Carlsson, B., Keane, P., & Martin, J. B. 1976. R&D organizations as learning systems. *Sloan Management Review*, (Spring), 17(3): 1–15.



- Carmeli, A., Brueller, D., & Dutton, J. E. 2009. Learning behaviours in the workplace: The role of high-quality interpersonal relationships and psychological safety. *Systems Research and Behavioral Science*, 26(1): 81–98.
- Casciaro, T., & Lobo, M. S. 2008. When competence is irrelevant: The role of interpersonal affect in task-related ties. *Administrative Science Quarterly*, 53(4): 655–684.
- Cassar, G., & Craig, J. 2009. An investigation of hindsight bias in nascent venture activity. *Journal of Business Venturing*, 24(2): 149–164.
- Chandler, G., & Lyon, D. 2009. Involvement in knowledge-acquisition activities by venture team members and venture performance. *Entrepreneurship Theory and Practice*, 33(3): 571–592.
- Chávez-Eakle, R., Graff-Guerrero, A., García-Reyna, J.-C., Vaugier, V., & Cruz-Fuentes, C. 2007. Cerebral blood flow associated with creative performance: A comparative study. *Neuroimage*, 38(3): 519–528.
- Cohen, P., & Cohen, J. 2002. *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum.
- Cohen, W. M., & Levinthal, D. A. 1989. Innovation and learning: The two faces of R&D. *The Economic Journal*, 99(397): 569–596.
- Cohen, W. M., & Levinthal, D. A. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1): 128–128.
- Cooney, T. M. 2005. What is an entrepreneurial team? *International Small Business Journal*, 23(3): 226–235.
- Cope, J., & Watts, G. 2000. Learning by doing – An exploration of experience, critical incidents and reflection in entrepreneurial learning. *International Journal of Entrepreneurial Behaviour & Research*, 6(3): 104–124.
- Corbett, A. 2005. Experiential learning within the process of opportunity identification and exploitation. *Entrepreneurship Theory and Practice*, 29(4): 473–492.
- Corbett, A. 2007. Learning asymmetries and the discovery of entrepreneurial opportunities. *Journal of Business Venturing*, 22(1): 97–118.
- Costello, A. B., & Osborne, J. 2005. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment Research & Evaluation*, 10(7). Available online at <http://www.pareonline.net/pdf/v10n7.pdf>

- Crossan, M. M., & Berdrow, I. 2003. Organizational learning and strategic renewal. *Strategic Management Journal*, 24(11): 1087–1105.
- Crossan, M. M., & Apaydin, M. 2010. A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies*, 47(6): 1154–1191.
- Crossan, M. M., Maurer, C. C., & White, R. E. 2011. Reflections on the 2009 AMR Decade Award: Do we have a theory of organizational learning? *Academy of Management Review*, 36(3): 446–460.
- Crossan, M. M., Lane, H. W., & White, R. E. 1999. An organizational learning framework: From intuition to institution. *The Academy of Management Review*, 24(3): 522–537.
- Csikszentmihalyi, M. 1996. The creative personality. *Psychology Today*, 29(4): 36–40.
- Curry, L. 1983. *Learning styles in continuing medical education*. Ottawa: Canadian Medical Association.
- Dahlin, K. B., Weingart, L. R., & Hinds, P. J. 2005. Team diversity and information use. *Academy of Management Journal*, 48(6): 1107–11231.
- Dane, E. 2010. Reconsidering the trade-off between expertise and flexibility: A cognitive entrenchment perspective. *The Academy of Management Review*, 35(4): 579–603.
- Dewey, J. 1922. An analysis of reflective thought. *The Journal of Philosophy*, 19(2): 29–38.
- Dewey, J. 1897. My pedagogic creed. *School Journal*, 54(1): 77–80.
- Dietrich, A. 2004. The cognitive neuroscience of creativity. *Psychonomic Bulletin & Review*, 11(6): 1011–1026.
- Dietrich, A. 2007. Who's afraid of a cognitive neuroscience of creativity? *Methods*, 42(1): 22–27.
- Dijksterhuis, A., & Nordgren, L. 2006. A theory of unconscious thought. *Perspectives on Psychological Science*, 1(2): 95–109.
- Dimov, D. 2007. Beyond the single person, single insight attribution in understanding entrepreneurial opportunities. *Entrepreneurship Theory and Practice*, 31(5): 713–731.
- Dixon, N. M. 1999. *The organizational learning cycle: How we can learn collectively*. Hampshire, Inglaterra: Gower.

