ABSTRACT

RIDEOUT, ELAINE CLARICE. Bounded Rationality and the Supply Side of Entrepreneurship: Evaluating Technology Entrepreneurship Education for Economic Impact. (Under the direction of Dr. Denis O. Gray).

Based on the assumption that Entrepreneurship Education (E-ed) can increase the number of entrepreneurs and boost economic growth, national and local governments have invested significant resources into an E-ed economic development strategy. But how much do we know about whether E-ed really works?

E-ed appears to be one of those phenomena where action and intervention have raced far ahead of the theory, pedagogy, and research needed to justify and explain it. A comprehensive review of the empirical literature concluded that while E-ed appears to be a promising tool for promoting local and national economic development, its value will remain unknown until the E-ed research community responds to the challenge to conduct higher quality and more sophisticated methodological evaluations--including more longitudinal studies, using more inferentially powerful quasi-experimental research designs, pre-measure controls for self-selection, and a defensible comparison group.

This research study set out to identify/quantify differences in entrepreneurial proclivity, behaviors, and economic impacts between alumni who received E-ed and a matched control group who did not up to 14 years later. The study also attempted to shed light on the role of promising mediators like entrepreneurial self efficacy, cognitive skills and knowledge, values and attitudes, social networks, and other contextual variables on policy-relevant entrepreneurial outcomes, and tests their utility with powerful statistical tools including Structural Equation Modeling. The research applied and empirically tested a bounded rationality conceptualization of the Entrepreneurship Event (the E-Correspondence

Model) and Entrepreneurship Cognition theories in order to inform evidence-based practice. In addition, the research attempted to address the methodological shortcomings found in the extant literature.

Several research designs were employed because of the unique availability of some pretest data for the undergraduate group. For undergraduate alumni, the study employed a pretest-post-test matched comparison group quasi-experimental design (Shadish et al, 2002) in support of group equivalence. For graduate alumni, the study utilized a post-test only matched comparison group design.

Data collection involved surveys (both email and mail) of E-ed alumni (N=2,000) and a matched (N=2,000) alumni comparison group, with 603 complete responses received. Specific measures included entrepreneurial courses respondents had taken, background data, local context, career histories and entrepreneurial intentions, activities, and accomplishments, and self-assessments along psycho and social cognitive dimensions, personality, and self-efficacy in general and in entrepreneurial tasks. Pre-measures included general entrepreneurship skills and abilities. Dependent variables included psychosocial measures typically found in similar studies (entrepreneurial intentions) as well as measures only available to longitudinal studies: 1) enterprising activities and social entrepreneurship, 2) new product/service development intrapreneurship, and; 3) business startups.

Confirmatory factor analysis validated the psychometric properties of the measures employed, and regression analysis and Structural Equation Modeling (SEM) was utilized to test hypotheses that E-ed alumni created more entrepreneurial outcomes and economic impacts than matched controls. In addition SEM was used to test the overall goodness of fit of a causal model of E-ed, grounded in theory. Results supported the theorized E-

Correspondence model, and showed that two of the E-ed programs evaluated created significantly more economic impacts (new businesses, new products and services) than matched controls, while one did not. The causal model's results held up even after controlling for a rigorous battery of covariates. For those that worked it was not E-ed itself that directly produced entrepreneurial outcomes and impact. E-ed primarily produced E-outcomes through mediating mechanisms including personal characteristics, networks, and E-self efficacy. The study concluded that technology entrepreneurship holds great promise in creating new firms, new jobs, and economic growth, and pedagogy matters. Robust andragogical approaches, (applied, relevant, problem-centered learning as opposed to the conventional lecture and case-based pedagogical approach), can in fact catalyze the entrepreneurial behaviors, activities, and enterprises that produce economic impact. Theoretical and practical implications of this research are offered for researchers, economists, educators, and policymakers.

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Bounded Rationality and the Supply Side of Entrepreneurship: Evaluating Technology Entrepreneurship Education for Economic Impact

by
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DEDICATION

To Jeffrey G. Shelden, with love.

BIOGRAPHY

Elaine C. Rideout is a Kauffman Dissertation Fellow in Entrepreneurship at North Carolina State University. Her research interest is entrepreneurship as a driver of economic development. Early in her career she served as a founding executive of the Federal Retirement Thrift Investment Board. Most recently she served as Instructor and Interim Director of the NC State Engineering Entrepreneurs Program. Rideout has 25 years of experience in conceiving new ideas and moving them to execution and routinization. She is a social entrepreneur who has created 2 public entities, 5 nonprofits and supported dozens more. She is a business entrepreneur who has founded two startup companies and supported the development of many more. Currently, she is CEO of WISERsystems, Inc., a startup located on NC State's Centennial Campus, and President/CEO of Economic Investment Strategies (EIS) Associates, an enterprise-based economic development public policy consulting firm. Rideout has raised over $100 million in support of her nonprofit and business ventures. She holds the MPP from the University of Michigan's Ford School of Public Policy.

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I. Introduction

The importance of entrepreneurship to the macro economy was first recognized as recently as 1987 with David Birch's seminal work, "Job Creation in America: How our Smallest Companies put the Most People to Work." More recent research confirms that entrepreneurial activity, especially high-growth, high-tech firm creation, can lead to regional and national economic growth (Sternberg & Wennekers, 2005) and can have a positive and significant impact on technological change (Acs & Varga, 2005). According to the SBA (2010), small businesses represent 44% of U.S. private payroll and generate 60-80% of all new jobs annually. According to analysis done by Haltiwanger, Jarmin, & Miranda (2009), the average U.S. net employment growth rate from 1980-2005 would have been negative if not for the jobs created by newly founded firms.

Increasingly, economic developers and policy makers are asking, "how can we get more entrepreneurs in order to create more new jobs?" The Global Entrepreneurship Monitor cites three major barriers to entrepreneurship: social and cultural barriers, lack of capital, and lack of education. Social and cultural barriers are less a problem in the U.S. where business failure is not stigmatized to the degree it is in some other countries; and U.S. small business lending programs, venture investors, and angel networks make access to capital less of a barrier than in most other nations. Education is the bigger issue in the U.S.; current education paradigms prepare American's youth to be employees as their only career choice. Even business schools, home to most university entrepreneurship courses, are more

likely to teach students how to run corporate R&D departments than they are to teach them how to create their own R&D, launch a venture, and manage it.

In a number of states in the U.S., including North Carolina, policymakers are focusing on Entrepreneurship education (E-ed) not only as a first step in tackling the other two obstacles but also to set the stage for increased levels of entrepreneurship over the long run, especially in areas hard-hit by manufacturing and industrial job losses. But is entrepreneurship education an effective approach for enhancing entrepreneurship in the USA? How do we know it works? What education methods and modalities are most effective in promoting the kinds of entrepreneurship that best creates the new wealth that produces economic growth?

This research study recognizes entrepreneurship as an important US policy prescription for economic growth. Chapter 1 presents a snapshot of university E-ed in the United States and the means, modes, and methods of university-based entrepreneurial education approaches. The potential antecedents of entrepreneurial proclivity and activity are identified in Chapter 2, which also explores the theoretical underpinnings of E-ed. In Chapter 3 the empirical research on entrepreneurship education is comprehensively summarized and critiqued in order to determine what has been empirically established about how effectively university-based E-education (high-tech/high-growth E-ed in particular) works to induce economic growth. How do the university-based high-tech entrepreneurial education interventions operate to produce high-growth ventures? And how successful are these interventions in terms of outcome measures (number of start-ups, new jobs, etc). Chapter 4 follows with a discussion of how the design of the current study was informed by

the methodological weaknesses of the E-ed evaluations that exist to-date. Survey methodology, instrumentation, and metrics are also discussed. The study's research hypotheses, data analysis, and empirical findings are presented in Chapter 5. Chapter 6 concludes by summarizing the results, discussing the limitations and implications of the study findings, and concluding with next steps for further research.

II. Economic Importance of Entrepreneurship

Individual entrepreneurs and the small firms they create have emerged as the essential mechanism for commercializing breakthrough ("radical") discoveries and new technologies that drive macro economies. Despite their substantial R&D budgets, large firms are more likely to lead in "incremental" innovation that drives much of the continuous improvement, deflationary pressures, and productivity so essential for economic growth. Research conducted by the Kauffman Foundation and others suggest that while large firms clearly play an essential role in the U.S. economy and the U.S. innovation system, a range of factors make it unusual for large firms to invent Schumpeter's creative-destructive radical innovations.

Arrow, (1962) suggests that established firms do not like to invest in opportunities that would cannibalize their existing operations. Henderson, (1993) found that the routines of established firms focus their attention away from new information and new activities. Established firms may not have the flexibility required to exploit entrepreneurial opportunity (Holmstrom, 1989) or they may suffer from high levels of inertia (Hannan & Freeman, 1977). The greater the importance of existing customers to an organization, and the stronger

the reputation of the existing firm, the less likely it will be to exploit opportunity, (Christenson & Bower, 1996).

Link and Rees (1990) found diseconomies of scale in large firms due to bureaucratic structures which inhibited both innovative activity and the speed with which new inventions are birthed by corporations. Also, while larger firms undertake greater R&D effort, each additional dollar is found to yield less in terms of innovative output (law of diminishing returns). Tushman and Anderson (1986) found that radical opportunities are exploited by new firms because they would undermine the core competencies of established firms. In surveying the research, Acs and Audretsch (2003) concluded that in innovative industries composed primarily of large firms, the relative innovative advantage is held by small enterprises.

Due to the path dependencies imposed by all of the above, large firms increasingly depend on small non-bureaucratic firms for new ideas and technologies. The institutional contrasts listed in Table 1 below all make large, established companies more likely to invest in start-ups and acquire small companies with promising technologies than to launch radical innovations themselves.

Table 1. Source and Type of Entrepreneurial Innovation

Source: Individual	Source: Corporate R&D
RADICAL	INCREMENTAL
Expert Scientists/Inventors	Corporate Brass, Planners, Marketers
Risk-Takers	Risk-Averse
Flexible Time and Budget Constraints	Tight Time and Budget Constraints
No Bureaucracy	Bureaucratic Controls

Small, new firms are the most innovative on a number of dimensions (Wong et al., 2005):

- Small firm patents are more likely than a large firm patent to be in the top 1% of the most frequently cited patents.
- Small firms make up one-third of the most prolific patenting companies.
- Small firm innovation is twice as closely linked to scientific research; it is more high-tech and cutting-edge.
- Small firms more effectively produce high-value innovations.
- Small firms are 13 times more innovative per employee than large patenting firms.
- Small firm patents are twice as likely to be among the top 1% of highest impact patents as large firms.

III. Education Strategies to Generate more Innovative Entrepreneurs

If interest in entrepreneurship by America's youth is any indicator, an educational opportunity exists to substantially increase the number of American graduates who seek out entrepreneurship and small business careers. A number of surveys have found increasing numbers of US young adults expressing interest in starting a business (including 45% of Northwestern University's first year students, 40% of Harvard's MBA graduating class, and nearly 70% of US high schoolers according to a 1994 Gallup poll) (Walstad, 1994; Fiet, 2000; GEM 2005).

Until relatively recently, entrepreneurship education has been considered something of an educational contradiction-in-terms, ill-suited to conventional pedagogy. Education institutions in general, it was argued, go to great lengths to squelch entrepreneurial attitudes and behaviors. In the US, primary school teachers typically do not encourage creativity, independence, and a questioning of convention. Instead conformity is preferred and thought diversity is undervalued. Furthermore, primary and secondary school teachers typically have no experience in the business world and are therefore ill-equipped to promote entrepreneurship awareness among their pupils. And teacher certification red-tape and low pay discourage professionals with business experience from transferring into the teaching profession. Given these institutional intransigencies, school-based E-ed approaches and curricula have not been widely adopted, nor have they been easy to develop and implement without controversy.

IV. University-Based E-ed

Student demand has been largely behind increasing numbers of university-based entrepreneurship education programs. Today, approximately 90% of the nation's 888 accredited master's and doctoral degree-granting institutions offer entrepreneurship courses, and in most cases, multiple degree options. (Cone, 2007). Over 400,000 students annually take 2,200 courses available at over 1,600 schools nationwide with 277 endowed faculty positions, 44 academic journals, and nearly 150 research centers, according to a survey released in June, 2006 by Indiana University's Johnson Center for Entrepreneurship and Innovation (Finkle et al., 2006). This can be compared to 24,000 students enrolled in E-ed courses as recently as 1996. In 1971 there was a grand total of 16 endowed professors. (Loten, 2006; Katz, 2003).

The growth of entrepreneurship majors exceeds that of the growth of all other majors combined in the last 10 years (Katz, 2003). As more and more universities attempt to expand their course offerings to include entrepreneurship majors, minors, and career-track E-ed (such as engineering, arts, and health entrepreneurship), a lack of qualified faculty is the top-ranked factor limiting the growth of the field.

Despite exploding enrollments, at the post-secondary level, E-ed is still typically a niche offering. Exposure to entrepreneurship as a career option is virtually unavailable in the majority of institutions. Universities' primary mission has long been to prepare students to be good employees of large companies. Business principles are not widely taught outside of business schools, and most students are not taught many of the skills required of

entrepreneurs including out-of-the-box thinking, invention, prototyping, how to leverage resources, networking, and how to work effectively in teams.

With regard to pedagogy, the research suggests that there is no single standard approach for teaching entrepreneurship. One survey (Ahiarah, 1989) revealed that the most common pedagogy for teaching small business management and entrepreneurship was a combination of lectures and case studies. The second most used tool was special projects, including live cases or case formulations. Solomon, et al. (2002) identified an emerging trend toward greater integration of practical applications and technology, with distinct courses in small business management and consulting and new venture creation becoming popular. But in fact the small business vs. new venture creation approaches are really quite different. (Winslow, et al. 1998). As Winslow explains: *"The traditional objectives of small business management programs have been to provide students with management 'know-how' relating to 'setting goals and objectives, leading, planning, organizing, and controlling from a small business perspective' (Fernald & Solomon, 1993, p. 103).* In contrast, entrepreneurial venture education has had as its focus an action orientation culminating in an implementable business plan.

Historically, a variety of curricula and teaching methods have been successfully used in all types of E-ed courses at the post-secondary level. Curricula content for venture creation might include, for example, opportunity identification, strategy development, functional disclosure, startup strategies, resource acquisition, and implementation. (Knight, 1991). Teaching modalities can be arranged along a continuum (as with many subjects) from the most concrete to the most abstract/theoretical. McMullan and Long (1987) suggest that

in addition E-Ed pedagogy should include skill-building in negotiation, leadership, creative thinking, exposure to technological innovation, and new product development. In their review of the literature, Gorman et. al (1997) concluded that the ideal pedagogical components of E-Ed programs should include: a focus on attributes and skills as well as tasks, an element of concrete experience derived from active participation through projects and the like, and content directed to stage of venture development and emphasizing functional integration.

Similarly, a 1997 George Washington University study indicated that successful entrepreneurship education increasingly involves more constructivist pedagogical approaches including live cases or case formulations, guest lectures and speakers, research projects, community development, site visits, business plan development, discussions, small business institute counseling, feasibility studies, virtual and non-virtual simulations, capstone curricula and internships. (Winslow et al., 1998). As a general conclusion, it appears that the more 'hands-on' the teaching method is, the greater its perceived chance of success (Solomon, 2002; Vesper & Gartner, 1997).

A further distinction is called for in pedagogical approaches for teaching courses that focus on catalyzing startup ventures with high-growth potential. As far back as 1982, Harrell noted that government policymakers erred in assuming that the programs designed to support small business development would also support high-growth, high-tech ("technopreneurial") entrepreneurship. (In this study "technopreneurial" is distinguished from imitative entrepreneurship and arbitrage entrepreneurship within established industries and markets, which is typically taught in conventional small business entrepreneurship courses).

Technopreneurship involves innovative strategies, emerging industries, and new technology commercialization. Not only do the two curricular approaches require different meta-strategies, they promote different kinds of organizations and different forms of networking. (Katz, 2008). Technopreneurial education courses can be further delineated from general E-ed courses in terms of content and pedagogy. With respect to content they tend to include a focus on unique curricular aspects like technology and high-tech product identification, ideation, and development, intellectual property protection, team-building, networking and strategic partnerships, venture/angel capitalization, and growth management. In recognition of the unique contextual aspects of technopreneurship, some University programs attempt to provide nascent entrepreneurs with sociopolitical strategies (facilitated network access and team building, for example) and entrepreneurial competencies (leadership and communications skills, for example) to redress these lacks (Ohland, et al., 2004, Kingon et al. 2002).

A pedagogical focus on hands-on experiential teaching approaches has also surfaced in the teaching of technopreneurship (Winslow et al., 1998). For instance, Kingon et al., (2001, 2002) describe a unique approach for high technology commercialization that involves interdisciplinary teams of graduate students (science/technical, business, and liberal arts) who begin with a technology so new that a product concept has not yet been developed. The students search for technologies /unexploited intellectual property, define product concepts with large market opportunity and high-growth potential, develop commercialization strategies, write business plans, raise money, and launch technopreneurial ventures.

In summary, current E-ed pedagogy appears to be quite diverse and eclectic. We can observe E-ed initiatives that employ the relatively traditional small business management approach as well as a more recent entrepreneurial venture approach. While diverse pedagogy, including the traditional lecture and case study approaches are very much in evidence, there appears to be a growing consensus that a more hands-on approach that is more active and allows for integration is superior. There is also an emerging consensus that technopreneurial education should have a somewhat different content and pedagogical focus. That is, it should be differentiated from other types of entrepreneurship education by new teaching approaches that integrate team building and network development, that have a special focus on technology ideation and development, resource acquisition, venture capital, growth management, and intellectual property protection, and that recognize the unique contextual demands of high-tech venture development.

What specific variants of entrepreneurship (lifestyle, high-tech, service, intrapreneurship, self-employment, franchising, etc.) in what fields (arts, agriculture, health, professional services, engineering, science for example) require their own pedagogical variant? What education methods and modalities are most effective in promoting "technopreneurial" entrepreneurship that produces the wealth-creating radical innovations that drive economic growth?