- Dowrick, P. W. 1999. A review of self modeling and related interventions. *Applied and Preventive Psychology*, 8(1): 23–39.
- Dutton, J. E., & Heaphy, E. 2003. The power of high quality relationships at work. In K. S. Cameron, J. E. Dutton, & R. E. Quinn (Eds.), *Positive organizational scholarship: Foundations of a new discipline*: 263–277. San Francisco, CA: Berrett-Koehler Publishers, Inc.
- Dyer, J. H., & Singh, H. 1998. The relational view: cooperative strategy and sources of interorganizational competitive advantage. *The Academy of Management Review*, 23(4): 660–679.
- Easterby-Smith, M., Snell, R., & Gherardi, S. 1998. Organizational learning: Diverging communities of practice? *Management Learning*, 29(3): 259–272.
- Edmondson, A. 1999. Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, 44(2): 350–383.
- Eisenhardt, K. M. 1989. Making fast strategic decisions in high-velocity environments. *The Academy of Management Journal*, 32(3): 543–576.
- Eisenhardt, K. M., & Sull, D. N. 2001. Strategy as simple rules. *Harvard Business Review*, 79(1): 106–116.
- Ensley, M. D., & Hmieleski, K. M. 2005. A comparative study of new venture top management team composition, dynamics and performance between university-based and independent start-ups. *Research Policy*, 34(7): 1091–1105.
- Ensley, M. D., Pearson, A. W., & Amason, A. C. 2002. Understanding the dynamics of new venture top management teams: Cohesion, conflict, and new venture performance. *Journal of Business Venturing*, 17(4): 365–386.
- Epstein, S., & O'Brien, E. J. 1985. The person–situation debate in historical and current perspective. *Psychological Bulletin*, 98(3): 513–537.
- Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. 1999. Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, 4(3): 272–299.
- Farrell, M. 2003. *Collaborative circles: Friendship dynamics and creative work*. University of Chicago Press.
- Felin, T., & Zenger, T. R. 2009. Entrepreneurs as theorists: on the origins of collective beliefs and novel strategies. *Strategic Entrepreneurship Journal*, 3(2): 127–146.
- Felmlee, D., Sprecher, S., & Bassin, E. 1990. The dissolution of intimate relationships: A hazard model. *Social Psychology Quarterly*, 53(1): 13–30.

- Finke, R. 1996. Imagery, creativity, and emergent structure. *Consciousness and Cognition*, 5(3): 381–393.
- Finke, R., Ward, T., & Smith, S. M. 1992. *Creative cognition: Theory, Research, and Applications*. Cambridge, MA: MIT Press.
- Fischer, G., Giaccardi, E., Eden, H., Sugimoto, M., & Ye, Y. 2005. Beyond binary choices: Integrating individual and social creativity. *International Journal of Human-Computer Studies*, 63(4-5): 482–512.
- Flavell, J. H. 1976. Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), *The nature of intelligence*: 231-236. Hillsdale, NJ: Erlbaum
- Forbes, D. P. 2005. Managerial determinants of decision speed in new ventures. *Strategic Management Journal*, 26(4): 355–366.
- Forbes, D., Borchert, P., Zellmer-Bruhn, M. E., & Sapienza, H. J. 2006. Entrepreneurial team formation: an exploration of new member addition. *Entrepreneurship Theory and Practice*, 30(2): 225–248.
- Forster, W., & Jansen, K. 2010. Co-creating new ventures: attraction, search, and uncertainty in founding partnership formation. *Frontiers of Entrepreneurship Research*, 30(10): 1–15.
- Frensch, P., & Sternberg, R. 1989. Expertise and intelligent thinking: When is it worse to know better. In R. J. Sternberg (Ed.), *Advances in the psychology of human intelligence* (Vol. 5): 157–188. Lawrence Erlbaum Associates.
- Garcia, R., & Calantone, R. 2002. A critical look at technological innovation typology and innovativeness terminology: A literature review. *Journal of Product Innovation Management*, 19(2): 110–132.
- Garnsey, E. 1998. A theory of the early growth of the firm. *Industrial and Corporate Change*, 7(3): 523–556.
- Gartner, W. B. 1988. Who is an entrepreneur? Is the wrong question. *American Journal of Small Business*, 12(4): 11–32.
- Gartner, W. B., Shaver, K. G., Gatewood, E., & Katz, J. A. 1994. Finding the entrepreneur in entrepreneurship. *Entrepreneurship: Theory & Practice*, 18(3): 5–9.
- Geiger, M. A., Boyle, E. J., & Pinto, J. K. 1993. An examination of ipsative and normative versions of Kolb's revised learning style inventory. *Educational and Psychological Measurement*, 53(3): 717–726.