The increase in both student demand for entrepreneurship curricula and higher education course offerings at this time in history comports with the theoretical observation that societal demand for entrepreneurs coincides with the pace of change in the economy (Casson, 2003). The faster the pace of change, the greater the demand and higher the reward

for being an entrepreneur. If educational approaches work to increase the stock of entrepreneurial ability in the population, then theoretically the supply of entrepreneurs in society will keep up with the need for them and the economy will grow in accordance with the economic innovation growth theories of Schumpeter and others. The evidence with regard to the known antecedents of entrepreneurship, including E-ed, and the theoretical case for how E-ed might inculcate the skillsets and mindsets that promote economic entrepreneurial creation is summarized next.

Chapter 2. Theoretical Research Literature

I. Relevant Antecedent Literature

The literature was reviewed to determine: 1) Does E-ed work to produce entrepreneurial outcomes; and, 2) do we have any evidence from the literature to help us understand how it might work? Specifically, the review addressed: What are the antecedents of entrepreneurship, and which of these are relevant to E-ed? (Part II-IV) What relevant theories can guide the study's research hypotheses? (Part V). What are the strengths and weaknesses of the extant empirical research? (Chapter 3).

Entrepreneurship is a field of research that has developed largely over the last two decades. As a new field of study, it is plagued by legitimacy concerns, undeveloped theory, and a lack of research cohesiveness. This is particularly true in the area of entrepreneurship education which, by way of comparison with the broader entrepreneurship literature, has been virtually ignored.

Scholarship in the field involves studies of the complex web of relationships that define entrepreneurship from the perspective of the entrepreneur, the entrepreneurial organization, and the contributions of entrepreneurship to economic growth. Most scholars see entrepreneurship occurring across five levels of analysis: individual, group, organization, industry, and society (Gartner, 2001). Other scholars (Sarasvathy, 2003) call for a focus on the different kinds of individual entrepreneurs, (nascent, novice, family, solo, serial, parallel, life-style, portfolio, and social for example).

The broader literature on the topic of entrepreneurship has emerged from a number of disciplinary perspectives including economics, psychology, sociology, management, finance, strategy, geography, and even anthropology (Acs & Audretsch, 2003). In addition to personal, cognitive, and behavioral characteristics of individual entrepreneurs, another topic of broad research interest includes the environmental influences on entrepreneurs as well as the development and influences of entrepreneurial organizations, networks, and geographic clusters of entrepreneurial activity.

Given that the "science" of entrepreneurship is being conducted by researchers across a number of disciplines, there is broad diversity in approaches and perspectives. From a macro-economic perspective, for example, entrepreneurship produces disequilibrium that disturbs the system until it is absorbed and a new economic equilibrium is achieved. Micro economists view entrepreneurs from an analytic, "rational person" perspective emphasizing the utility and opportunity costs of entrepreneurial behaviors. The psychologists' "entrepreneur" bears little resemblance to the economists' "rational person". This unusual personality is inclined to make decisions while relying heavily on "bounded rationality" (Simon, 1979), cognitive heuristics, and other cognitive biases such as counterfactural thinking, representativeness, and over-optimism/over-confidence. Management researchers, on the other hand, focus on the firm-level growth strategies and resource-based theories to understand entrepreneurial firm creation and management.

In emerging disciplines with scores of definitions, a concept can begin to lose meaning in academic venues if it becomes difficult to operationalize or if it is operationalized differently and inconsistently. The field's primary definitions of entrepreneurship are

summarized in Table 2 below. (For the purpose of this research study and its focus on three distinct E-outcome dependent variables (enterprise, small business entrepreneurship, and technopreneurship), the author's definition (the last cells in the table) will be utilized).

Table 2. Major Definitions of Entrepreneurship

Author of Definition	Noun (the individual)	Verb (entrepreneurial act)	Uncertainty Risk Tolerating Aspect	Organization Creating Aspect	Economic/ Wealth Creating Aspect	Novelty/ Innovation Aspect
Richard Cantillon (1755)	He	Who invents	No	No	No	Yes
Jean Baptiste-Say (1803)	One who uses knowledge, judgment, managerial skills, leadership, and technical ability	that shifts economic resources out of an area of lower into higher productivity and yield.	No	No	Yes	No
Joseph Schumpeter (1934)	Individual source of creative destruction who	creates new combinations (new good, method of production, new market, source of supply, new organization) done in a new way.	No	Yes	Yes	Yes
Knight (1948)	Entrepreneurs	receive a return for bearing risk and uncertainty due to imperfect knowledge of productive resources	Yes	No	Yes	No
Cole (1949)	Individual who	engages in purposeful activity to initiate, maintain, and aggrandize a profit-oriented business.	No	Yes	No	Yes
Kirzner (1973)	A decision maker who	is alert to unnoticed opportunities. Recognition and seizing of opportunities creates the competitive behaviors that correct the market and restore equilibrium.	No	No	Yes	No
Smilor, (1997)	Entrepreneurs	have the ability to create meaning; the skills to orchestrate talent; the confidence and capacity to embrace chaos; and, the ability to accelerate personal and team learning	No	No	No	No
Drucker (1985)	Entrepreneurs are change agents who	catalyze innovation and as a result endow existing resources with new wealth producing capacity	No	No	Yes	Yes
Rumelt (1987)	Entrepreneurs	create new businesses with some element of novelty.	No	Yes	No	Yes
Low & MacMillan (1988)	Entrepreneurs	create new enterprises	No	Yes	No	No
Gartner (1988)	Entrepreneurs	create new organizations	No	Yes	No	No
Hisrisch & Peters (1989)	Entrepreneurs devote time and effort, assume financial, psychological, and social risks	in order to create something different with value and receive the resulting rewards of monetary and personal satisfaction.	Yes	No	Yes	Yes
Stevenson & Jarillo (1990)	Individuals either on their own or inside organizations	pursue opportunities without regard to the resources they currently control.	Yes	Yes	No	No
Bygrave & Hofer (1991)	Entrepreneurs	take on all functions, activities, and actions associated with the perceiving of opportunities and the creation of organizations to pursue them.	No	Yes	No	No

Table 2. Continued

Author of Definition	Noun (the individual)	Verb (entrepreneurial act)	Uncertainty Risk Tolerating Aspect	Organization Creating Aspect	Economic/ Wealth Creating Aspect	Novelty/ Innovation Aspect
Amit, Glosten & Muller (1993)	Entrepreneurs	Extract profits from new, unique, and valuable combinations of resources in an uncertain and ambiguous environment	Yes	No	Yes	Yes
Bull & Willard (1993)	Entrepreneurs are motivated (by task, vision, social value, or expectation of gain) under conditions of comfort and support	to create new combinations that cause economic discontinuity.	No	No	Yes	Yes
Kreuger & Bazeal (1994)	Entrepreneurs	pursue opportunities irrespective of existing processes.	Yes	No	No	No
Timmons (1994)	Entrepreneurs	create and build something of value from practically nothing.	No	No	Yes	No
Dollinger (1995)	Entrepreneurs	Create an innovative economic organization for the purpose of gain or growth under conditions of uncertainty	Yes	Yes	Yes	Yes
Hatten (1997)	individual	Who sees an opportunity and assumes the risks (financial, material, and psychological) of starting a business to take advantage of the opportunity or idea.	Yes	Yes	No	No
Venkataraman (1997)	Entrepreneurs	discover, evaluate, and exploit opportunities to create future goods and services.	No	No	Yes	No
Barrow (1998)	Entrepreneurs	Utilize a wide range of skills to add value to a particular scheme of human activity. The effort expended in finding and implementing opportunities is rewarded by income, independence, and pride in creation	No	No	Yes	No
Wiklund (1998)	Entrepreneurs	take advantage of opportunity by novel combinations of resources in ways which have impact on the market.	No	No	Yes	Yes
Rideout (2007)	Enterprisers	are the set of individuals who creatively initiate, evaluate, and organize to exploit opportunities under conditions of uncertainty.	Yes	Yes	No	No
Rideout (2007)	Business Entrepreneurs	are the set of individuals who creatively initiate, evaluate, and organize to exploit imitative wealth-creating business opportunities under conditions of uncertainty.	Yes	Yes	Yes	No
Rideout (2007)	Technopreneurs	Are the set of individuals who creatively initiate, evaluate, and organize to exploit innovative wealth-creating and technological opportunities under conditions of uncertainty.	Yes	Yes	Yes	Yes

A close look at the varied nature of entrepreneurship definitions reveals connections between the definition and the perspective the creator of the definition is most interested in. This is problematic for scholars who require all-encompassing, multi-disciplinary perspectives. For example, because most of the research on entrepreneurship is at the firm level, (the majority of scholars come from business schools), a large number of the definitions (Cole, Bygrave & Hofer, Gartner, Low & MacMillan, Brockhaus, Lumpkin & Dess, Hatten, Dollinger, etc.) involve the creation of an organization or small business as the defining entrepreneurial act, as is also the case with theorists from the fields of organizational behavior. Psychologists and sociologists are more likely to support definitions derived from the individual level of analysis, while recognizing the influence of contextual/ social factors on entrepreneurial activity of all sorts. (Hisrisch & Peters, Smilor, Barrow, for example). Their perspective is particularly useful in that all aspects of entrepreneurial activity and behaviors, from ideation to prototyping to firm creation to firm expansion may be studied consistently from an individual entrepreneur decision-maker level of analysis without compromising the validity of results by mixing levels of analysis (firm level in some instances, entrepreneur-level in others, for example).

Other researchers try to integrate both the individual entrepreneur and a business opportunity realization into a single definition (Sevenson & Jarillo, Kreuger & Bazeal) of which the best known is Venkataraman and Shane who define entrepreneurship as the discovery, evaluation, and exploitation of opportunities; and the set of individuals who discover, evaluate, and exploit them. Unfortunately this sort of definition, which tries to capture the lowest common denominator of all enterprising behaviors, tends to lose the vital

wealth-creating innovation aspects of entrepreneurship captured by the original economic thinkers beginning with Cantillon, Says, and Schumpeter and ending with Kirzner and Wiklund who emphasize the economic contexts and market implications of entrepreneurship.

The latter notion, removing entrepreneurship from an economic or business context has already achieved some traction, particularly outside the United States. In the UK, for example, theorists argue that anyone--artists, preachers, teachers, even enterprising students who have figured out how to go to college—is an entrepreneur if they are productively and creatively engaged (Gibb, 2002). Similarly, in the US, universities are increasingly adopting the non-economic definitions, ("entrepreneurship is both the act of invention and invention realization," for example) since they are useful in teaching both social and business entrepreneurship in the same course.

Given the ink that has spilled in extensive debate with no hope in sight of reaching any consensus as to a single "right" definition, perhaps the time has come for the field to coalesce around the idea of different definitions according to type of entrepreneur and kind of venture. For this study, therefore, I have found it useful to define entrepreneurship 3 ways on the basis of whether the entrepreneur employs an imitative wealth-creating strategy (business entrepreneur); an innovative wealth-creating strategy (technopreneur), or other non-wealth creating entrepreneurial activity (enterpriser).

A definition that distinguishes between three fundamental types of "entrepreneurs" also addresses the differences in the magnitude of their contribution to economic wealth creation. Those creative thinkers and doers (artists, philosophers, teachers, preachers, and nonprofiteers, for example) who make a social contribution but do not create wealth are more

"enterprisers" than "entrepreneurs" and should be defined as such. Those who create businesses that create wealth (in addition to making a social contribution, e.g. jobs, employee benefits, social responsibility) are entrepreneurs. "Entrepreneurs" in this proposal are distinguished from enterprising individuals. While business entrepreneurs create imitative enterprises, technopreneurs are the subclass of entrepreneurs who create new economic wealth by inventing and commercializing new and innovative products, processes, and services for markets that may or may not yet exist.

Across the definitions and perspectives, the body of entrepreneurship literature is enormous. One way of dealing with multiple definitions and multidisciplinary perspectives is to parse the literature (Bozeman, 2000). Early scholars, for example, began with a somewhat static focus on the personality "trait" domain at the individual level of analysis. Later theorists focused more on the processes of venture creation, usually at the organizational level of analysis. Today the field has matured to the point where entrepreneurship is recognized as a dynamic person-in-situation process (Krueger, 2003) where individual differences, opportunity identification and/or construction, cognition, and context (familial, organizational, cultural, and political) are all important domains of study.

This literature review will focus on the three domains that are most relevant to E-ed: Personal Characteristics, Cognitions and Skillsets, and Social Context in order to identify what critical preconditions help facilitate and inhibit the emergence of entrepreneurship.

II. Personal Characteristics Research Domain

The early research in entrepreneurship focused on what historically had been considered the "source" of entrepreneurship and entrepreneurial behaviors—the personality of the individual. What characteristics of the entrepreneurial personality accounted for entrepreneurial behaviors? Psychology, a principal discipline involved in the study of entrepreneurship, is most concerned about the characteristics—both psychological and behavioral—of entrepreneurial individuals. Early entrepreneurship research was primarily concerned with this question: are entrepreneurs born with individualistic traits that predispose them to entrepreneurship? Psychologists were among the first to study entrepreneurship because of conventional wisdom that, like crime, entrepreneurial acts represented deviant social behavior by a few strange individuals (Winslow & Solomon, 1987; Campbell, 1992).

Personality trait research fell into disfavor for a number of years while researchers preferred to focus on behaviors (Gartner, 1989). The field had been unable to coalesce in a coherent fashion around a broad array of conflicting, scattered, and disjointed data. At that time a flurry of studies seemed to suggest that individuals with entrepreneurial proclivities may achieve higher return for their education, may be more risk tolerant (or not), are improvisers, can adapt to uncertainty including role ambiguity, are creative, optimistic, persistent, and confident, are proactive, socially competent, open to experience, wealth-motivated (or not), and cognitively intuitive. Since high achievers in business management as well as other fields have many, if not most, of the same characteristics, this literature was

enlightening only to those wondering if what drives success in other professions could also drive success among entrepreneurs (Carsrud & Brannback, 2011).

On the other hand, it is now generally accepted that psychological variables including both predispositions and preferences may in fact represent critical antecedents of entrepreneurial behavior (Baum & Locke, 2004; Rauch & Frese, 2000). The early trait-based research focused on relatively stable personality traits (Need for Achievement, Locus of Control, Risk Propensity, and Tolerance for Ambiguity), with mixed results. (Brockhaus, 1982; McClelland, 1961; Shaver & Scott, 1991). More recently, however, Stewart (2007) conducted a meta-analysis of the research connecting entrepreneurship with the Need for Achievement personality trait and found moderate positive support. As a result, new research is underway (Carsrud, forthcoming) seeking a better understanding of the personal motivations behind entrepreneurship, including achievement (Ach) motivation.

Likewise, Hansemark (2003) conducted a meta-analysis of three decades of work and concluded that empirical research has uncovered three personality characteristics that consistently predict entrepreneurship: 1) degree of adaptability and impulsiveness; 2) intensity of need for autonomy/independence; and, 3) internal locus of control (although measures of the latter have been found to be unreliable in a number of more recent studies). Ciaverarella (2003) found a statistically significant correlation between the entrepreneurial characteristics of conscientiousness (industrious and persistent) and openness to new experiences.

The entrepreneurial personality has been found to have high capacity for inequality, and high tolerance for uncertainty/ambiguity (Acs & Audretsch, 2003), found to be cognitive

leaders, self-competitive (desiring to achieve ever-greater goals over time), resilient to adversity, and optimistically persistent (self-efficacious). (Acs & Audretsch, 2003).

A number of other researchers have reported similar findings:

- Aberrant levels of overconfidence and over-optimism (Amit, et. al, 2000, Busentiz & Barney, 1997).
- May not be more risk averse but entrepreneurs may evaluate or view risk differently (Brockhaus, 1986; Hongwei & Reuf, 2004).
- High self-efficacy, high need for control and autonomy, action-oriented, (Schein, 1994, Winslow & Solomon, 1987).
- Restlessness, independence, a tendency to be a loner, and extreme self confidence (Cohen, 1980, see Krueger, 2003).

Entrepreneurs may be more alike to each other, regardless of sex, creed, or culture, than they are to non-entrepreneurs. In fact, the pursuit of entrepreneurial activity itself may give rise to certain shared values. Fagenson (1993), for example, found that men and women who become entrepreneurs are more similar in values to members of the opposite sex within their profession (entrepreneur) than they are to members of their own sex in a complimentary profession (Busenitz & Lau, 1996). McGrath and MacMillan (1992) found that even across different cultures, entrepreneurs tended to share certain beliefs (such as a greater belief in the efficacy of individual effort) to a greater extent than did a contrast sample of non entrepreneurs. In a study comparing the values of Chinese entrepreneurs with those of managers of state-owned /controlled enterprises, Holt (1997) found that the Chinese

entrepreneurs' values were more similar to those of American entrepreneurs. The Chinese entrepreneurs demonstrated a high degree of independence and self-determination, were more prone to accept uncertainty, and more inclined to question authority. In fact the Chinese scored higher than the Americans on several individualism measures (self determination, achievement, and stimulation), (Holt, 1997). Similarly, Morris, Schindehutte et al, (2005) found in several cross-culture studies that despite their ethnic differences, entrepreneurs were consistently likely to share similar values, such as hard work of high quality, independence, achievement, individual effort, and tolerance of failure, risk, and uncertainty.

Hood and Young (1993) surveyed 100 entrepreneurs and CEO's of fast-growing entrepreneurial firms to find out what entrepreneurs need to become successful. Creativity was the most important "mentality" attribute, while opportunistic thinking, vision, and positive thinking were also important. Critical personality attributes included self-motivation, propensity for risk-taking, and deep-seated ethical values. Likewise, Ciavarella et al. (2004) found that of the Big Five personality characteristics, conscientiousness is positively associated with venture survival.

The difficulties with personality research in the area of entrepreneurship includes nearly unlimited, often nested variables, difficulties replicating results where individual-level variables and outcomes are subjectively operationalized, heterogeneous samples (such as entrepreneurs in different stages of the process), and contradictory findings (Rauch & Frese, 2000). Although research continues into the psychological aspects of entrepreneurship, interest in typecasting entrepreneurs has faded as the recognition has grown that

entrepreneurs come in all types of people, and some of the individual characteristics of the hard-driving, autonomous, innovative, proactive, flexible, persistent entrepreneurial personality type may derive less from hard-wired personality traits and more from personal values/beliefs and entrepreneurial experience.

As a result, "mixed theorists" are now focusing on cognitive and behavioral aspects of entrepreneurship and the interaction of individual aspects such as predispositions and values in varying environments. For example, Sternberg and Lubart (1996) found creativity to be the result not only of divergent thinking and personality traits but also motivation, style, and cultural and environmental circumstances.

Likewise, Neufeldt found that self-directed-employment-oriented individuals had four cornerstone characteristics: self concept, know-how, resources, and the extent to which the context and social/policy environments were enabling. (Neufeldt, 2003).

The research literature is generally suggestive that there is a great deal more to explaining entrepreneurship than simply personal characteristics, both inate and learned. An entrepreneurial personality, although important, may be just one of many antecedents for entrepreneurship. The implication that entrepreneurs are not necessarily "born" reinforces the notion that E-ed has the potential to work in achieving concrete entrepreneurial outcomes.

Education teaches both abstract thinking and creates broad knowledge and in doing so opens eyes to the realms of the possible. By encouraging open-mindedness it grows tolerance for diversity, failure, and ambiguity. Each of the latter improves social skills. (In fact educational settings themselves may improve social skills, as well as study skills, goal-setting, self discipline, persistence, and personal responsibility). The broad mindedness that

results from a well-rounded education, combined with an individual's broad-based skills, abilities, and experiences then set the stage for both Einstein's "combinatorial play" creativity and Jung's "synchronicity" which in turn catalyze opportunity identification (See Cognition, Part III below). To the degree that education teaches experimentation/ the scientific method, it may encourage adaptive persistence and experimental improvisation which augments resourcefulness. In sum, an education that rewards creative thinking, initiative taking, and opportunity-seeking, combined with a willingness to question convention, may in fact cultivate the mindsets and skillsets that drive individual innovation and creativity outcomes.

Not surprisingly, then, that the research shows entrepreneurs achieving higher returns on education! (Delmar & Davidsson, 2000; Davidsson & Honig, 2003; Ritsila & Tervo, 2002). Kim, Aldrich, et. al, (2003) for example, found that household wealth was unrelated to the intentions of nascent entrepreneurs, however advanced formal education was significantly associated, as was managerial experience.

While further research is needed to definitively determine which of the personal values and predispositions supportive of entrepreneurism are truly innate and which are susceptible to instruction, it appears increasingly likely that personal mindsets and skillsets may be what primarily or exclusively distinguishes entrepreneurs—that they have unusual perceptive abilities allowing them to see opportunity where others do not; they make and follow-through on judgments everyone else thinks are wrong (Casson, 2003); and they follow-through with talented execution. They are not, as was historically suspected, social deviants. Instead, entrepreneurial predispositions (for example, creative, proactive,

independent, adaptive and persistent tendencies) supported by the cognitive talents, skills, and abilities that engender opportunity perception and actualization (such as alertness, leadership, management, risk attenuation, resourcefulness), personal experiences, and contextual considerations including both physical and social (family, organizational, societal) environments may all play a significant part in explaining individuals' entrepreneurial behaviors. These cognitive and contextual literatures, and what they imply for efficacious E-ed, will be discussed next.

III. Cognition: Mindsets and Skillsets Research Domain

A great deal of the research in entrepreneurship that is relevant to understanding entrepreneurship education theory and practice concerns the domain of cognitive science. The literature review attempted to determine the degree to which the cognition research identifies cognitive processes (skills and abilities in things like opportunity identification, exploitation, and risk management) that are supportive of entrepreneurial behaviors. Is there any evidence to support a hypothesis that educational interventions that augment these cognitive processes may produce superior entrepreneurial outcomes?

Interest in the potential of entrepreneurial cognition for understanding entrepreneurial behavior has produced a research literature exploring the potential role of individual cognitive differences. The subdomains of cognitive science that hold promise for entrepreneurship and education researchers are both psycho-cognitive, (they involve research on individual learning processes and mechanisms—mental schema for example), and social-cognitive (they involve mental dimensions associated with social context—social

networking, for example). Key psycho and social cognitive domain research areas in entrepreneurship include: opportunity identification, motivation, creativity, knowledge/skills and learning, as well as decision-making under conditions of uncertainty and risk (heuristics).

A. Opportunity Identification

Cognitive psychologists have given more attention to opportunity identification than any other topic. While the research may benefit from "testability," the practical application of this focus may be questionable (there is some evidence that finding or generating new ideas may be less of a problem for entrepreneurs than trying to sort through an overabundance of ideas for the one that is most promising).

A number of different hypotheses have emerged in answer to the question: how do entrepreneurs get their ideas? One school of thought suggests that entrepreneurs identify opportunities by being cognitively alert and noticing opportunities that the market presents. Alertness has been described as individual receptiveness and ability to use information to create new means-ends/input-outcome frameworks from pieces of information (Kirzner, 1985). Alertness may be caused by a response to some kind of stimulus, real or imagined, internal to the person or external in the environment. Discontinuities such as surprise or anything unexpected is believed to be the most common trigger. (Kahneman et al., 1994, Kasimatis & Wells, 1995).

Gaglio and Katz (2001) suggest that alertness to opportunity is a function of variation across people in their ability to deconstruct causal relationships, to link pieces of information, to understand how economic, social, and physical processes work, to critically evaluate

information, challenge assumptions, re-label categories, use analogies, identify counterintuitive patterns, or engage in counterfactual thinking. (Acs & Audretsch, 2003).

According to Sarasvathy, Simon, and Lave (1998), cognitive differences may cause some people to view new information in terms of opportunities instead of risks. Shackle attributes the ability to be "alert" to variations in people's creativity and imagination. Other researchers hypothesize other stimulants such as frustration or malcontented questioning of established conventions. Still others postulate that opportunity identification is simply another form of pattern recognition (Baron, 2006).

In any event, ultimately, the genesis of entrepreneurship and innovation is the spark of human perception at the individual level of analysis. If the perception of opportunity is at the heart of entrepreneurship, from whence do perceptions of opportunity derive? (Krueger, 2003). This depends, according to Krueger, on whether opportunities are discovered, or whether they are constructed by entrepreneurs. While research might be best served epistemologically if opportunities exist and entrepreneurs simply discover or recognize them, Krueger suggests that entrepreneurs enact their opportunities, constructing them mentally from their perceptions of the world around them. While no one really knows whether opportunity is a concrete reality waiting to be noticed, or whether (as structural theoreticians argue) it is constructed by the dynamic interaction between individual and context, in truth, given the idiosyncratic nature of entrepreneurial mindsets, it's likely that entrepreneurs use both methods, depending on the circumstances.

Either way, cognitive science offers useful insight. For example, if opportunities are discovered then people with entrepreneurial propensity should see similar things. If

opportunities are constructed, then it's likely that the perception of opportunity will vary significantly across individuals, and should vary across situations as well. In the latter circumstance, further research must be done to identify the cognitive processes by which individuals take signals from the environment and construct personally credible opportunities. (Acs & Audretsch, 2003).

B. Motivation

While conventional wisdom suggests that entrepreneurs are motivated by money, recent research suggests this is *not* in fact the case. Solomon (1989) for example has found other motives more salient than wealth, including desire to innovate, vision, independence, and the challenge of creating something new. Motivation can also be influenced by psycho-social variables such as personal values, beliefs, cultural/societal norms and world views (cultural determinism, for example). (Bandura, 2006). Other psychological research suggests that in addition to anticipated rewards/benefits, individuals are motivated by the availability or lack of availability of time and/or energy (their absorptive capacity for additional effort). An individual who has an excess of capital (an inheritance, for example), may be more motivated by that, and by her potential to grow her investment, than she is by innate personal characteristics when it comes to taking a shot at an entrepreneurial venture. Likewise, research by Thurik at al. (2008) documents entrepreneurial "push" motivations that arise when people are forced to turn to entrepreneurship after losing a job during economic downturns when there are few other job prospects.

C. Creativity

According to Csikszentmihalyi (1996), "Every human has (the) creative urge as his or her birthright. It can be squelched and corrupted but it cannot be completely extinguished." In human life, and thus the life of human society, there is the innate tendency to expand, extend, develop, mature, and to express and develop our capacities and potential. While this tendency may be deeply buried under encrusted defenses of the familiar, still it exists in every person, awaiting the proper conditions for release and expression. (Banathy, 1996).

Psychologists have long believed that creativity results from the formation of a large number of cognitive associations, followed by the combining of associations that may be particularly interesting or useful. Einstein once referred to creativity as "combinatorial play." (Gastle, 2003). Creative individuals, this suggests, are able to formulate a large number of associations because they have a large number of learning experiences. There is some evidence that creativity and divergent thinking can be purposefully enhanced by exposure to variety (Woodman, Sawyer, and Griffin, 1993), and thus subject to education influence.

D. Skillsets and Decision Making

Cognitive learning theorists suggest that learning itself is contextual and subjective, rooted in the specific environment (physical and social) of the potential entrepreneur as determined by historic time, and thus relies as much on personal affective characteristics (predispositional values, attitudes, interests, self-esteem) as on personal cognition characteristics (Bloom, 1976). Cognitive scientists are fascinated by the antisocial aspects of how entrepreneurs can make and adhere to judgments everyone else thinks are wrong (Casson, 2003). And along the same vein, they wonder, how do entrepreneurs have the

ability to make decisions—and sometimes very risky decisions—on the basis of little or no information?

One idea is that entrepreneurial cognition is a technical expertise so well honed through deliberate practice that entrepreneurs may develop innate/second-nature skills in decision making. A relatively recent line of research suggests entrepreneurs develop unique knowledge structures (schema) specific to entrepreneurship (Mitchell, et al., 2002). With practice they become "experts" able to create and store master action-oriented "scripts" (tacit knowledge) they can draw upon instantly and instinctively when faced with difficult decisions that must be made quickly with insufficient information. This line of research is already making promising inroads into better understanding how tacit, experiential, and affective teaching and learning works as an effective andragogical strategy.

E. Heuristic Mindsets and Decision Making

A number of studies confirm entrepreneurial decision-making relies heavily on intuition, biases, and heuristic cognition (Tversky & Kahneman, 1981). In fact, research suggests that intuition may serve as an indicator of entrepreneurial perception—the ability to see what does not yet exist. (Carland & Carland, 2001). Sarasvathy (2001) takes an aligned approach, hypothesizing that entrepreneurs are less focused than other people on outcomes that don't yet exist/can't be seen and are more focused on the means at hand, allowing them to "effectuate" toward entrepreneurial achievement.

Among the other heuristics that entrepreneurs rely upon to make decisions when faced with a lack of information (no product or market yet exists, for example) are overconfidence and representativeness (the latter being the tendency to overgeneralize from a

few characteristics or observations), (Busenitz & Barney, 1997); as well as self-serving and actor-observer attribution/correspondence biases (Rogoff et. al, 2004). (Correspondence biases help to explain persistence in the face of failure. People tend to attribute failures in others more to disposition but see their own failures as situational). How people respond to setbacks can either cause them to give up or try all the harder. (Weiner and Kukla, 1970; Dweck & Leggett, 1988, Wortman and Brehm, 1975). Perhaps entrepreneurs are more confident, and thus less disturbed by risk and uncertainty because of these and other cognitive biases, such as their underutilization of counterfactual thinking (how past events might have turned out differently). (Baron, 2000; Markman et al., 2002).

As discussed in Chapter 1, little is known about how entrepreneurs' best learn, although evidence is emerging that experiential, hands-on, real-world kinds of learning experiences may be beneficial. Learning styles including Tacit, Explicit, and Affective dimensions may be more typical of E-ed students. While the cognition literature holds great promise in terms of better understanding entrepreneurship theory and practice, a great deal more must be learned in order to develop direct applications to entrepreneurship education. Specifically, research into the hypothesized cognitive antecedents of entrepreneurship including motivation/initiative, intuition, creative cognition, and heuristics such as counterfactual thinking, risk attenuation, and failure management (the variable "setback response" in this study) would be fruitful avenues for further research. In addition, research needs to be undertaken to understand the extent to which entrepreneurial endeavors and outcomes result from cognitive styles and in what contexts, and whether cognitive or personality characteristics are more or less equivalent influences on entrepreneurial actions.

Environmental antecedents and contextual influences including entrepreneurial organizational settings and how social context influences entrepreneurship are discussed next.

IV. Social Context Research Domain

Sociological researchers are interested in how group, organizational, and societal structures influence entrepreneurial behaviors. In fact, a number of theorists have argued that without a supportive social context there would be no entrepreneurs, and therefore entrepreneurship itself *is* a social construct. (Shapero & Sokol, 1982). Austrian economists and endogenous growth theoreticians source economic growth to economic actors acting in their own boundedly rational self-interest within local contexts and spheres of knowledge (Romer, 1986, 1990; Simon, 1979; Baumol, 2010). Schumpeter was the first to recognize entrepreneurship as a *local* phenomenon. (And, as this study will show, such remains the case today, despite trendy notions of a flattening world (Friedman, 2005).

The immediate social and environmental context an individual finds him/herself in can influence entrepreneurial proclivities and activities. Stephan & El-Ganainy (2007), for example, blame context for much of the differences between men and women to engage in entrepreneurial activity and technology transfer activities in university settings. And while national cultures and ethnicities matter (particularly with regard to family settings), societal and institutional structures that nurture, support, and encourage entrepreneurial behaviors may help influence (or offset) culture and traditions, and may prove as important as personal characteristics in catalyzing entrepreneurship (Baumol, 2010).

Research studies have demonstrated that entrepreneurial start-ups tend to cluster in supportive regional environments, and their founders are typically themselves embedded in supportive social networks. A sizeable body of literature exists on environmental attributes that encourage the geographic "clustering" of entrepreneurial ventures (Chrisman, et al., 2002). Bruno and Tyebjee's (1982) review of the literature found 12 conducive environmental attributes including accessible capital and markets, other entrepreneurs, universities, available land, skilled labor, transportation, support services, suppliers, and attractive living conditions. Of more recent interest is the role of the research university as the geographic "hub" of the wheel of innovation and the impact of university spin-offs on local economies; a great deal of work has been done in the area of technology transfer (which is outside the scope of this literature review). Recent literature on high-technology clustering has emphasized knowledge spillovers (Audretsch, et al., 2007) and the benefits of having access to specialized inputs, including university research and technology-proficient labor expertise (Almeida & Kogut, 1997).

The benefits of proximal social networks may be particularly acute for technopreneurs given the complex systems and interrelationships they typically must develop and navigate to achieve success. (Cohen & Fields, 1999). Social networks have been identified in supporting entrepreneurial ventures in the development of innovation, knowledge, skills, and procurement of capital, both formal and informal venture capital (Aldrich & Zimmer, 1986; Dubini & Aldrich, 1991; Fountain, 1998; Putnam, 2000; Baker & Nelson, 2005).

While social context is considered by most researchers to be an important factor in individual creativity, there is no agreement about what an entrepreneurial-supportive social context is; and little acknowledgment that social context may be contradictory, even for the same individual (a supportive national context and restrictive organizational climate, for example). Social context is often thought of as embedded within institutions at varying levels of analysis. In evaluating Swiss entrepreneurial activity, Leleux (2003) found that socio-cultural norms (work ethics, international outlook, risk aversion, and contentment with current economic well-being), government policy (and the lack thereof), and education were the prime social processes to be blamed for low levels of entrepreneurship in Switzerland.

While E-ed may not be able to affect local geographical contexts it is important that E-educators recognize contextual assets and local environmental aspects supportive of entrepreneurship. For example, a University embedded within clusters of technology and innovation should consider offering courses in technopreneurship rather than limiting their E-ed offerings to small business management.

Other contextual research of interest to the domain of E-education includes scholarship in familial environments and how family environments influence entrepreneurial proclivities and activities. Researchers interested, for example, in how entrepreneurship is passed down through the generations have found that a number of variables including entrepreneurial family values, parental role modeling, genetics, kinship ties, and social immobility (ethnicity, education, physical factors and even out-group discrimination) all help to promote ethnic and immigrant entrepreneurship (Portes & Zhou 1996).

Organizational climate is another context among many sorts of physical and social environments that may influence, encourage and/or hinder entrepreneurial proclivities and activities. In fact, a number of scholars (Gartner, 1985) have gone so far as to define entrepreneurs as "organization creators." This social activity is dependent on attributes both of the individual entrepreneur and the opportunity they are pursuing. Although not all entrepreneurs need to know how to create organizations, some entrepreneurs (technopreneurs in particular) require skillsets for building teams and creating and running organizations in order to effectively realize the market potential of their high-tech innovations.

The organizational research literature suggests that entrepreneurial climates promote individual effort and organizational commitment. In addition, employees' access to resources and subjective views of managerial/ organizational support and fair rewards may stimulate entrepreneurial behavior. A number of studies have found that an organization's entrepreneurial culture, (the relative importance of the organization's desire for employee innovation behavior) can be a stronger factor than personality traits when it comes to members' innovation behaviors (Kashdan & Yuen, 2007) Similarly, Jelinek and Litterer (1995) and Aamo, (2003) found that a highly entrepreneurial organization with highly supportive policies need not have many entrepreneurial individuals to be highly effective.