- Gemmell, R. M., Kolb, D. A., & Somers, A. 2012. *Individual learning style and learning flexibility: Mediated effects on entrepreneurial performance*. Babson College Entrepreneurship Research Conference, Fort Worth, TX.
- Gemmell, R. M., Boland, R. J., & Kolb, D. A. 2011. The socio-cognitive dynamics of entrepreneurial ideation. *Entrepreneurship Theory and Practice*, 36(5): 1053–1073.
- Gentner, D. 1983. Structure-mapping: A theoretical framework for analogy. *Cognitive Science*, 7(2): 155–170.
- Getzels, J., & Csikszentmihalyi, M. 1976. *The creative vision: A longitudinal study of problem finding in art*. New York: Wiley.
- Gino, F., Argote, L., Miron-Spektor, E., & Todorova, G. 2010. First, get your feet wet: The effects of learning from direct and indirect experience on team creativity. *Organizational Behavior and Human Decision Processes*, 111(2): 102–115.
- Granovetter, M. 1973. The strength of weak ties. *American Journal of Sociology*, 78(6): 1360.
- Hair, J. J., Black, W., Babin, B., & Anderson, R. 2010. *Multivariate data analysis* (7th ed.). Upper Saddle River, NJ: Prentice Hall.
- Hambrick, D. C., & Mason, P. A. 1984. Upper echelons: The organization as a reflection of its top managers. *The Academy of Management Review*, 9(2): 193–206.
- Hambrick, D. C., Cho, T. S., & Chen, M.-J. 1996. The influence of top management team heterogeneity on firms' competitive moves. *Administrative Science Quarterly*, 41(4): 659–684.
- Harrison, D. A., Price, K. H., Gavin, J. H., & Florey, A. T. 2002. Time, teams, and task performance: Changing effects of surface- and deep-level diversity on group functioning. *Academy of Management Journal*, 45(5): 1029–1045.
- Hitt, M. A., Hoskisson, R. E., & Kim, H. 1997. International diversification: Effects on innovation and firm performance in product-diversified firms. *The Academy of Management Journal*, 40(4): 767–798.
- Hmieleski, K., & Baron, R. 2009. Entrepreneurs' optimism and new venture performance: A social cognitive perspective. *The Academy of Management Journal*, 52(3): 473–488.
- Hmieleski, K. M., & Corbett, A. C. 2006. Proclivity for Improvisation as a predictor of entrepreneurial intentions. *Journal of Small Business Management*, 44(1): 45–63.