Applying the definition of entrepreneurship beyond the individual level to the organizational level of analysis is difficult to conceptualize. Is an entrepreneurial organization merely a collection of entrepreneurial personalities? Do people who have proactive, innovative, and risk-tolerant personalities make the firm where they work similarly entrepreneurially-oriented? Social cognition research shows that the attitudes, beliefs, and

intentions of a group of people do not necessarily reflect the average perceptions of group members. A group may exhibit entirely different behaviors from that of its members. In researching entrepreneurial organizations, Kassicieh (1997) found that the perception of organizational support for entrepreneurship was a higher predictor of innovativeness than individual innovativeness. This suggests that a favorable organizational context can catalyze entrepreneurial activity even among individual employees who may not themselves ordinarily initiate much in the way of entrepreneurial behaviors; it can also inhibit entrepreneurial initiative-taking by otherwise enterprising individuals. A corollary likely exists at higher levels of analysis—nation states for example. E-ed should be more productive in societies with favorable political and social structures (Hofheinz & Calder, 1982; Tan, 1996, 2002). From the opposite perspective, individual entrepreneurs also are capable of shaping their social and organizational environments. (Kassicieh). This is especially true when the firm and the founder are one and the same and when the firm is small. Smaller environments (organizations) are clearly more "shapable" by individual "champions" of innovative ideas.

The findings of firm-level organizational researchers that organizational attributes can influence individual level characteristics of creativity and innovation are extremely valuable to entrepreneurship educators on two levels: 1) they suggest that similarly, an organizational setting like a university may be able to enhance the personal creative and innovative characteristics of students; and, 2) they suggest that E-educators should incorporate what is known about how to create and sustain entrepreneurial organizations into E-ed pedagogy, since this information will support students who do go on to create, staff, and manage

entrepreneurial startups. Firm-level research findings in the domains of networks, capitalization, growth management, and teams are all potentially important to educators interested in efficacious E-ed intervention designs. In fact, Universities are organizations that themselves can encourage entrepreneurial thinking and acting both in the classroom and beyond.

V. Theory

Despite the many disparate research interests and agendas, entrepreneurial scholars across the board universally agree there is a need for more rigorous, theory-driven research, longitudinal/archival-data research, linked micro-macro studies (Davidsson, Low, & Wright, 2001), more process-oriented approaches (Low & Macmillan, 1988), and better/more research into the origins and antecedents of entrepreneurship (Henry et al., 2005; Carsrud et al., 2009). Additional empirical research is needed in support of the development of a theory of E-ed (how it works as an antecedent of entrepreneurship). In this study an effort was made to address each of the above concerns, and the theoretical research was thoroughly evaluated for grounded application.

The antecedents identified in each of the three E-ed related domains (Personal Characteristics, Cognition, and Social Context) included key *social-cognitive* variables and processes as well as *psycho-cognitive* variables and processes that provide important insight into promising E-ed process mechanisms. (Interestingly, a number of cognitive scientists are rejecting the notion that there is any distinction between "psycho-cognitive" and "social-cognitive," arguing that there is no "cognitive module" in the brain and in fact *all* cognition

is social in that it emerges from multiple domains and systems including the environment, perception, action, affect, and sociocultural systems (Spivey, 2007; Barsalou, 2010)).

Consistent with this line of thinking the research suggests that having the right tools (skillset and mindset E-cognitions) and being in the right place at the right time (the entrepreneurial situation) are critically important. What grounded theories exist, across the disciplines of psychology, economics, sociology, and management that best explain the data and research summarized above? What are the psycho-social person-in-context theories that help explain how entrepreneurs are able to envision, invent, and implement novel creations? What psycho-social theories exist to help inform a theory of E-ed and guide the hypotheses of the current study?

Interestingly, each discipline has evolved a number of psycho-social theories that fit the bill, and in fact each of them are similar enough it's likely many of them evolved under the influence of the aligned theories of the other disciplines. The most relevant psychological theories informing the present study include: Social Cognitive Career Theory, Agency Theory, Theory of School Learning, and Theory of Planned Behavior. The most relevant business and economic theories informing the present study include: Knowledge Spillover Theory, Social Networking Theory, and I-O Knowledge Theory (from Dynamic Systems Theory). Two of these theories are in turn derived from Adam Smith's Human Capital Theory postulating that investing in human resource capacity (knowledge/skills development) increases human performance/outcomes (Social Cognitive Career Theory, and I-O Knowledge Theory).

Social Cognitive Career Theory (Lent, Brown, and Hackett, 1994) is one of several key theories grounded in research that underpins the current study. Career theory is the overriding theory that cites education, or the lack of a specific type of education, as the contributing factor for a lack of individuals entering certain professions (women in engineering, for example) (Becker, 1964). Specifically, a positive E-Ed/E-outcome relationship is supported by the theory that a lack of knowledge and understanding about starting a business is perceived as a major obstacle to entrepreneurship of all stripes (Kourilsky & Walstad, 2002).

Psychologists have conducted a number of different studies investigating whether education may "socialize" (via reinforcing existing personal predispositions, knowledge, skills, role playing, role models, etc. etc.) individuals into considering entrepreneurship as a career path. (Dyer, 1994). Social Cognitive Career Theory suggests that career goals/choices are related to self-efficacy beliefs and outcome expectations. The idea that individuals are motivated by self beliefs about their talents and abilities and their subsequent confidence in successful outcomes is derived from Bandura's agentic theory of human development. This theory supports the human capacity to transcend the dictates of the immediate environment and self-direct one's life.

Agency Theory in support of E-ed posits that to the degree education can cultivate agentic capabilities—entrepreneurship-specific competencies, self-regulatory skills, and enabling beliefs in self-efficacy—individuals will identify and pursue a wider array of opportunities and become more successful in realizing desired futures than those with less

developed agentic resources (Bandura, 2006; Meichenbaum, 1984; Schunk & Zimmerman, 1998).

Bandura himself may have been influenced by an even earlier theory, Bloom's (1976) Theory of School Learning. According to Bloom, it is the dynamic interaction between the overlapping cognitive and affective domains, (the latter of which he defined as personal values, attitudes, interests, and self esteem), during the instructional process that results in both cognitive learning outcomes and associated affective outcomes. These affective outcomes help guide future feelings about course content and issues (attitudes), feelings of personal worth and success (self-esteem), desires to become involved in various activities (interests) and personal standards (values).

Personal standards or predispositional values (self-reliance/work ethic, or example) represent guiding principles in living one's life and thus tend to direct attitude and belief perceptions (Gable & Wolf, 1993). Recall that while early researchers considered entrepreneurship an innate characteristic, today's researchers have begun to appreciate that entrepreneurship is both behaviors that can be taught, with behavioral motivation subject to predispositional tendencies and supportive values systems all potentially influenced by socialization including education. (Stewart & Roth, 2007; Baum & Locke, 2004; Rauch & Frese, 2000).

Bloom's theory may be as relevant today as it ever was, with the rise of E-ed programs and research suggesting that in addition to teaching entrepreneurial skills, values and predispositions supportive of entrepreneurship can also be encouraged through education. Bloom's theory supports the idea (introduced in this research proposal) that self

beliefs supportive of entrepreneurial habits of mind (self reliance, persistence, adaptability, creativity and proactive achievement, for example), may be just as critical to successful E-ed outcomes as knowledge and skills (content-oriented) education. The affective domain thus likely supplements cognition in fomenting agentic capability and Bandura's self efficacy.

According to Bandura (1986), self-efficacy in an activity such as entrepreneurship develops through four processes: (1) enactive mastery or repeated performance accomplishments, (2) vicarious experience or modeling, (3) verbal persuasion, and (4) autonomic or physiological arousal. Likewise, and in line with (1) above, some researchers theorize that E-ed may enhance students' entrepreneurship outcome expectations, (Segal, Borgia, et al., 2002). To the degree E-ed instructional delivery imparts these four processes and enhances students' entrepreneurship outcome expectations, entrepreneurial self efficacy can theoretically be enhanced and more young people motivated to pursue entrepreneurial economic activities.

Interestingly, successful outcome expectations connect Bandura's agentic ability to Shapero and Sokol's (1982) Classic Entrepreneurial Event Model (another key theory underpinning the current study). Their model, which has earned a great deal of empirical support, predicts that entrepreneurship requires both perceived desirability and perceived feasibility on the part of the individual to happen. Shapero's "feasibility" is consistent with agentic ability—an individual must not only believe they know *how* to do something; they also must believe they will succeed.

To this model Krueger and Brazeal (1994) integrated in Ajzen & Fishbein's Theory of Planned Behavior which postulates that actions must be preceded by intentions. To know

what a person will do you first have to know what they *plan* to do. Krueger's intentions model, (Carsrud et al., 2009) has become an industry research standard:

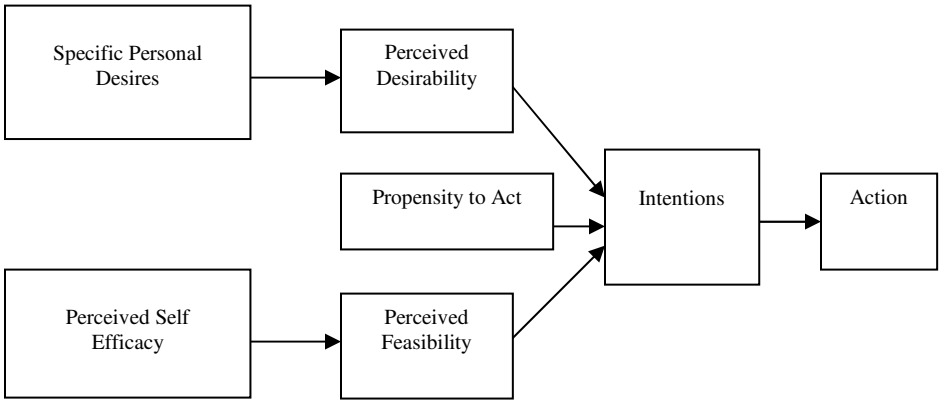

Figure 1. Shapero-Krueger Model of Entrepreneurial Intent

While the Shapero model has significant empirical support, Krueger's addition of the intentions construct has had mixed results, possibly because Ajzen's Theory of Planned Behavior (TPB) underlying the model is not consistently reliable as a predictor of entrepreneurial actions. The reason, as Carsrud et al. (2011) concisely points out, is because intention is not enough to lead to an action. Ajzen's theory only explains performances that are solely dependent on an intention and where no obstacles can prevent the execution of the intention. So many nearly insurmountable barriers exist in entrepreneurial startups (technopreneurial even more so) that it is no wonder the best of intentions do not always lead to entrepreneurial behaviors. Furthermore, the temporal aspect of the TPB/intentions model is underspecified. In entrepreneurship, an E-intention needs to be consummated in the very short term for the construct to be useful as a proxy for venture creation.

If the Theory of Planned Behavior is not a good fit with Shapero, perhaps the Theory of Work Adjustment (Lofquist & Dawis, 1969, 1991) is. The Theory of Work Adjustment (TWA) is a promising candidate (from the field of Industrial-Organizational Psychology) as a theory of Entrepreneurship because it integrates the research of all three of the hypothesized E-ed relevant antecedent domains (Personal, Cognitive, and Contextual) while also fitting well within (and extending) Shapero's classic entrepreneurial event model. The TWA presents us with a theoretically grounded model for expanding Shapero beyond the individual to include person x situation variables. TWA, as adapted for this research study, hypothesizes that there must be correspondence between Shapero's perceived desirability (a worker's wants, goals, and needs) and the perceived satisfaction of these wants/needs he receives in the workplace. Likewise, the theory requires correspondence between perceived feasibility (confidence in abilities and success) and the positively reinforced/rewarded application of these abilities to accomplish work tasks. If there is aligned correspondence both between a worker's intrinsic skills and a job's extrinsic skill requirements and a worker's intrinsic values and goals and a job's extrinsic fulfillment of these desires, an individual will stay engaged in the work context. The two measures of correspondence (See Figure 2 below) are the workplace feedback loops (positive reinforcement of the individual's skillsets (job-related knowledge, skills, and abilities (KSA's) as well as personality fit) that predict the tenure of the individual in the work environment (the situation/work context at the center of the model). A good person-workplace fit is required for lengthy tenure (the "No Go" decision at the center of the model). When there is a discrepancy between a worker's needs

or skills and the job's needs or skills, then either the worker leaves willingly or she is forced out unwillingly (the "Go" decision), or the environment must change.

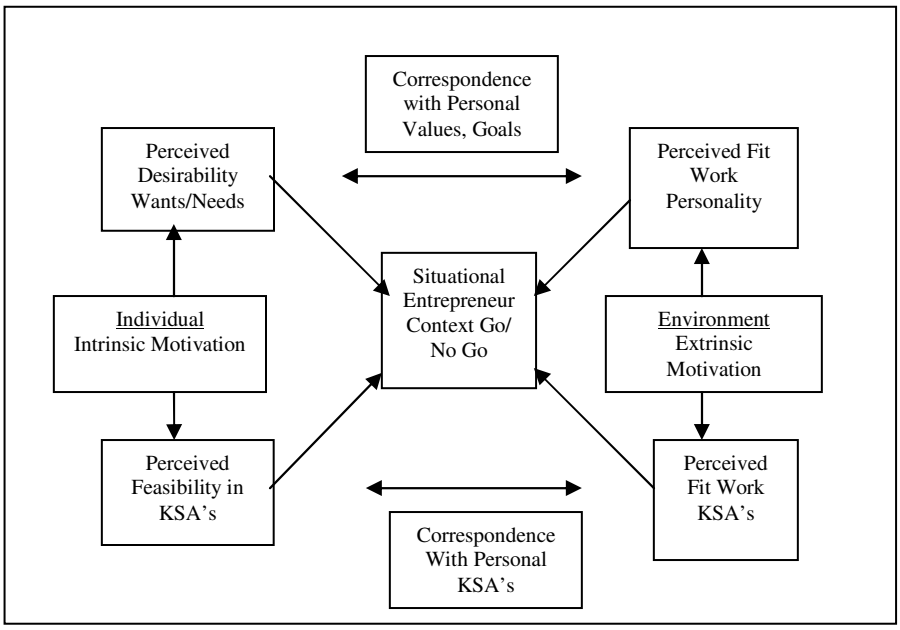

Figure 2. Bounded Rationality of the Entrepreneur:
Entrepreneurial Event in Context with Intrinsic/Extrinsic Correspondence Feedback
(Adapted from Shapero & Sokol; Lofquist & Dawis)

The E-Correspondence model itself is an antecedent mechanism for entrepreneurship, since, according to the Kauffman Foundation, the majority of entrepreneurs leave a paid position with an employer, sometime in midlife, to start their own venture. The model builds on Shapero in suggesting that not only do these individuals require desirability and feasibility, they feel compelled to work in contexts that correspond to their values and goals (work personalities) as well as where their skills and abilities are vital and highly valued. The model explains why an individual with desirability and feasibility might *not* leave an

employer to launch a venture, as well as why they would. An entrepreneur who has launched their own venture will be motivated to stick with it or abandon it in precisely the same way.

Perhaps entrepreneurs place higher utility than other people on person-workplace fit variables (utilized in this study), and thus are more likely than others to choose a "Go" decision, leaving their current job in order to start their own venture. Or perhaps they are more sensitive to the feedback loops that influence both intrinsic and extrinsic motivation.

The above model parsimoniously depicts the story of the psycho-social antecedent research into a conceptualization of the bounded rationality of the Entrepreneur. It identifies the antecedent E-event mechanisms (each box) for this study (See Chapter 4). Unfortunately, however, the typology pays short-shrift to entrepreneurial cognition, which was identified in the literature as an important antecedent domain. (The E-Correspondence model lumps E-cognition in with skills and abilities).

A specific theory of human entrepreneurial cognition (how entrepreneurs think) would also be most helpful in developing efficacious E-ed interventions. Recall that cognitive alertness, tacit knowledge and expert-based scripts/schema/schemata, counterfactual thinking, and other heuristic shortcuts (effectuation, etc.) have all been identified as aspects of entrepreneurial cognition in the research. Given the commonalities between these cognitive strategies an overarching theory would be useful (similar to that presented above) to pull these distinctive E-cognitions together, in support of a theory of entrepreneurial cognition.

Input-Output (IO) Knowledge Theory, derived from the Knowledge-Based Theory of the Firm (Spender, 1996), (itself a derivative of the Resource-Based Theory of the Firm) is a

logical place to start. IO Knowledge Theory has a focus on specific inputs and their corresponding outputs. It differs from Structural Knowledge Theory, which is general knowledge about the variables of a system and their causal relations. The research surrounding the two classifications (IO vs. Structural) is a robust and controversial topic among cognitive psychologists (Medin & Shaffer, 1978; Nosofsky, 1984; Nosofsky, Palmeri, & McKinley, 1994; Allan, 1993; Anderson & Sheu, 1995). Conventional management scholarship suggests that structural knowledge is the preferred focus for firms and other complex systems, while IO is the purview of simple relationships or small systems (hence its application in micro electronics).

Recent developments in electronics and systems theory, where controlling dynamic systems under conditions of uncertainty are of paramount importance (for example domestic airliners in conditions of turbulence), suggest that IO may offer an interesting model for a theory of entrepreneurial cognition. The individual entrepreneur, who is founder, opportunity, and firm all in one, as well as the primary resource of the firm, clearly appears to be a suitable "small systems" candidate. Further, entrepreneurs and the embryonic ventures they create also fit well the definition of controlled action-taking in a dynamic, uncertain environment in an attempt to produce a successful outcome.

Interestingly, experiments pitting the two models (IO vs. Structural) against each other found they performed similarly with both small and large complex systems when decisions had to be made with little information. And while superior structural (or functional) knowledge can lead to higher performance, these experiments show, it did not consistently do so. Even when structural knowledge was available about the relationships

between components and desired outcomes, some participants successfully controlled dynamic system performance without it, using some other knowledge strategy (tacit?) instead. The studies showed that declarative knowledge about causal relations is not sufficient to control a system successfully (Gibson et al., 1997; Vollmeyer et al., 1996; Funk, 1993). Interestingly, subsequent research found that most uninstructed subjects did not try to acquire and use structural knowledge. IO knowledge, however, seemed to be acquired spontaneously, and was found sufficient for the control of rather small systems (Schoppek, 2002). Schoppek found that the more powerful predictor of performance than structural knowledge was the *number of input variables* used at the outset. Higher numbers of input variables were used when structural knowledge was low while lower numbers of inputs were associated with high structural knowledge in predicting performance. Hence, Schoppek concluded, when uncertainty is high and structural knowledge is low, participants employ IO cognitive strategies (manipulating the number of inputs if that's the only strategy that's available, for example) to control dynamic systems outcomes in a way that can be as effective performance-wise as when structural knowledge about a system is available.