- Holcomb, T., Ireland, R., Holmes, Jr., M., & Hitt, M. A. 2009. Architecture of entrepreneurial learning: Exploring the link among heuristics, knowledge, and action. *Entrepreneurship Theory and Practice*, 33(1): 167–192.
- Hu, L., & Bentler, P. M. 1999. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1): 1–55.
- Huber, G. P. 1991. Organizational learning: The contributing processes and the literatures. *Organization Science*, 2(1): 88–115.
- Hutchins, E. 1991. The social organization of distributed cognition. In L. B. Resnick, J. M. Levine & S. D. Teasley (Eds.), *Perspectives on socially shared cognition*: 283–307. Washington, DC: American Psychological Association.
- Johnson, D. W., & Johnson, R. T. 1996. Cooperation and the use of technology. In J. M. Spector, M. D. Merrill, J. van Merriënboer, M. P. Driscoll (Eds.), *Handbook of research for educational communications and technology* (3<sup>rd</sup> ed.): 401–424. New York: Simon and Schuster Macmillan.
- Joreskog, K. G., & Sorbom, D. 1997. *LISREL 8: A guide to the program and applications*. Chicago, IL: SPSS Inc.
- Judge, W. Q., & Miller, A. 1991. Antecedents and outcomes of decision speed in different environmental contexts. *Academy of Management Journal*, 34(2): 449–463.
- Kane, M., & Engle, R. 2002. The role of prefrontal cortex in working-memory capacity, executive attention, and general fluid intelligence: An individual-differences perspective. *Psychonomic Bulletin and Review*, 9(4): 637–671.
- Kang, S.-C., & Snell, S. A. 2009. Intellectual capital architectures and ambidextrous learning: A framework for human resource management. *Journal of Management Studies*, 46(1): 65–92.
- Katz, N. 1986. Construct validity of Kolb's learning style inventory, using factor analysis and Guttman's smallest space analysis. *Perceptual and Motor Skills*, 63(3): 1323–1326.
- Kayes, A. B., Kayes, D. C., & Kolb, D. A. 2005. Experiential learning in teams. *Simulation & Gaming*, 36(3): 330–354.
- Kessler, E. H., & Chakrabarti, A. K. 1996. Innovation speed: A conceptual model of context, antecedents, and outcomes. *The Academy of Management Review*, 21(4): 1143–1191.

- Kim, D. 1993. A framework for integrating individual learning and organizational learning. *Sloan Management Review*, 35: 37.
- Knapp, R. 2010. Collective (team) learning process models: A conceptual review. *Human Resource Development Review*, 9(3): 285–299.
- Kolb, D. 1982. Problem management: learning from experience. In S. Srivastva (Ed.), *The executive mind*: 109–143. San Francisco, CA: Jossey-Bass,
- Kolb, D. 1984. *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.
- Kolb, A., & Kolb, D. 2005a. Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning and Education*, 4(2): 193–212.
- Kolb, A., & Kolb, D. 2005b. *The Kolb learning style inventory-version 3.1 2005 technical specifications*. Boston, MA: Hay Group Transforming Learning.
- Kolb, A., & Kolb, D. 2009. The learning way: Meta-cognitive aspects of experiential learning. *Simulation & Gaming*, 40(3): 297.
- Krueger, R., & Casey, M. 2000. *Focus groups: A practical guide for applied research*. Sage Publications.
- Lane, P. J., Koka, B. R., & Pathak, S. 2006. The reification of absorptive capacity: A critical review and rejuvenation of the construct. *The Academy of Management Review*, 31(4): 833–863.
- Lave, J., & Wenger, E. 1990. *Situated learning: Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.
- Legendre, P. 2005. Species associations: The Kendall coefficient of concordance revisited. *Journal of Agricultural, Biological, and Environmental Statistics*, 10(2): 226–245.
- Levinthal, D., & Rerup, C. 2006. Crossing an apparent chasm: Bridging mindful and less-mindful perspectives on organizational learning. *Organization Science*, 17(4): 502–513.
- Levitt, B., & March, J. G. 1988. Organizational learning. *Annual Review of Sociology*, 14: 319–340.
- Lewandowsky, S., & Thomas, J. L. 2009. Expertise: Acquisition, limitations, and control. *Reviews of Human Factors and Ergonomics*, 5(1): 140–165.