IO Knowledge Theory is relevant to entrepreneurial cognition because, under conditions of uncertainty, with low levels of resources, and not even a clear idea of final outcomes, entrepreneurs employ, and expertly apply, a large number of varying cognitive input strategies according to this review of the research. Recall that entrepreneurs utilize tacit knowledge, and draw upon "expert" scripts to make decisions. The cognitive heuristic techniques they employ (representativeness, counterfactual thinking, planning fallacies, attribution biases, etc.) are also input approaches (or substitutes). Other input strategies

include “bricolage” resourcefulness, which relies upon inputs-at-hand resource acquisition activity. (Baker & Nelson, 2005). Entrepreneurs “effectuate,” employing the means, or inputs, close at hand in making decisions, rather than acting on the basis of end-states (Sarasvathy, 2001). Like Sarasvathy, Hans Joas’ (1996) theorizes that entrepreneurs have the ability to make decisions even in the absence of pre-existing concrete goals by means of idiosyncratic inputs and path-dependency. Perhaps what all of these input-oriented cognitive strategies have in common is they are used by entrepreneurs to attenuate risk under conditions of uncertainty.

The IO model even leaves room for cognitive insight/intuition and break-through-thinking, all of which are linked to the kinds of “Ah-Ha!” revelations radical entrepreneurs and technopreneurs are so good at. Cope (2003), for example, hypothesized that entrepreneurship best happens as a result of discontinuous events that induce higher-level transformative learning episodes. When discontinuities synchronize to produce new, unusual patterns or combinations, “Ah-Ha” revelations may result. While Carl Jung initiated a line of research into “synchronicity” and “synchronous episodes,” a robust scholarly literature has yet to evolve in this area of psychology. The IO model would consider these factors as just another sort of cognitive input. Perhaps break through thinking occurs when an input has observer effects, as in quantum mechanics. Or perhaps in these cases the input is operating under conditions highly sensitive to initial conditions, as with chaotic systems.

Given the obvious difficulty of integrating discontinuities into classroom teaching in general, very little is known about how insight and break-through thinking cognitive processes interface with educational practices such as E-ed. On the other hand, new

experiential pedagogies including virtual reality, game playing, role playing, and real-world simulations suggest a promising line of research.

The review of the theoretical research suggests that to the degree E-ed can create self efficacy it may support entrepreneurial activity. Tacit skills play a part in all theories of E-ed, from formulating "expert" scripts, to cognitive "alertness" to satisficing on inputs under conditions of uncertainty, little information, and few resources (IO Knowledge Theory). Tacit knowledge is also central to Knowledge Spillover Theory (Audretsch et al., 2007) which attributes the clustering of entrepreneurial activity around universities to be a direct result of tacit knowledge spillovers.

Social Networking Theory is the theory of how tacit knowledge spills over. While a vast research shows that entrepreneurs use social networks to competitive advantage, (Aldrich & Zimmer, 1986; Fountain, 1998; Cohen & Fields, 1999; Davidsson & Honig, 2003; Greve & Salaff, 2003), these networks can be inter or extra organizational. Sociologists are also applying a number of theories (Collins's Interaction Ritual Theory (IRT), for example) to deconstruct social networks to the underlying constructs (values and emotions, for example) that make them work. Several theorists suggest that trust-based value systems underlie effective social networking (Fukuyama, 1995). While the literature has surfaced a number of interesting studies in specific values and in collective value systems in relation to entrepreneurially supportive social contexts, no theory in this area has yet emerged.

Among all the psycho-social theories to emerge in explaining entrepreneurial action and its likely antecedents (like education), the influence of both Agency theory and the

Theory of Planned Behavior is most evident. Two of the most common outcome variables in the limited number of E-ed evaluations that do exist are the psycho-social measures of entrepreneurial self-efficacy and entrepreneurial intentions. In addition, these theories have influenced E-ed teaching modalities. For example, if an individual has low self-efficacy but views entrepreneurship as desirable, he or she might enroll in a course employing Bandura's interventions listed above to enhance his or her self-efficacy. Enactive mastery, one of Bandura's four mechanisms, might be obtained through successful accomplishment of smallscale, classroom-based entrepreneurial activities and simulations involving low levels of risk and challenge. (Segal, Borgia, et al., 2002).

In sum, a survey of the theoretical literature suggests that the creation of new entrepreneurs and growing the supply of new companies, (high-tech, high-growth companies in particular), may not be as simple as boosting the numbers of college graduates with academic credentials in entrepreneurship. Just as new doctors and dentists need practitioner "internships," entrepreneurs may also need boundary-spanning affective experiences across three psycho-social-cognitive domains in order to develop the tacit knowledge and intangible skills (such as IO's input-oriented strategies of risk attenuation) required of successful entrepreneurs. Technopreneurs may need even more of these abilities than small business entrepreneurs in that high-tech startups typically involve not only sophisticated cognition/technical expertise (skillsets) but also the personal values, work habits, beliefs (mindsets) and the social skills required to raise large amounts of money, build an organization, and put together a winning team.

Chapter 3. Empirical Research Literature

Unfortunately, although the amount of research on E-ed has grown over the years, there continues to be lingering concerns about the adequacy of this research. In its special issue on Entrepreneurship Education the Academy of Management (2004) issued a call for rigorous theory-driven research to help forge the conceptual, theoretical, and empirical links among the many forms of entrepreneurship education. (Greene, P. G., Katz, J. A., Johannisson, B., 2004).

Storey (2000), in his seminal critique of the evaluation methodologies used to review small business development and general E-ed initiatives in developed countries, found the vast majority of evaluations are not evaluations at all but simple monitoring efforts. Storey developed a typology for categorizing the studies into six progressively more inferentially robust steps.

Table 3 shows the nature of the University E-ed studies found categorized generally according to each Storey step, along with the number of empirical E-ed studies identified. Monitoring, the first several steps in Storey's typology, involves documenting practical indicators of inputs and outputs, as well as participants' attitudes, opinions, and perceptions. Monitorings typically appear in the literature as case study and qualitative research. Sometimes changes in attitudes, opinions, and perceptions are documented by means of a pre-test conducted prior to the E-ed course, for example, and/or a post-test taken after the course's conclusion (Storey's Step 3). Step 3 efforts are the most common form of "evaluation" in the published literature but they are subject to a number of validity threats

including social desirability and survivor or attrition bias. For an E-ed evaluation to be empirically valid, it must create a counterfactual (e.g., a control group of equivalent subjects that did not receive the benefit of the intervention or some other mechanism). Studies at Storey's evaluation Steps 4-6 get progressively inferentially stronger, however only a dozen studies were found at these levels.

Other broad reviews of the empirical literature on E-ed interventions (Lee et al., 2006; Fayolle, 2005; and Gorman, Hanlon & King 1997-- which built upon Dainow's 1974-1984 survey of the E-ed literature and Block and Stumpf's 1992 review) seem to paint a similar picture. With respect to university E-ed in particular, Vesper and Gartner's (1997) review concluded that universities typically evaluate their entrepreneurship education efforts by monitoring programmatic variables like course offerings, student enrollment, faculty publications, financial commitment, faculty qualifications, economic impact, administrative support, popularity, university-wide impacts, anecdotes of alumni exploits, innovations, start-ups, and outreach to scholars. This is consistent with Step 1 in Storey's typology!

Table 3. Storey's Six Steps to Entrepreneurship Education Evaluation Validity and Counts of University E-ed Studies Found in Literature Review

MONITORING:	**Step #1** Capture number and description of participants	**Step #2** Capture #1 and participants' opinions of treatment	**Step #3** Capture #s 1&2 and participants' views of difference made from treatment
Number of Studies:	> 50	>50	32
EVALUATION:	**Step #4** Comparison between participants and typical non-participant group	**Step #5** Comparison between participants and matched control	**Step #6** Step #5 that also takes into account (controls for) self selection bias
Number of Studies:	5	7	0

In summary, previous broad-based reviews of the E-ed literature have remarked on the poor inferential quality of the studies they found, a clear indication that empirically, the economic case for E-ed, or for technopreneurial E-ed in particular, has not been made. Not surprisingly given these circumstances, Gorman et al. conclude their 1997 review by suggesting that, "the utilization of basic quasi-experimental controls and more careful descriptions of the programs and the research samples would result in substantial progress in the field, as would a more comprehensive and systematic review of the literature." Consistent with this view, I have attempted a deep-dive review of the extant empirical research on university-based E-ed to see what can be learned about the quantity, coverage and quality of that research on this topic and the extent to which it can answer the question: "Does E-ed really work?"

I. Review and Critique of Empirical Literature

An exhaustive and detailed review of the E-ed literature was conducted in an attempt to identify all empirical studies measuring outcomes and impacts of University-based E-ed[1]. The review focused on the past 15 years but relevant studies that were found outside that timeframe were included.

[1] Keywords "Entrepreneurship Education", "University Entrepreneurship Education," "outcomes," "impacts," "post-secondary" "high-tech entrepreneurship education," and "Evaluation" were used alone and in combination. In addition, leading entrepreneurship scholarship repository websites were searched (The Educational Resources Information Center's (ERIC) Center for Entrepreneurial Leadership Clearinghouse on Entrepreneurship (CELCEE) database/EPRN Ewing Marion Kauffman entrepreneurship research portal http://www.ssrn.com/erpn/index.html , Babson's Frontiers of Entrepreneurship Research and the Babson College website), and leading peer-reviewed entrepreneurship journals in the field were manually searched by title. (Journals searched included: *Entrepreneurship Theory and Practice*, *Journal of Small Business Management*, *Journal of Business Venturing*, *Academy of Management Learning and Education*, *Technovation*, *International Review of Entrepreneurship*, *Journal of Entrepreneurship*, *Entrepreneurship and Regional Development,* and several others).

Given my explicit interest in the outcomes and impacts of university-based E-ed and my desire to concentrate on more inferentially powerful studies, the review was conducted on the basis of the following screening criteria:

1) Limit review to studies of university based E-ed in general and technopreneurial education in particular (small business assistance programs and K-12 programs were excluded).

2) Limit the review to studies published in peer-reviewed journals (non-published and consulting firm reports were excluded).

3) Limit review to modalities (curriculum and pedagogy) with an explicit E-ed objective. (Studies measuring the entrepreneurial tendencies of college graduates in general, or business and technical graduates were not included).

4) Limit review to empirical studies that included some attempt to provide a counterfactual. These studies tended to correspond to Storey's Steps 3-5 above and to be best characterized as quasi-experiments although some correlational and causal analyses met this standard[2].

Twelve empirical E-ed studies were found that met these review criteria. Five of the studies limited themselves to psychosocial outcomes (such as learning, attitudes, intentions) while the remaining seven included various objective outcomes (such as reduced attrition, skills/abilities, businesses started, jobs created). The methodological details (e.g., design,

[2] Unfortunately, no Stage 6 experimental studies (with random assignment to conditions, or controls for self-selection) were found.

population, analysis, primary DV, follow-up assessment and results) of these studies are summarized in Table 1.

Since the 12 studies attempt to address a causal question, namely "Does E-ed really work?", it is appropriate, in reviewing their research modalities, to focus on the validity issues highlighted in Shadish, Cook and Campbell's (2002) updated classic, *Experimental and quasi-experimental designs*. Specifically, I will comment on: *internal validity*, (confidence that a treatment caused a particular effect); *statistical conclusion validity*, (confidence in inferences derived from covariation between treatment and outcome); *construct validity*, (confidence in inferences about higher order treatment or outcome constructs); and, *external validity*, (confidence in whether cause effect relations hold over variations in persons, settings, etc.). I will also comment on measurement psychometrics and other operationalization issues highlighted in Davidsson (2004).

Table 4. Summary of Empirical Studies Evaluating University-Based Entrepreneurship Education

Author/Date	Design	Population	Analysis	Primary DV	Follow-Up/Length	Results
Studies with Psychosocial Outcome Measures						
Chen, C., Greene, P., & Crick, A. 1998	Pretest with Comparison Groups	MBA, Undergraduate Psych: 34 E-ed; 107 comparison	Regression (ANOVA and MANOVA)	Intention to start business, self efficacy	None	E-ed students higher self efficacy and higher intentions to start business at premeasure
Clouse, Van G. H. 1990	One-group, Pretest-Posttest	Undergraduate business: 47 E-ed students	Multiple Regression	Simulated decision to start business	End of course (1 semester)	Venture decisions changed at post test
Cooper, S. Y. & Lucas, W. A. 2006	One-group, Pretest-Post-test, with 2nd Post-test	Students (US; UK): 218 undergraduate E-ed; 218 at Posttest1; 75 at Posttest2	T-tests; Multiple Regression (OLS)	Intention to start business; 14 start-up skills measures	End of program; 6 months	E-ed students had sustained higher self efficacy in skills but no long term E-ed effect on intentions
DeTienne, D. R. & Chandler, G. N. 2004	Pretest-posttest with 2 comparison groups	Undergraduate business; 71 treatment, 24 pre and posttest comparison, 35 pretest only comparison.	T-tests; Multiple Regression (Hierarchical)	Number and degree of innovativeness of opportunities identified	End of course (1 semester)	E-ed had higher and more innovative opportunities identified. E-ed lower E-intentions.
Zhao, Seibert & Hills, 2005	Pretest-posttest correlational path analysis	265 MBA students	Structural Equation Modeling	Entrepreneurial Intention to start business	Graduation 2 years	E-topic exposure and E-self efficacy predict E-intentions

Table 4. Continued

Studies with Objective Outcome Measures						
Brown, R. 1990	Posttest with Controls and cohort pretest	Undergraduates: 214 E-ed program applicants and 75 comparison	Frequencies	Time intend to start; biz survival; jobs created; sales; profits	4 months to 3 years	E-ed accelerates business start-ups
Kolvereid, L., & Moen, O. 1997	Posttest with comparison group	Graduate business (Norway): 105 E-ed; 265 comparison	Multiple Regression (Logistic and OLS)	Business startups; entrepreneurial intentions	1 year to 8 years	E-ed majors scored higher in both business starts and E-intentions than non-majors
Souitaris, V., Zerbinati, S., & Al-Laham, A. 2007	Pre and Posttest with Comparison Groups	Undergraduate science and engineering students at two Universities (France, UK): 124 E-ed; 126 comparison	Regression (ANOVA, GLM)	Attitudes/Intention to become self-employed; Nascent activity	5 months	learning and resources did not impact intention although E-ed inspiration did affect norms and intentions.
Charney, A. & Libecap, G. D. 2000	Posttest with matched control	Business and Public Admin graduate and undergraduate students: 105 E-ed; 406 Comparison	Multiple Regression (Probit, OLS)	Startup; self employed; income; job satisfaction; firm performance	1 year to 13 years	Grad students more than 3X more likely to start a business
Menzies, T. V., & Paradi, J. C. 2002	Post-test with matched control	Undergraduate engineers (Canada): 287; E-ed and controls	Frequencies, Multiple Regression (OLS)	Current/ past /serial business ownership	4-11 years	E-ed grads had more businesses, more serial start-ups, sooner after graduation than controls
Ohland, M. W. et al. 2004	Post-test with matched control	Undergraduate engineers: 177 E-ed; 110 comparison	Multiple Regression (OLS) and Confidence Intervals	Retention, GPA	1 year to 6 years	E-ed students less likely to drop out of engineering and had higher GPAs than matched controls
Thursby, M, Fuller, A., and Thursby, J 2009	Pre-post with matched control	MBA's, Ph.D's, JD's: 71 E-ed; 46 comparison pre, 15 comparison post	Multiple Regression Ordinal Logistic	Learning competencies in legal, finance, marketing, opportunity ID, tech writing, risk assess.	End of program 2 years	E-ed students reported higher competencies in 9 of 14 skills at post

II. Studies with Psychosocial Outcomes

Five of the 12 studies reviewed limited themselves to examining various psychosocial outcomes of E-ed. Only one study involved pre and posttests with a comparison group, one included comparison groups but only obtained pre-measures, and three studies used variations on a one-group pre-test post-test design. As discussed below, this design is not considered a very inferentially strong design.

DeTienne & Chandler was the only experimental (as opposed to quasi-experimental) study found in the review, and it is one of only two studies not plagued by self-selection biases. Two randomly selected sections of students in a strategic management course for undergraduates at a Western US University (N=71) received an opportunity identification training curriculum (SEEC), while other sections did not. 24 of the students in the control sections participated in both the pre and posttest while 35 participated only in the pretest. Using a paired sample t-test, the authors found that the students who received the training identified more and more innovative opportunities than the control students who did not receive the training. Interestingly, the authors also found that students with greater innovative propensity (measured by the Kirton Adaption Innovation Inventory (KAI) at pre-test) scored no differently than those with lower propensities. Also of great interest, unlike the other studies, this study's E-ed students had lower E-intentions than comparison/control students as measured by their likelihood of getting involved in a start-up in the next 12 months.

The study, by nature of its superior design, provides the greatest support of all the studies for the conclusion that E-ed can impact a cognitive construct (opportunity identification) believed to support the entrepreneurial process. At the same time, its design also undermines the results of other studies that show E-ed effects on E-intentions. The only concern for the validity of the results concerns possible limitations with respect to the measures employed—the construct validity of both the innovative propensity pre-measure (KAI) and the measure of "innovativeness" of the opportunities identified at post-test. As with all the psychosocial impact studies, this one sheds little light on the efficacy of E-ed in creating actual new business activity; opportunity identification skills, may or may not predicate the ability to successfully launch an entrepreneurial startup.

Chen et al. (1998) were interested in understanding whether entrepreneurial self-efficacy (ESE), locus-of-control and demographic variables predicted entrepreneurial intentions for students enrolled in a MBA introductory E-ed class (not further described). In addition to an E-ed group (N=34), Chen et al. collected data from two comparison groups, a MBA organizational behavior class (N=78) and an undergraduate psychology class (N=29). In this study, only pre-treatment data are presented.

Since all the data they reported were collected before participants enrolled in the E-ed class, this study can be best described as a multiple-group pre-test only predictive design. While basically a correlational design that provides little internal validity, it minimally meets our selection criteria since it includes data on students enrolled in an introductory university E-ed business course and a comparison group.

Based on regression analysis the authors demonstrated that: 1) a higher score in self efficacy in terms of five entrepreneurial skills and abilities; and, 2) exposure to entrepreneurial friends and relatives, significantly predicted students' entrepreneurial intentions. Thus, consistent with some of the postulates of Bandura's Agentic Theory of Human Behavior, one could speculate entrepreneurial self-efficacy might be an important target mediator for E-ed programs. However, for my purposes, it is most important to note that based on MANOVA analyses of between group differences Chen and colleagues also found that students enrolled in the E-ed program exhibited significantly higher E-Self Efficacy (on three dimensions) and higher entrepreneurial intentions than the two comparison groups *at the time the pre-measure was taken*. In other words, students enrolled in E-ed were higher on these key variables *prior* to obtaining their specialized training. This finding suggests considerable caution should be exercised in interpreting post-test differences between E-ed and various underspecified comparison groups.

One of the earliest studies (Clouse, 1990) focused exclusively on psychosocial measures to determine if participation in an E-ed course would have an impact on students' entrepreneurial thinking and decision behavior. The course was a semester-long introductory entrepreneurship course designed for undergraduate business majors and employed project-based (team) and lecture instructional modalities.

A one group pretest-posttest design was used with 47 students completing a venture start-up simulation program "The New Venture Start-Up Decision-Making Exercise (NVSDME)" on the first and last days of the course. The simulations required students to make a start up recommendation for 35 case scenarios while evaluating six dimensions (e.g.,

profitability, market acceptance). Based on multiple regression analyses, the authors report that the E-ed course had a significant impact on the weighting given various decision criteria with 19 students showing change on one criteria, 13 on two criteria and 3 on three criteria.

On the surface, this study appears to provide some support for the conclusion that E-ed training can have an impact on objectively measured cognitive constructs that are believed to mediate entrepreneurial success. However, since the study appears to be lacking in both internal validity and construct validity, this conclusion is difficult to justify. As Shadish et al. (2002) point out, it is very difficult to defend causal conclusions based on one group pre-test post-test designs because this design is vulnerable to various threats to internal validity including history, social desirability, maturation, etc. In this particular study, testing becomes a very plausible explanation for any changes occurring between pre and post-test. In other words, the process of having taken a pre-test might account for post-test changes. In addition, in spite of efforts to demonstrate the reliability of the measures used, the authors provide no data or justification linking the measures used in this study (e.g., changes in weighting given various dimensions) with superior decision making about new venture start-ups (Davidsson, 2004).

In another study involving psychosocial outcomes, Cooper and Lucas (2006) attempted to evaluate whether participation in an E-ed program, specifically the Enterprisers Program, a 5-day extracurricular workshop for undergraduate students from 40 UK universities and MIT, had an impact on entrepreneurial self-efficacy and on intention to start a company. The curriculum included segments focused on self-understanding, creative thinking, teamwork and leadership exercises (simulations, games, role-playing),

communication, creating networks, and sustaining motivation. The curriculum was delivered in group discussions and hands-on exercises, and role models are provided.

Once again, the authors used a one-group pretest-posttest design, however in this case they added a second post-test six months after the program ended. Data were collected on 218 students enrolled in four different sessions of the Enterprisers program. The key dependent variables were entrepreneurial self-efficacy (14 measures of self-confidence in entrepreneurial skills and abilities including opportunity recognition, unstructured problem solving, motivating others, etc.), and intention to start a new company (5-items scored separately and combined).

A series of T-tests were used to evaluate the pretest-posttest 1 and pretest-posttest 2 differences. Unfortunately, while the response rate for the first post-test was 100%, for the second it was only 34%. The authors found that 9 of 14 measures of entrepreneurial self-efficacy and 4 of 5 measures of entrepreneurial intent increased significantly between pretest-posttest 1. Between pretest and posttest 2, 14 of 14 self-efficacy measures increased significantly while entrepreneurial intention did not. The study concluded that while the Enterprisers program had a significant and enduring impact on student entrepreneurial efficacy/self confidence, it had only a transient effect, if any at all, on entrepreneurial intentions.

A major strength of this study was the use of a second follow up posttest assessment at six months. Shadish et al. (2002) assert that adding additional post or even pretests can strengthen the internal validity of a basic one-group pretest-posttest design. Unfortunately, in this study the benefits provided by this methodological enhancement are mitigated by a

variety of other problems. First, the substantially lower response rates observed at posttest 2 introduces serious concerns that any differences observed are likely due to attrition (Shadish, et al., 2002). In other words, any differences or lack of differences observed between the various assessments are just as likely to be due to the characteristics of students who elected to respond or not respond as they are to the Enterprisers program. Further, serious concerns can also be raised about other methodological qualities: statistical conclusion validity (based on the excessive number of individual T-tests examined); construct validity (based on the undocumented validity of the measures used); and external validity (based on the conflicting response rates). (Shadish et al., 2002; Davidsson, 2004).

Zhao, Seibert, and Hills (2005) were interested in whether the variety of E-ed experiences obtained by graduate students while matriculating for a degree had an effect on entrepreneurial self-efficacy and ultimately entrepreneurial intentions. In order to achieve this objective, students were surveyed at matriculation and at the end of their 2-year MBA programs. Complete data were obtained from 265 students (34 percent response rate). At pretest students were asked to provide information about previous entrepreneurial experience, risk propensity, gender and entrepreneurial intentions. At posttest students reported how much they perceived they had learned during their MBA education regarding areas of entrepreneurship (e.g., opportunity recognition, evaluation, and starting a business), their entrepreneurial self-efficacy and their entrepreneurial intentions.

While it is tempting to characterize this study as a pretest-posttest comparison group design, the fact that not all variables are measured at pretest and posttest and we have no objective information about participation in E-ed programs (only self-reports on how much

they learned) suggests this study can be best characterized as a pretest-posttest predictive study. Nonetheless, Zhao et al. used a powerful statistical tool, Structural Equation Modeling (SEM) (Kline, 2004), to test their research hypotheses. The authors report support for a hypothesized model that shows the effects of perceived entrepreneurial learning (as well as entrepreneurial experience, and risk propensity) on entrepreneurial intentions is mediated by entrepreneurial self-efficacy. Interestingly, gender does not affect entrepreneurial self-efficacy but does have an effect on intentions.

This study has a number of obvious strengths. First, since SEM is a widely accepted tool for evaluating causal models (including both direct and indirect effects) and some of the variables in the model were measured pre- and posttest, their findings appear to provide some support for the causal connection between E-ed and entrepreneurial self efficacy and intention, two widely researched psychosocial precursors to entrepreneurship. In addition, Zhao et al. enhanced the external validity of their results by collecting data from MBA students at a diverse collection of universities.

However, as the authors admit, the study is not without its limitations. For our purposes, undoubtedly the biggest issue revolves around the construct validity of their E-ed measure – perceptions of formal learning. Since this measure is basically a self-report of how much students *believe* they learned about entrepreneurship during their MBA, it is not clear to what extent this measure reflects actual participation in/ exposure to E-ed courses or lectures, the nature of those experiences, and the extent to which this measure is contaminated with non-E-ed learning or experiences that occurred at the same time, or even by social desirability biases (Davidsson, 2004). For example, it is possible that students who

did not enroll in a specific entrepreneurship course felt they had "learned a lot" about the subject in their general business courses or in discussions/experiences with faculty or students. Further, the authors never comment on the fact that entrepreneurial intentions at pretest has virtually the same effect size on intentions at posttest as all the other variables in the model. In other words, similar to Chen et al.'s findings we are left wondering whether outcome effects are primarily due to differences that exist before E-ed experiences.

III. Studies with Objective Outcomes

The other seven studies identified in this review examined the impact of E-ed on the kind of objective (although typically self-report-based) entrepreneurship outcomes that might catch the attention of policymakers and economic development officials (e.g., involvement in start-ups, self-employment and firm performance). Of these, two studies focused on hard education-related outcomes and *not* startup-related outcomes. For example, one study (Ohland Miller) found engineering students introduced to entrepreneurship early in their course of study had higher GPA's and were less likely to drop out. Encouragingly, some of these studies also simultaneously examined program impact on a variety of psycho-social measures. While two teams attempted a stronger pretest-posttest comparison group design, when all is said and done, comparison group deficiencies caused all but one of the studies to report findings based on posttest only comparison group design.

Given the predominant use of "posttest-only with a non-equivalent comparison group" quasi experimental designs, it is worth noting that this design is also seriously compromised (Shadish et al., 2002), primarily because of selection biases. In other words,

without a pretest one cannot be confident the treatment and comparison groups were equivalent to begin with. This threat to internal validity is even greater when one is trying to compare a group comprised of individuals who volunteered for treatment with a group that did not (Campbell and Stanley, 1966). This caution seems particularly salient for my review, for two reasons: 1. Virtually all review studies compared volunteers with non-volunteers; and, 2. Research reported in the previous section by both Chen et al. and Zhao et al. shows that E-ed volunteers were significantly different than non-volunteers at pretest on entrepreneurial self efficacy and intentions. Zhao et al. further show that pretest entrepreneurial intentions have a significant and very large effect on later entrepreneurial intentions.

However, while selection problems with this design *cannot be eliminated,* it is important to note that its internal validity can be improved. Concerns about self-selection induced internal validity can be reduced by using *effective* matching strategies and/or by trying to statistically control for the effects of various known and measurable differences as will be explained further below.

In a rather ambitious study, Brown (1990) attempted to evaluate the impact of Britain's Graduate Enterprise Program (GEP) on both entrepreneurial intentions and actual attempts to start a business by undergraduate seniors. Students accepted into the GEP attended awareness seminars (where they complete a mini-business plan application), a two-day business workshop training weekend, and a 5-week GEP program at their participating university's school of management, interspersed with 11 non-residential weeks of market research activities. These activities culminated in a final business plan presentation to

financiers. GEP teaching methods were individual project-based, with guest speakers and role models.

From a design standpoint, this study was *intended* to be an inferentially more robust pretest-posttest matched comparison group quasi-experimental design. Specifically, over two hundred GEP students who applied for and were accepted into the program and seventy-five students who applied but were not admitted (comparison) over several cohorts were surveyed during the application process (pretest) and then surveyed or audited 4 months to 3 years later as a posttest. Dependent variables included intention to start a business (regardless of acceptance into GEP), companies started, time to start a business, longevity/survival of company, number of jobs created, sales, and profits.

This study is a good example of how difficult it is to produce a methodologically sound evaluation of an E-ed initiative. While the authors attempted to produce a relatively strong quasi-experimental study that includes both pre and post measures and a defensible comparison group, specifically one that actually wanted the E-ed training, they were not able to achieve this goal. In their write-up, the authors report that their pre-measures were lacking and, more importantly, they were only able to obtain follow up data from 19 of the 75 comparison students. A quarterly "audit" followed up on the 214 GEP students but response rates were not reported. As a consequence, the authors were left to report what amounts to descriptive statistics detailing the success achieved by some GEP graduates who participated in the voluntary quarterly audit. While some of the results reported by GEP graduates were impressive (one-half and two-thirds of GEP participants survived their first 30 months in business), the study amounts to a single-group case study with little inferential value

(Campbell & Stanley, 1966). While ambitious in its intent, this study provides little basis for evaluating whether GEP was an effective or ineffective intervention.

In one of the few studies to focus on the impact of E-ed on a population of scientifically-trained students, Menzies and Paradi (2002) evaluated the impact of an entrepreneurship course offered to undergraduate engineering majors at a major university in Canada. Few details about the nature of the course were offered other than to indicate that it was a typical introductory entrepreneurship class with some orientation toward technology start-ups[3].

This study involved a posttest only quasi-experimental design with a comparison group. A treatment group consisting of multi-year cohorts of engineering graduates who had taken an E-ed course was surveyed. A control group from the same university was also surveyed, selected by a stratified random sampling of engineering graduates matched by year of graduation, major, and gender. Dependent variables included entrepreneurship activity (e.g., current business owner, business owner at some time since graduation, serial entrepreneur), and characteristics of business (type, sales, number of employees). The authors reported a variety of significant effects associated with taking an E-ed course, including increases in business ownership, length of time owned a business, and serial entrepreneurship.

This study shows some increased methodological sophistication by trying to create a matched comparison group and by using demographic variables as covariates. Unfortunately,

[3] The authors also collected data on students who enrolled in a three course entrepreneurship sequence in later years but did not obtain enough data on this group to evaluate their results.

the benefit of these improvements are compromised by the dramatically different response rates obtained for the two groups. The authors report 99% of the E-ed students they were able to trace responded to their survey (N=177), while only 12.5% of their comparison group (N= 110) responded. Part of the difference in response rates may be attributable to the extra effort they made to contact E-ed students including completing their surveys based on a telephone interview. However, it seems likely that any pre-existing differences between E-ed and comparison students were magnified by the differential response rate obtained by proactively collecting data from just one group – the E-ed group. Further, these biases are unlikely to be controlled by using age and gender as covariates.

In a well-designed study, Charney et al. (2000) evaluated the Berger Entrepreneurship Education Program at the Eller College of Business and Public Administration, a three semester-long course sequence taken by second year MBA and fourth year undergraduate students. The program initially employed lectures and case studies teaching modalities but subsequently evolved to a more applied "real world" pedagogy including business plan and case analysis competitions, consulting projects, guest lecturers and speakers.

Once again, a posttest only comparison group design was used. Specifically, a self-report follow up survey was conducted with Berger graduates from 1985-1998 (N=460) and with a random sample of non-Berger graduates from the Eller College of Business and Public Administration (N=2024) in 1999. Response rate for the Berger group was 22.8% (N=105) and 20.1% for the non-Berger graduates (N=406). A wide range of outcome variables were assessed including: involvement in a start up, employment status (e.g., employee, self-employed, private consultant), size of employer, business performance measures (e.g.,

number of employees, sales), personal assets, instrumentally involved in start up, number of startups, and job satisfaction.

In order to assess and address selection threats the authors took a number of steps. First, they demonstrated that the Berger and non-Berger alumni were comparable on a number demographic characteristics (e.g., age, gender, ethnicity, level of education, and socio-economic status). In addition, these and other variables were used as covariates in multivariate probit and other regression analyses. Results showed that E-ed graduates were 25% more likely to be instrumentally involved in a new business venture and were 11% more likely to be self employed. They were also more likely to work full time and have higher incomes, (including earning more for working for large firms), and were more likely to be working for a high-tech firm (13%) and developing new products (9%). In terms of these latter outcomes, the authors must be commended. This was the only study that looked specifically for high-economic impact technopreneurial outcomes!

Obviously, this study has a number of methodological strengths. First, it included a large and diverse sample, some of whom had graduated over ten years ago which should permit a meaningful assessment of their entrepreneurial activities and outcomes. Second, the Berger program, at least in its latest iteration, appears to be the type of comprehensive, hands on program many experts believe is most likely to produce effects (Solomon, 2002; Winslow et al., 1999). More importantly, the authors attempted to reduce the threats to internal validity posed by selection related biases by creating a matched comparison group. They also used multivariate analyses to control the effects of various potentially confounding variables.

Unfortunately, while we cannot find a "smoking gun", we suspect the matching strategy used by the researchers may have compromised what was otherwise a fine study. According to their report, comparison students were drawn from the same *college* cohort. However, the Eller College includes both business and public administration majors. Interestingly, results show that over twice as many non-E-ed students were employed in government or non-profit organizations than the Berger E-ed students. While this comparison is not explained by the authors, this is exactly the result one would expect if the comparison group included a significant number of public administration majors and the E-ed (treatment) group did not. If this is the case, it would undermine the confidence one could place in these findings. Regretably, this problem could have been mitigated by dropping public administration majors from the study or using major as a covariate.

In another study, Kolvereid and Moen (1997) attempted to evaluate the impact of majoring in entrepreneurship on entrepreneurial intentions and behavior for students earning a graduate business degree in Norway. The entrepreneurship major consisted of 75% of their work during their final year with 50% class work (primarily new business formation, innovation, and strategy) and 50% thesis work. The program curriculum focused on entrepreneurship awareness, small business development, and training of trainers more than training in start-up skills.

A post-test only comparison group design was used to evaluate the effectiveness of pursuing an entrepreneurship major. More specifically, the authors surveyed all business graduates (entrepreneurship majors and others) who received their degrees during a twelve year period from 1987-1994 (N=720). Although they received feedback from 374 (56%),

missing data lowered their sample for their multivariate analyses for starting new firms (N=303) and self-employment intentions (N=278). The authors report that majoring in entrepreneurship had a significant effect on both entrepreneurial intentions and starting a new firm.

Compared to the previous studies summarized in this section, this study appears to do a better job of reducing selection threats by matching participants and statistically controlling for confounding factors. First, the authors included a comparison group made up of individuals who graduated from the same homogeneous business college cohort as the E-ed majors. They also attempted to demonstrate that the individuals who responded to the survey were comparable to the college population on two characteristics: cohort and gender[4]. Further, the reliability of key measures was demonstrated to be adequate. Finally, the authors attempted to control for the effects of a variety of biasing variables including career history, demographic, and current employment (position, sector, work motivation) via multivariate analyses (logistic regression for start-ups and OLS for intentions). Since the authors do not report response rates across the two conditions, our main concern with this study would be the potential for a differential response bias like we observed in Brown (1990) and Menzies et al. (2002).