- Lewin, K. 1948. *Resolving social conflicts; selected papers on group dynamics*. Oxford, England: Harper.
- Liang, H., Saraf, N., Hu, Q., & Xue, Y. 2007. Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. *MIS Quarterly*, 31(1): 59–87.
- Lichtenthaler, U. 2009. Absorptive capacity, environmental turbulence, and the complementarity of organizational learning processes. *Academy of Management Journal*, 52(4): 822.
- Lindell, M. K., & Whitney, D. J. 2001. Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology*, 86(1): 114–121.
- Linzmayr, O. W. 2004. *Apple confidential 2.0: The definitive history of the world's most colorful company*. No Starch Press.
- Liu, W. 2006. Knowledge exploitation, knowledge exploration, and competency trap. *Knowledge and Process Management*, 13(3): 144–161.
- Low, M. B., & MacMillan, I. C. 1988. Entrepreneurship: Past research and future challenges. *Journal of Management*, 14(2): 139–161.
- MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. 2002. A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, 7(1): 83–104.
- Mainemelis, C., Boyatzis, R., & Kolb, D. A. 2002. Learning styles and adaptive flexibility: Testing experiential learning theory. *Management Learning*, 33(1): 5–34.
- March, J. G. 1991. Exploration and exploitation in organizational learning. *Organization Science*, 2(1): 71–87.
- March, J. G., & Olsen, J. P. 1975. The uncertainty of the past: Organizational learning under ambiguity. *European Journal of Political Research*, 3(2): 147–171.
- Mathieu, J. E., & Taylor, S. R. 2006. Clarifying conditions and decision points for mediational type inferences in Organizational Behavior. *Journal of Organizational Behavior*, 27(8): 1031–1056.
- Maxwell, J. 2005. *Qualitative research design: An interactive approach*. Applied Social Research Methods Series, Vol. 41. Thousand Oaks, CA: Sage Publications.
- McCarthy, A., & Garavan, T. N. 2008. Team learning and metacognition: A neglected area of HRD research and practice. *Advances in Developing Human Resources*, 10(4): 509–524.



- McPherson, M., Smith-Lovin, L., & Cook, J. M. 2001. Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 27: 415–444.
- Mednick, S. 1962. The associative basis of the creative process. *Psychological Review*, 69(3): 220–232.
- Mills, T. M. 1967. *The sociology of small groups*. Prentice-Hall.
- Miner, A. S. 2001. Organizational improvisation and learning: A field study. *Administrative Science Quarterly*, 46(2): 304–337.
- Minniti, M., & Bygrave, W. 2001. A dynamic model of entrepreneurial learning. *Entrepreneurship Theory & Practice*, 25(3): 5–16.
- Mintzberg, H. 1987. The strategy concept I: Five Ps for strategy. *California Management Review*, 30(1): 11–24.
- Mintzberg, H., Ahlstrand, B., & Lampel, J. 2005. *Strategy safari: A guided tour through the wilds of strategic management*. Free Press.
- Mischel, W. 1968. *Personality and assessment*. John Wiley & Sons, Inc.
- Mitchell, J. R., Shepherd, D. A., & Sharfman, M. P. 2011. Erratic strategic decisions: when and why managers are inconsistent in strategic decision making. *Strategic Management Journal*, 32(7): 683–704.
- Morse, J. M., & Niehaus, L. 2009. *Mixed method design: principles and procedures*. Left Coast Press.
- Mowery, D. C., Oxley, J. E., & Silverman, B. S. 1996. Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal (1986-1998)*, 17(Winter Special Issue): 77–77.
- Mumford, M., Reiter-Palmon, R., & Redmond, M. R. 1994. Problem construction and cognition: Applying problem representations in ill-defined domains. In M. A. Runco (Ed.), *Problem finding, problem solving, and creativity*: 3–39. Ablex Publishing Corporation.
- Nastasi, B. K., Hitchcock, J., Sarkar, S., Burkholder, G., Verjas, K., & Jayasena, A. 2007. Mixed methods in intervention research: Theory to adaptation. *Journal of Mixed Methods Research*, 1(2): 164–182.
- Nicholls-Nixon, C. L., Cooper, A. C., & Woo, C. Y. 2000. Strategic experimentation: Understanding change and performance in new ventures. *Journal of Business Venturing*, 15(5-6): 493–521.

- Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1): 14–37.
- Nooteboom, B. 2000. Learning by interaction: absorptive capacity, cognitive distance and governance. *Journal of Management and Governance*, 4(1): 69–92.
- O'Reilly, C. A., III, Caldwell, D. F., & Barnett, W. P. 1989. Work group demography, social integration, and turnover. *Administrative Science Quarterly*, 34(1): 21–21.
- Osborn, A. 1950. *Your creative power: How to use imagination*. Charles Scribner's Sons.
- Ozgen, E., & Baron, R. 2007. Social sources of information in opportunity recognition: Effects of mentors, industry networks, and professional forums. *Journal of Business Venturing*, 22(2): 174–192.
- Parker, S. C. 2006. Learning about the unknown: How fast do entrepreneurs adjust their beliefs? *Journal of Business Venturing*, 21(1): 1–26.
- Parks, M. R. 1977. Relational communication: theory and research. *Human Communication Research*, 3(4): 372.
- Pawlowsky, P. 2001. The treatment of organizational learning in management science. In A. B. A. M. Dierkes, J. Child & I. Nonaka (Eds.), *Handbook of organizational learning and knowledge*: 61–88. Oxford: Oxford University Press.
- Pearce, C., & Ensley, M. 2004. A reciprocal and longitudinal investigation of the innovation process: The central role of shared vision in product and process innovation teams (PPITs). *Journal of Organizational Behavior*, 25(2): 259–278.
- Perlow, L. A., Okhuysen, G. A., & Repenning, N. P. 2002. The speed trap: Exploring the relationship between decision making and temporal context. *Academy of Management Journal*, 45(5): 931–955.
- Perry-Smith, J. 2006. Social yet creative: The role of social relationships in facilitating individual creativity. *Academy of Management Journal*, 49(1): 85–101.
- Pinard, M., & Allio, R. 2005. Improving the creativity of MBA students. *Strategy & Leadership*, 33(1): 49–51.
- 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.
- Politis, D. 2005. The process of entrepreneurial learning: A conceptual framework. *Entrepreneurship Theory and Practice*, 29(4): 399–424.

- Prange, C. 1999. Organizational learning: Desperately seeking theory? In M. Easterby-Smith, J. Burgoyne & L. Araujo (Eds.), *Organizational learning and the learning organization*: 23–43. London: Sage.
- Purser, R. E., Pasmore, W. A., & Tenkasi, R. V. 1994. *Towards and understanding of the factors which enable and obstruct learning in new product development: An action research study*. Center for Effective Organizations, University of Southern California, Los Angeles, CA.
- Rae, D., & Carswell, M. 2000. Using a life-story approach in researching entrepreneurial learning: the development of a conceptual model and its implications in the design of learning experiences. *Education + Training*, 42(4-5): 220–228.
- Rae, D., & Carswell, M. 2001. Towards a conceptual understanding of entrepreneurial learning. *Journal of Small Business and Enterprise Development*, 8(2): 150–158.
- Rauch, A., & Frese, M. 2007. Let's put the person back into entrepreneurship research: A meta-analysis on the relationship between business owners' personality traits, business creation, and success. *European Journal of Work and Organizational Psychology*, 16(4): 353–385.
- Ravasi, D., & Turati, C. 2005. Exploring entrepreneurial learning: a comparative study of technology development projects. *Journal of Business Venturing*, 20(1): 137–164.
- Reinartz, W., Krafft, M., & Hoyer, W. D. 2004. The customer relationship management process: Its measurement and impact on performance. *Journal of Marketing Research*, 41(3): 293–305.
- Reuber, A. R., & Fischer, E. 1999. Understanding the consequences of founders' experience. *Journal of Small Business Management*, 37(2): 30–45.
- Richard, O. C. 2000. Racial diversity, business strategy, and firm performance: A resource-based view. *Academy of Management Journal*, 43(2): 164–177.
- Rivera, M. T., Soderstrom, S. B., & Uzzi, B. 2010. Dynamics of dyads in social networks: Assortative, relational, and proximity mechanisms. *Annual Review of Sociology*, 36: 91–115.
- Roberge, M.-É., & van Dick, R. 2010. Recognizing the benefits of diversity: When and how does diversity increase group performance? *Human Resource Management Review*, 20(4): 295.
- Roese, N. J., & Olson, J. M. 1995. *What might have been: The social psychology of counterfactual thinking*. Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.