While Souitaris and colleagues (2007) indicated they had two primary goals, to find out whether E-ed experiences could increase attitudes and intentions (to become self employed) and to try to identify which "program derived benefits" (e.g., program

[4] However, they do not report statistical tests on these comparisons.

mechanisms) were responsible for such increases, they also evaluated impact on what others consider objective outcomes, namely nascent entrepreneurship and start up activities. In order to achieve these goals undergraduate science and engineering students that experienced an E-ed program at a university in the UK and France as well as comparison groups at each campus completed pretest and posttest (four months later) assessments. E-ed students were also categorized by mode of selection (self-selected versus compulsory). The E-ed program was described as "good practice" and included some combination of course, business planning and interaction with practitioners.

Complete data were obtained from 124 program (53.4% response rate) and 120 (57.2% response rate) comparison students. Students were asked to provide information about entrepreneurial attitudes, subjective norms and perceived behavioral control (e.g., E-Self Efficacy) at both pretest and posttest E-ed students were asked to provide information about program benefits (e.g. learning, inspiration and use of resources) and nascent entrepreneurship and start up activity at posttest. The authors used a variety of statistical techniques to test their study hypotheses and report results indicating that E-ed students (but not comparison) demonstrated a significant increase in subjective (entrepreneurial) norms and intentions (for self-employment) but not attitudes and behavioral control. They also report evidence to support the connection between inspiration (but not learning or use of resources) and intentions. Unfortunately, however, they also report that there was no relationship between intentions and nascent entrepreneurship or start ups. The authors conclude that E-ed appears to influence norms and intentions and that an emotional factor, inspiration, appears to be the key programmatic instrumental process.

This study has a number of methodological strengths. First, it is one of only two studies found in our review (DeTienne & Chandler being the other one) that included both a pretest-posttest and a comparison group, AND where the authors tested for differences between respondents and non-respondents. In addition, collection of data from two universities in two countries enhances external validity. The authors also provide reliability measures on all their scales. Perhaps most importantly, the authors collected data not only on psychosocial and objective outcomes but also on the "program derived benefits" that might explain how E-ed works.

However, the study also has some important limitations. First, in spite of the use of a stronger quasi-experimental design, since the authors report significant differences between self-selected participants and mandatory participants, internal validity remains a concern. With respect to construct validity concerns can be raised about the whether the primary dependant variable used in this study, intention to be *self-employed*, is consistent with the start up-focused entrepreneurial intentions measures used in other studies. In addition, the authors admit concerns can be raised about the reliability and validity of their one-item measure of inspiration. Finally, while the authors attempt to be very thorough in their analyses, many of their hypotheses should have been evaluated by more powerful multivariate statistics (like MANOVA rather than ANOVA)[5]. In particular, their laudable attempt to assess whether program derived benefits like inspiration mediate the effect of E-ed on intentions should be tested by a mediational technique (Sobel, 1982, See Baron & Kenney

[5] Concerns can also be raised by the use of change scores and use of separate pre-post tests for the E-ed and comparison groups.

(1986) and/or SEM, for example). Thus, in spite of all of the strengths of this study, it is difficult to put much confidence in either the significant (E-ed increases E-intention; inspiration is the key mechanism for this change) or non-significant (absence of an intention-nascent entrepreneurship link) findings.

The two final studies, Ohland et al. (2004), and Thursby et al. (2009) had a different outcome focus than the other studies in our review, having focused on objective educational and learning outcomes. Unlike some of the other studies they also included matched control groups, and for this reason alone could be considered among the stronger studies. Ohland conducted an evaluation of the Entrepreneurs in Engineering Program (EEP), the senior capstone design alternative for undergraduate engineering students at NC State University. EEP enrolls lower division engineering (primarily) students in the design experience and overlays that with entrepreneurship and business education. The primary teaching modality is a project-based (team) approach. Program designers hypothesized that the hands-on EEP course would increase the relevance of and interest in engineering coursework among the lower division engineering students, thus improving participating students' retention and academic performance compared to the students who did not receive the entrepreneurship experience.

The study design was a posttest only quasi-experiment with a matched pair control group. The treatment group included 91 students who had participated in the EEP as lower division students and an equal number of non-EEP students matched on gender, ethnicity, cohort, engineering major and similar SAT scores. The study found that the EEP engineers

were significantly more likely to be retained in engineering (6.5%; p = .005) and also had a higher GPA (M = 3.08) than comparison students (M = 2.83; p<.05).

This study had two major strengths. First, it used a stronger matched-pair matching strategy than the other studies used (Shadish et al., 2002). Secondly, the use of objective and independently obtained outcome measures (GPA and retention) prevented the differential response bias that has plagued other studies while simultaneously avoiding concerns about social desirability biases that always linger when relying solely on self report measures.

Thursby et al. (2009) was also an evaluation of an innovative E-ed program, the TI:GER program at Georgia Tech and Emory University. The program created multi-disciplinary teams of Science/ Engineering Ph.D. students, MBA students, and Emory law students who learned about technology commercialization and then applied that knowledge in exploring the commercialization potential of the Ph.D. students' research. The program's objectives include encouraging Ph.D's to consider the commercialization applications of their research early in the process, and expose MBA and JD students to careers in technology and R&D management.

The study design was pre-test/post-test with a control group matched to one of three cohorts (N=84). While the study lacked Ohland's exceptional matched pair strategy, unlike Ohland it did include a pretest. The control group consisted of 46 students at pretest and 15 at posttest. The study asked students to self-assess their capabilities in a number of specific skill areas including: legal, regulatory, finance, marketing, opportunity identification, technical writing, risk assessment, and quality control.

The study found significant differences (e.g. higher competency) between pre and post on 9 capabilities for the program group, and two significant differences for the control group. (Response-nonresponse group differences were not reported). While the presence of a counterfactual was a major strength of the study, especially given that the controls were randomly selected based on demographic data (program and student level), there may have been a problem with the matching procedure that compromised group equivalence since there were significant group differences between control and treatment upon entry in five areas. On the other hand, selection "bias" may simply have been a reflection of the very small sample size (only 15 controls completed the post-test). It's not clear from the study what, if any, measures were taken to control for social desirability response bias, which is common to end-of-course self-assessments—students like to tell their teachers what they think they want to hear!

IV. Summary of Findings: Methodological Critique of Empirical Literature

The purpose of the deep-dive review into the most sophisticated (Storey Stage 3 and above) empirical literature on university-based E-ed was to assess the quantity, coverage and quality of the research and to try to understand the extent to which this body of research can answer the question: "Does E-ed really work?"

My review examined studies of university-based E-ed that were published from 1998 to 2011 (plus relevant studies from outside that time frame) that were identified by: 1) searching the EDGAR/CELCEE/ERPN databases; 2) major search engines; and, 3) by reviewing the major entrepreneurship journals. In order to exclude the large number of

inferentially worthless monitoring studies that Storey (2000) identified in his paper, I limited my review to studies that attempted to use some minimal counterfactual comparison including pretest-posttest or comparison group designs; (another preferred condition, validated psychometrics, were rarely reported and thus dropped from the criteria in order to allow for at least a dozen reviews). Given the results of previous reviews, it came as no surprise that the number of studies that met this criterion was relatively small. Specifically, I was able to identify only 12 studies that *attempted* one or all of the above. Unfortunately, since Chen et al. (1998) only involved a pretest comparison and Clouse et al. (1990) was not able to actually make a pretest-posttest comparison, only nine studies truly met this criterion; of these almost all had comparison group problems.

With respect to outcome measures examined, five of the studies attempted to examine E-ed effects on psychosocial outcome measures while the remaining seven examined effects on the kind of objective outcomes that policymakers are more likely to be interested in. These studies also examined a diverse collection of target audiences. Seven of the studies examined effects on undergraduate students with three of these focusing on the science and engineering populations that are more likely to produce the technology-driven radical innovations that are most likely to affect the wealth and job creation objectives policymakers covet. Three studies examined effects on MBA and other kinds of graduate students, and the remaining two studies commingled undergraduate and graduate students. As other reviews discovered, since some researchers do not provide enough information about their E-ed programs, it is not easy to precisely characterize the pedagogy of the programs tested. Nonetheless, based on what was disclosed, the evaluated programs appear to reflect the

diversity of approaches described in Chapter 1, Part IV above: most involved at least course length interventions, while some involved entrepreneurship majors/minors or multiple course sequences; some appeared to follow pretty conventional classroom pedagogy while some appeared to reflect the increasing focus on a more constructivist hands-on approach to E-ed. From a methodological standpoint, this body of research does appear to provide evidence that E-ed scholarship is getting more inferentially sophisticated. For instance, the 7 attempts I found to conduct Storey Step 5 evaluations (those that included a comparison based on a matched control group), were published since 1997.

Virtually all of the studies attempted to control for the effects of known demographic correlates by including these variables as covariates in multivariate analyses. About half the studies used objective outcome measures, which appear to be getting more concrete and meaningful over time. Zhao et al.'s (2005) use of structural equation modeling (SEM) to test for direct and indirect causal effects of E-ed on various psychosocial outcomes, Cooper et al.'s use of a second longer-term posttest, and the long follow up periods used in many of the objective outcome studies are also to be commended. Unfortunately, my review also demonstrates that there is still a great deal of room for improvement in evaluating the effects of E-ed.

A. Psychosocial Outcome Studies

While the studies that examine psychosocial outcomes might not provide a basis for truly answering the policymaker's question, "Does E-ed really work?", they do have the potential to help us begin to answer the more refined question: "*If E-ed works,* how does it

work?". Based on the studies in this review, there appears to be modest support for a Social Cognitive Theory-based hypothesis that E-ed can affect entrepreneurial self efficacy. Support for entrepreneurial intentions is weak. While the field still puts great stock in a strong theoretical case for the link between entrepreneurial intentions and entrepreneurial acts, in fact I found surprisingly limited empirical support for this assumption, which is the underlying assumption common to much of the psycho-social E-ed evaluation research.

For instance, DeTienne and Chandler showed LOWER intentions after E-ed in comparison with controls—suggesting that E-ed in the form of opportunity identification skill-building may be a cognitive skill that is unrelated to entrepreneurial intent and subsequent activity. Similarly, Zhao et al.'s (2005) findings suggest that the effect of E-ed on entrepreneurial intentions is mediated by entrepreneurial self-efficacy. However, since gender (being a women) has a negative effect on intentions, one is left wondering if we need to develop a different causal model and/or perhaps a different E-ed intervention for women. Unfortunately, understanding this issue is further complicated by concerns about the construct validity of their "perceived learning from entrepreneurship-related courses" E-ed Measure. But while Zhao et al.'s (2005) study appears to support a connection between E-ed and intentions, Cooper's et al.'s (2006) study suggests only a transient effect. Potentially, the objective outcome studies that also included psychosocial measures could contribute to this question and begin to also look at objective outcomes. Unfortunately, none of these studies used the kind of robust statistical methodology (e.g., SEM) that might help clear up the linkage between E-ed interventions-psychosocial mediators-objective outcomes. These shortcomings plus well-grounded concerns about the internal validity of inferentially weak

pretest-posttest designs used in most of these studies appear to leave us where we started. *If E-ed works,* how does it work? The answer provided by the psychosocial outcome studies collectively appears to be: we really do not know.

B. Objective Outcome Studies

Seven of the 12 viable studies included in my review attempted to evaluate the impact of E-ed on hard outcomes, including the kind that policymakers and economic developers care about--business start ups, serial entrepreneurial activity, time to start up, and various personal and business economic measures. Encouragingly, these studies also included a diverse set of interventions and populations and relatively long follow up periods. While three of these studies examined the technically trained engineering populations that are most likely to contribute to technoentrepreneuial outcomes, two of these studies (Ohland et al, 2004; Thursby & Thursby, 2009) only looked at academic outcomes. Interestingly, only Charney et al. (2000) appeared to try to measure outcomes that captured technology-driven entrepreneurial activity.

Regardless, evidence from the three more robust hard outcome studies is consistently positive. Kolvereid et al. (1997), Charney et al. (2000) and Menzies et al. (2002) all found that E-ed majors produced more business start ups and other markers of entrepreneurial success than students in their respective comparison groups. Taken at face value, these results appear to suggest that E-ed is an effective vehicle for promoting economic development goals. While these results should be encouraging to those who believe in the

value of E-ed, my optimism in this regard needs to be tempered because of the inferential weakness of the designs used in these studies.

Because the posttest-only comparison group design used in these three outcome studies is considered to have relatively poor internal validity, the ability to confidently assert a cause-effect relationship is compromised. Encouragingly, most of the investigators attempted to strengthen the inferential power of the basic design by using various matching strategies to create a comparison group and/or using demographic predictors as covariates. However, the benefit of these steps appears to be mitigated by two other factors. First, in most instances the value of these steps was negated by other problems including apparent flaws in the way the matching was done and huge discrepancies in response rates between the two conditions, apparently often caused by a misguided desire to "get as much data as possible from our treatment group." Second, the version of posttest-only design used in all of these studies, individuals who seek treatment versus a group who did not, (as opposed to a comparison of two naturally assembled collectives), is considered a weak sister to an already weak basic design.

The major concern with this design is selection biases. The salience of this concern is vividly illustrated by the findings of two of the reviewed studies: Chen et al.'s (1998) found that individuals enrolled in an E-ed course had significantly higher entrepreneurial intentions than comparison group members *before* their training began; and, Zhao et al. (2005) found that intentions before training is the strongest single predictor of intentions after training. Since none of the three best objective outcome studies included pretest scores on critical entrepreneurial precursors already identified, (or, if none, even hypothesized in the empirical

research--like entrepreneurial experiences (prior courses, parent entrepreneur, for example), demographics (age, gender, etc.), entrepreneurial skillsets and mindsets) that could be used as covariates (see discussion below), there is no way to confidently know whether E-ed training produced these positive findings or whether these effects are simply due to the most motivated nascent entrepreneurs finding their way into training (or perhaps a combination of these factors). Thus, although the findings of this set of studies are generally positive, when trying to answer the question, "Does E-ed really work?" we are once again left with the same answer: we really do not know.

V. Lessons Learned for Design of this Study

As discussed earlier, the entrepreneurship education tide appears to have shifted. Interest in and opportunities for training in this area, particularly at the post-secondary level, have grown by leaps and bounds over the past several decades. At least some of this growth has been encouraged and supported by national and local policymakers who see E-ed as a vehicle for promoting job creation and economic growth, particularly if they could affect the technopreneurial growth that tends to happen in and around our major universities.

My deep-dive review and methodological critique of the empirical research literature attempted to assess how much scholarly support there is for the implicit belief that entrepreneurs are not just born but also can be manufactured via E-ed and thereby affect societally beneficial outcomes. Unfortunately, although some progress has been made, E-ed scholarship continues to be at a very early stage of development and we have a long way to go before we can confidently answer questions like, "Does E-ed work?", let alone "If it

works, how does it work?" In truth, E-ed appears to be one of those phenomena where action and intervention have raced far ahead of the theory, pedagogy and research needed to justify and explain it.

While there are signs of progress on the research front, findings from my review of empirical research on E-ed programs are particularly disappointing. In spite of Gorman's 1997 call for "the utilization of basic quasi-experimental controls" none of the studies examined in this review utilized the kind of strong quasi-experimental designs that would begin to address concerns about internal validity. If an interest and investment in E-ed is going to be sustained let alone grow, we will need to provide policymakers and university executives with methodologically sound evidence that the significant investments being made in these initiatives are paying economic dividends. Toward this end, the quality of research in this area must be improved, by order of magnitude, as follows:

A. Take Steps to Strengthen Inferentially Weak Designs

The two basic designs used in virtually all the studies reviewed, one-group pretest-posttest and posttest-only with non-equivalent comparison group, were originally classified as "pre-experimental" as opposed to true quasi-experimental by Campbell and Stanley (1963) and were included to show "bad examples" of research design that were essentially not worth pursuing. In the case of E-ed specifically, however, the unfortunate reality is some (but not all) field research situations and circumstances do not readily lend themselves to using more powerful designs (DenTienne & Chandler's random experiment was the exception in this review). Recognizing this situation, in the most recent version of *Experimental and quasi-*

experimental designs Shadish et al. (2002) suggest these designs can be improved (although only marginally so) by some simple enhancements. For instance, they demonstrate how the pretest-posttest design can be strengthened by the addition of an extra pretest or collection of other "non-equivalent dependent variables" and how the posttest-only comparison group design can be improved by adding a pretest on an independent sample of non-participants or by using powerful matching techniques like propensity scores or by using internal controls like late enrollees. Clearly, E-ed researchers who cannot do better than these two designs are well recommended to use these relatively simple design enhancement techniques.

B. Use More Powerful Quasi-experimental Designs

One of the most striking findings of my review was the failure of researchers to use any of the inferentially more powerful quasi-experimental designs. Particularly noteworthy in this regard was the absence of what Campbell and Stanley called the non-equivalent control group design[6], basically the posttest-only comparison group design with a pretest added. Although still not up the standards of an experiment, if implemented correctly, this design is a significant improvement over the posttest only design. Implementing this design correctly involves trying to find/create a control group that is as similar as possible to the treatment group, measuring and using as covariates pretests on variables that might account for group differences, like entrepreneurial proclivities or experiences, and considering other enhancements like an extra pretest or posttest (Shadish et al., 2002). A specific benefit of

[6] Shadish et al. label this design the "untreated control group design with dependent pretest and posttest samples".

this design is its ability to evaluate the kind of attrition bias that was so prevalent and damaging in the studies reviewed.

Clearly, the fact that there are no Storey Stage 6 evaluations of E-ed programs is evidence enough that this is very hard to do. Nonetheless, the present research study will attempt to "raise the bar" by responding, via improved survey design, to some of the weaknesses identified by the review. While random experiments are not possible in this kind of effort, a near-Storey Stage 6 will be attempted with a carefully crafted pre-test, post-test matched comparison longitudinal quasi-experimental research design, as described in the next chapter.