- Roschelle, J. 1992. Learning by collaborating: Convergent conceptual change. *Journal of the Learning Sciences*, 2(3): 235–276.
- Ruef, M., Aldrich, H., & Carter, N. M. 2003. The structure of founding teams: Homophily, strong ties, and isolation among US entrepreneurs. *American Sociological Review*, 68(2): 195–222.
- Runco, M., & Chand, I. 1995. Cognition and creativity. *Educational Psychology Review*, 7(3): 243–267.
- Sadler-Smith, E. 2001. The relationship between learning style and cognitive style. *Personality and Individual Differences*, 30(4): 609–616.
- Schilling, M. A., Vidal, P., Ployhart, R. E., & Marangoni, A. 2003. Learning by doing something else: Variation, relatedness, and the learning curve. *Management Science*, 49(1): 39–56.
- Schumpeter, J. 1942. *Capitalism, socialism and democracy*. Routledge.
- Schumpeter, J. 1947. The creative response in economic history. *The Journal of Economic History*, 7(2): 149–159.
- Senge, P. M. 1993. The fifth discipline: The art and practice of the learning organization: Book review. *Consulting Psychology Journal: Practice and Research*, 45(4): 31–32.
- Shan, W., Walker, G., & Kogut, B. 1994. Interfirm cooperation and startup innovation in the biotechnology industry. *Strategic Management Journal*, 15(5): 387–394.
- Shane, S. 2000. Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11(4): 448–469.
- Shane, S. 2003. *A general theory of entrepreneurship: The individual-opportunity nexus*. Edward Elgar Publishing, Ltd.
- Sharma, G., & Kolb, D. 2009. *The learning flexibility index: Assessing contextual flexibility in learning style*. Case Western Reserve University, Department of Organizational Behavior, Working Paper Series: 28. Available at <https://staging.weatherhead.case.edu/departments/organizational-behavior/workingPapers/WP-10-01.pdf>
- Shea, G. P., & Guzzo, R.A. 1987. Groups as human resources. In K. M. Rowland & G. R. Ferris (Eds.), *Research in personnel and human resources management*, Vol. 5: 323–356. Greenwich, CT: JAI Press.
- Simmel, G. 1964. *The sociology of George Simmel*. Glencoe: The Free Press.

- Singer, J. 1978. Experimental studies of daydreaming and the stream of thought. In K. S. Pope & J. L. Singer (Eds.), *The stream of consciousness: Scientific investigations into the flow of human experience*: 209–227. New York: Plenum Press.
- Smith, S., Ward, T., & Schumacher, J. S. 1993. Constraining effects of examples in a creative generation task. *Memory and Cognition*, 21: 837–837.
- Somech, A., & Drach-Zahavy, A. 2011. Translating team creativity to innovation implementation: The role of team composition and climate for innovation. *Journal of Management* [online], February 7, 2011.
- Song, M., Dyer, B., & Thieme, R. J. 2006. Conflict management and innovation performance: An integrated contingency perspective. *Journal of the Academy of Marketing Science*, 34(3): 341–356.
- Staw, B. M. 1976. Knee-deep in the big muddy: a study of escalating commitment to a chosen course of action. *Organizational Behavior and Human Performance*, 16(1): 27–44.
- Staw, B. M., & Fox, F. V. 1977. Escalation: The determinants of commitment to a chosen course of action. *Human Relations*, 30(5): 431–450.
- Stein, M. 1975. *Stimulating creativity: Group procedures*. Academic Press.
- Stephens, J. P., Heaphy, E., & Dutton, J. E. 2012. High quality connections. In K. Cameron & G. Spreitzer (Eds.), *The Oxford handbook of positive organizational scholarship*. New York: Oxford University Press.
- Sternberg, R. J. 1999. The theory of successful intelligence. *Review of General Psychology*, 3(4): 292–316.
- Sternberg, R. J., & Hedlund, J. 2002. Practical intelligence, g, and work psychology. *Human Performance*, 15(1-2): 143–160.
- Stevens, G., & Burley, J. 1997. 3000 raw ideas equals 1 commercial success! *Research Technology Management*, 40(3): 16–27.
- Strauss, A., & Corbin, J. 1990. *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA Sage.
- Sull, D. 2004. Disciplined entrepreneurship. *MIT Sloan Management Review*, 46(1): 71–77.
- Tabachnick, B. G., & Fidell, L. S. 2000. *Using multivariate statistics*. Boston, MA: Allyn and Bacon.

- Tennant, M. 1988. *Psychology and adult learning*. London: Routledge.
- Thomke, S. H. 2003. *Experimentation matters : unlocking the potential of new technologies for innovation*. Boston, MA: Harvard Business School Press.
- Thompson, L., & Walker, A. J. 1982. The dyad as the unit of analysis: Conceptual and methodological issues. *Journal of Marriage and Family*, 44(4): 889–900.
- Tsai, W., & Ghoshal, S. 1998. Social capital and value creation: The role of intrafirm networks. *Academy of Management Journal*, 41(4): 464–476.
- Tversky, A., & Kahneman, D. 1974. Judgment under uncertainty: Heuristics and biases. *Science*, New Series, 185(4157): 1124–1131.
- Uzzi, B., & Dunlap, S. 2005. How to build your network. *Harvard Business Review*, 83(12): 53–60.
- Van de Ven, A. 1999. *The innovation journey*. New York: Oxford University Press.
- Van den Bossche, P., Gijssels, W. H., Segers, M., & Kirschner, P. A. 2006. Social and cognitive factors driving teamwork in collaborative learning environments. *Small Group Research*, 37(5): 490–521.
- Van Der Veegt, G. S., & Bunderson, J. S. 2005. Learning and performance in multidisciplinary teams: The importance of collective team identification. *Academy of Management Journal*, 48(3): 532–547.
- Van Wijk, R., Jansen, J. J. P., & Lyles, M. A. 2008. Inter- and intra-organizational knowledge transfer: A meta-analytic review and assessment of its antecedents and consequences. *Journal of Management Studies*, 45(4): 830–853.
- Vandervert, L., Schimpf, P., & Liu, H. 2007. How working memory and the cerebellum collaborate to produce creativity and innovation. *Creativity Research Journal*, 19(1): 1–18.
- Wallace, J., & Erickson, J. 1993. *Hard drive: Bill Gates and the making of the Microsoft empire*. HarperBusiness.
- Wallas, G. 1926. *The art of thought*. Jonathan Cape.
- Ward, T. 2007. Creative cognition as a window on creativity. *Methods*, 42(1): 28–37.
- Ward, T. B. 2004. Cognition, creativity, and entrepreneurship. *Journal of Business Venturing*, 19: 173.
- Ward, T., Patterson, M., & Sifonis, C. M. 2004. The role of specificity and abstraction in creative idea generation. *Creativity Research Journal*, 16(1): 1–9.

- Watson, W. E., Ponthieu, L. D., & Critelli, J. W. 1995. Team interpersonal process effectiveness in venture partnerships and its connection to perceived success. *Journal of Business Venturing*, 10(5): 393–411.
- Weick, K. E., & Sutcliffe, 2006. K. M. Mindfulness and the quality of organizational attention. *Organization Science*, 17(4): 514–524.
- Weisberg, R. 1999. Creativity and knowledge: A challenge of theories. In R. J. Sternberg & L. A. O'Hara (Eds.), *Handbook of creativity*: 226–250. Cambridge, U.K.: Cambridge University Press.
- West, G. 2007. Collective cognition: When entrepreneurial teams, not individuals, make decisions. *Entrepreneurship Theory and Practice*, 31(1): 77–102.
- Willcoxson, L., & Prosser, M. 1996. Kolb's Learning Style Inventory (1985): Review and further study of validity and reliability. *British Journal of Educational Psychology*, 66(2): 247–257.
- Williams, C. 2007. Transfer in context: replication and adaptation in knowledge transfer relationships. *Strategic Management Journal*, 28(9): 867–889.
- Zi-Lin, H., & Poh-Kam, W. 2004. Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science*, 15(4): 481–494.