Chapter 4. Methods

University-based E-ed may indeed increase the stock of US entrepreneurs and bolster economic activity but, as Chapter 3 concluded, this has yet to be empirically proven. Researchers in the field have called for more rigorous, theory-driven research, longitudinal/archival-data research, better/more research into the origins and antecedents of entrepreneurship, more E-ed process-oriented research, and more impacts studies.

This study therefore had two objectives. First, I attempted to conduct a methodologically sound evaluation of a large southeastern university's long-running and respected entrepreneurship education (E-ed) programs for undergraduate and graduate students. In addition, I attempted to contribute to theory by testing a theoretically-grounded causal model (the E-Correspondence Model) of entrepreneurship and its operating mechanism (personal and contextual) precursors of a continuum of entrepreneurial event outcomes from propensities to behaviors to successful startup ventures. The ultimate research objective was to help provide a methodologically sound understanding of whether and how E-ed programs contribute to increased entrepreneurial activity and ultimately social and economic development.

I. Hypotheses

The study tested three hypotheses and two exploratory questions:

- H1: Undergraduate and graduate E-ed students (U-ed and G-ed) will exhibit significantly higher entrepreneurial outcomes (e.g., higher intentions, enterprising behaviors, and start-

up activity), than a matched comparison group of students who have not participated in E-ed (No E-ed group).

  - H1a: Undergraduate UEng students will exhibit significantly higher entrepreneurial outcomes (e.g., higher intentions, enterprising behaviors and start-up activity), than a matched comparison group of students who have not participated in UEng (No E-ed group).
  - H1b: Undergraduate UBiz students will exhibit significantly higher entrepreneurial outcomes (e.g., higher intentions, enterprising behaviors and start-up activity), than a matched comparison group of students who have not participated in UBiz (No E-ed group).
  - H1c: Graduate GBiz students will exhibit significantly higher entrepreneurial outcomes (e.g., higher intentions, enterprising behaviors and start-up activity), than a matched comparison group of students who have not participated in GBiz (No E-ed group).

- H2: The effect of E-ed on entrepreneurial outcomes will still be statistically significant after controlling for various demographic and personal characteristics.
- H3: The effects of UE-ed and GE-ed on entrepreneurial outcomes will be mediated by endogenous psycho-social-cognitive mechanisms, including knowledge, skills, entrepreneurial self-efficacy, and other personal characteristics.

In addition, the study addressed the following exploratory questions:

1. What motivations, factors and influences do entrepreneurs attribute their willingness to establish a new business to?

2. What motivations, factors and influences do entrepreneurs attribute their success to?

II. Research Design

Because of the unique availability of some pretest data for the undergraduate alumni group, slightly different designs were used. For undergraduates, the study employed a pre-test-post-test matched comparison group quasi-experimental design (Shadish et al, 2002). The pretest involved self assessment on entrepreneurial KSA items gleaned from a freshman survey administered to all incoming undergraduates. For the graduate alumni group, the study employed a post-test-only matched comparison group quasi-experimental design:

Table 5. Type of Quasi Experimental Design by Study Group

Undergraduate Alumni Study Group	Graduate Alumni Study Group
Pre-Test Post-Test with Matched Comparison Group	Post-Test Only with Matched Comparison Group
NR O1 X_1 O2 NR O1 O2 --- NR O1 X_2 O2 NR O1 O2	NR X_3 O2 NR O2

The treatment group thus consisted of *all* the Southeastern University's graduate and undergraduate E-ed alumni over a 12-14 year period. In order to reduce selection threats to

internal validity, these individuals were compared to a comparison group based on a variety of matching demographic characteristics including (in rank order): year enrolled, degree level, gender, race, college of major, age, and GPA. The E-ed sample and their matched controls were sent a "career-follow-up" survey participation request and questionnaire via email or regular mail and asked to provide information about their career and workplace experiences and preferences since graduation.

III. Setting

The research setting was a major state university with prominent engineering program in the Southeastern U.S. This university is embedded within a high-tech region of the US and is known for its technology focus and generation of high-tech spin-outs from University research. Recently, the University adopted a campus-wide entrepreneurship initiative. While high-tech entrepreneurship has always been a priority of several University departmental programs, it has within the past year become a prominent focus of the university.

Two university entrepreneurship programs, one at the graduate level offered by the business school, and the other an undergraduate engineering elective, have gained international prominence as model programs for teaching high-tech entrepreneurship. In addition, undergraduates may take a popular introduction to entrepreneurship business course. Pedagogically, the courses are a-typical in that they all involve, to some degree, an andragogical approach that is applied, experiential, relevant, and problem-centered. The high-tech focus of the graduate program is especially unusual as a business school/MBA

degree elective. While the programs have been in place since the mid 1990's, no systematic, longitudinal evaluation has ever been conducted on program outcomes.

IV. Treatments: E-ed Interventions

The university-based E-ed programs have each been in operation since 1994/1996 (undergraduate programs) and 1995 (graduate program) and offer an ideal opportunity to examine the long term effects of three E-ed modalities and compare results. While the undergraduate business course is oriented toward facilitating entrepreneurial mindsets and activities at the individual level, the undergraduate engineering E-ed program and the graduate level high-tech business school program have distinctive team-based modalities that differ significantly from the four conventional E-ed approaches--war stories, case study, business planning, and generic action/role playing-- identified by Lee et al., 2006.

These latter two programs have a technology focus, although they differ significantly in their respective approaches to technology-push/ market-pull. While the undergraduate engineers identify customer needs and invent/design/build a product accordingly, the graduate students are given a technology (often a patent) and they identify optimal technology-product-market commercialization opportunities. In both programs, however, student teams design new products, identify markets, write business plans, present to real venture capitalists, and create launchable companies. In addition both programs teach basic business fundamentals, provide each team with mentor entrepreneurs, and expose students to successful alumni, social networks, venture capitalists, intellectual property experts, attorneys, marketing professionals, and other key regional contacts.

Two of the three programs are taught by full professors with entrepreneurial experience, (not the undergraduate business course), and all are taught during fall and winter semesters (about 14 weeks). They differ in population, given that two are taught at the undergraduate level (business and engineers) and the other at the graduate level (MBA students), and course content varies accordingly. For example, because the undergraduate engineering program is a senior design capstone course, the deliverable emphasis is primarily on a product prototype, with business plan/investor pitches being of secondary importance. The graduate course deliverable is the executable business plan and investor presentation. Thus for these two courses, instruction modalities are completely different even while course objectives (technology product development and commercialization) are identical.

While the two business programs (undergraduate and graduate) have endeavored since inception to attract students from across the university, the undergraduate engineering program was broadened in 2002 to attract students from outside engineering. Still, the vast majority of students in all programs come into the course from within the discipline.

All the programs are grounded in the research by their emphasis on "hands-on experience" (Stumpf et al., 1991). Students are exposed to problem solving and strategies for dealing with ambiguous and complex situations (McMullan & Long, 1987), as well as mastery experiences, opportunities to act entrepreneurially, and exposure to real-life entrepreneurs (Cox et al., 2002).

Dosage levels of the three programs was variable, with nearly all of the undergraduate engineers participating over two semesters, the first semester focused on ideation and customer development and the second semester involving the creation of a prototype and

business plan. (Some students also completed a 1-credit course prior to their capstone experience where they served as "employees" on an upperclassmen team's capstone project). Most of the graduate students also participated two semesters, with both semesters engaged in an iterative technology-product-market-linkage and business planning effort. On the other hand, a minority of the undergraduate business students participated beyond one semester (two additional courses were briefly made available to business undergraduates but not until the last two years of the survey period).

A. The Undergraduate E-ed Programs

The undergraduate E-ed program for engineers' website describes the program as follows:

The program is a full-immersion environment for new product development that has been holistically designed to improve the overall undergraduate educational experience. This is accomplished by involving undergraduate students from all grade levels and all engineering and science disciplines in the prototyping of new products. These new products are the ideas of seniors who are fulfilling their senior capstone design project requirements. The seniors run their design projects as virtual start-up companies that are proto-typing their first products. They serve as the executives in their virtual companies where they organize, research, design, prototype, test, and document their new product and business ideas; the underclassmen serve as their virtual employees…This (startup simulation) methodology provides the students more in-depth knowledge of topic areas critical to successful new product and business development. These areas include leadership,

management, project planning, marketing, sales, operations, organizational behavior, financials, corporate formation, business planning, and intellectual property. Lastly, high technology product developers, entrepreneurs, and business professionals mentor these students and review their completed products and business plans.

Approximately 700 students completed the program through 2007. Of those a handful are known to have started one or more companies they later sold for millions of dollars, according to program administrators.

The business school's undergraduate E-ed course is, like the engineering course, a 400 level course (at least Junior standing is a pre-requisite). However, the course employs a very different curriculum from the andragogical technology-focused undergraduate engineering course described above, and is closer to the approach conventionally taken in undergraduate entrepreneurship education. While the course is taught in conventional lecture format, the focus is on student development of an individual entrepreneurial perspective via exposure to the elements and application of the entrepreneurial process. Students focus on their own talents and aspirations, learn about entrepreneurship, practice problem-finding and solving, and begin to develop and apply entrepreneurial mindsets. Topics include business planning, entrepreneurial opportunities and strategies, structuring and financing a venture, managing growth and risk, and intrapreneurship. Faculty endeavor to coach, rather than "teach", and students are introduced to mentors, investors, and other local entrepreneurial network resources. The course culminates with each student developing a business plan. Approximately 400 students completed the course from 1996-2007.

B. The Graduate E-ed Program

The graduate E-ed program is offered as part of a technology commercialization concentration of the business school's MBA program. Full completion of the program requires a two-course sequence. The focus of the program is to educate business and technical graduate students in technology entrepreneurship and commercialization. Like the undergraduate Engineering program, the graduate business program takes a experiential simulation approach to teaching the technology commercialization process. The program taps into technologies developed within the university, as well as intellectual property owned by local companies, research labs, and the Federal government that has yet to produce viable commercial products. According to the program's website:

Working in teams, students research markets, talk with potential customers, and draw up business plans for their firms. Instructors have created a comprehensive methodology to teach the process of starting a technology-based business, with a focus on finding a product within the technology to best meet market needs. Some class projects later make the jump from hypothetical to reality.

Approximately 400 students have participated in the program since its inception in 1995. The program has influenced the commercialization of more than a hundred technologies, helped to raise more than $120 million in venture capital, and created more than 300 new jobs in the region, according to program administrators.

V. Sampling (Participants and Matched Controls)

The survey sampling procedure involved the identification in University records of all individuals who, as part of their course of study, had taken either of the three treatment courses/course sequences (the undergraduate engineering entrepreneurs course (#1), the undergrad business entrepreneurship course (#2), and the graduate course (#3) beginning the fall semester of 1994 up until the fall semester of 2007. The records identified 1,417 participants (with contact information) of which 684 participated in program #1/UEng; 343 participated in program #2/UBiz; and 390 participated in program #3/GBiz. For each of these individuals, two matches (control subjects) were randomly selected from the cohort of non-E-ed comparison alumni identified by the matching algorithm. Recall that the match was made on characteristics that included year enrolled, degree level, gender, race, college of major, age, and GPA.[7] Once the treatment population was matched with two alumni who were similar in every way except that they had *not* taken any of the E-ed courses, the complete sample frame was sent to the alumni office, which provided the latest contact information (both mailing address and email address, if available) for each subject.

The university identified 1,307 control matches for program #1/UEng; 631 control matches for program #2/UBiz; and 700 control matches for program #3/GBiz with contact information. All together the sampling procedure identified 1,147 treatment subjects and 2,638 control subjects for the study, for a total of 3,785 with contact data; (4,113 including an

[7] While the computer selected two matching individuals, sometimes the computer selected the same individual for more than one match, which is why the 2:1 control/treatment ratio is only a close approximation

additional 328 subjects who had missing or multiple program-level data fields, and thus were categorized as "other" until their actual response clarified their program status).

VI. Data Collection

About half of the subjects had email addresses listed. For cost reasons, I decided to divide the sample in half, with those with email addresses receiving the web-based version of the survey instrument first via email, and the remainder (those with no email addresses—or those with bad email addresses) receiving the mailed survey in hard copy. The survey was emailed to 2,195 subjects. Of these 460 either bounced, the recipients had previously opted-out of receiving email surveys, or were returned as undeliverable for a total email mailing of 1,735.[8] The survey was bulk mailed to 2,301 subjects. Of these 60 with bad addresses were returned, for an assumed total mailing of 2,241.[9]

Multiple contacts and follow-ups were made to both groups of respondents in an attempt to increase the return rate. The initial invitation to participate consisted of a cover email/letter from the University's Vice Chancellor of Extension and Engagement, requesting their participation in this important initiative. In addition, participants were incented to participate by their automatic entry into a drawing for a free Ipod Nano, (which was awarded to a respondent via random number generator) at the conclusion of the data collection phase. For those who received the emailed version of the survey, three reminders were sent,

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[8] It turned out that most of the subjects who had bad email addresses *also* had mailing addresses and those addresses were added to the hard-copy mailing.

[9] The bulk mail rate did not include return-to-sender and so the actual number of Post Office non-deliveries is not known.

approximately ten days apart. For those who received the mailed survey, two post card reminders were sent approximately 14 days apart. The post card included the web address of the online survey in the event the subject's hard copy had been misplaced. Every effort was made to ensure that the contact and follow-up procedures used to contact respondents and collect data was equivalent between the E-ed and comparison group conditions by method (email and postal mail). Consistent procedures between methods were employed where possible/practical. The primary procedural difference being, in leu of a second snail mailing of the hard copy survey (which was cost-prohibitive), non-respondents who had a mail address but no email address only received the two reminder postcards.

VII. Instrument

The survey instrument was constructed as both a paper questionnaire and a web survey. (See Appendix B for a hard copy of the questionnaire). Post hoc analyses was conducted to determine if return rates differed by method of data collection (they did not). The survey instrument included questions crafted around each of the measurement variables (dependent variables, covariates, and mediator variables). The instrument received IRB approval and the web version of the survey was pretested on 70 test subjects, including university faculty, students, entrepreneur service providers, local entrepreneurs, incubator company employees, business executives, and other professionals, with 38 responses received and no problems identified.

The survey instrument asked respondents (both treatment and control) to describe their career and workplace experiences post-graduation. (In order to preclude social

desirability bias, the survey was not labeled an "entrepreneurship" survey per se). Respondents were asked to indicate the number and types of entrepreneurial courses they took, to report on factual data with regard to their backgrounds, local context, career histories, workplace preferences, and entrepreneurial intentions, activities, and accomplishments and to self-assess along psycho-cognitive and social-cognitive dimensions and self-efficacy (both in general and in entrepreneurial tasks). The instrument's measurement variables are described in detail next.

A. Measures

A variety of measures were collected from and about respondents including treatment vs. control group membership (independent variables), e-activity outcome measures (dependent variables), control measures (covariates), mediators (endogenous psycho-social-cognitive mechanism variables including knowledge, skills, and self-efficacy variables) as well as exogenous contextual and personal characteristic variables. Some of the data collected was descriptive to facilitate drill-down and qualitative exploratory analysis.

In the following sections the measures will be described in depth in terms of associated constructs, goodness of fit with these constructs (alpha values), source, and application. Exploratory factor analysis was conducted on all of the scale variables to validate their psychometric properties. The analysis involved preliminary runs to determine the number of factors produced, and a look at the variance explained by each factor, (default Eigenvalue =1, fixed to number of variables). Then the analysis was re-run based on the number of factors that made sense, and forced to the lower number (e.g. 3, or 4).

Two primary independent variables were employed (treatment vs. control) for the undergraduate and graduate alumni. The primary independent variables were used to test the research question—are there differences in entrepreneurial outcomes between those who received E-ed and those who did not? Do alumni who participated in undergraduate and graduate E-ed programs engage in more entrepreneurial behaviors and activities than matched non-alums post graduation? After testing that question, two additional hypotheses were tested: 1) were there differences at the program level between groups? And, 2) If so, what were the causal mechanisms that explain *how* E-ed works where it works?

Three kinds of dependent variables (9 DV's in all) measuring entrepreneurial outcomes were used: entrepreneurial intentions, startups and startup activities, and enterprising behaviors (intrapreneurship, new product development, nonprofit, and artistic creation and sale). All of the DV's were either continuous or ordinal metrics, with the exception of Startups which was measured three ways (in support of internal validity): continuous, ordinal, and dichotomous. One summary-level continuous DV was derived by summing all of the respondent's responses on the other DV's to allow for advanced statistical analysis and strengthened inferential power (Shadish et al., 2002).

Covariates, primarily demographic variables known to correlate with entrepreneurialism, were also utilized. Covariates were of two types: the demographic variables used in the matching algorithm that created the control groups (major, age, degree, for example), and statistical controls (group differences resulting from response bias or from self-selection bias identified by the pre-test items), as well as indicators associated with

entrepreneurialism suggested by similar studies/the literature (later E-ed, a pre-college business, for example).

The study employed endogenous psycho-social mediators hypothesized to be the "mechanisms" of E-ed. There were two kinds of mechanism measures: psycho and social cognitive skillsets and mindsets variables, as well as self efficacy measures. Measures were aligned with the feasibility constructs depicted in the theorized E-Correspondence model (See Figure 2, p. 42). Likewise there were two kinds of exogenous mechanisms: 1) personal characteristics (including person-workplace-fit personality and ability metrics theorized by the model), and; 2) other demographic and contextual variables. Qualitative data on intrinsic and extrinsic motivations (desirability) was also collected for exploratory analysis.

To facilitate the discussion framework, see the summary table of metrics (Table 6.) below:

Table 6. Summary of Measures

Variable Type	Variable Name	Variable Descriptor	Measurement Kind
Independent (IV_1)	Group Treatment 1, Control 0	Treatment vs Control Whole Group	Categorical Dichotomous
Independent (IV_2)	UEng	Undergraduate Engineering Treatment vs Control	Categorical Dichotomous
Independent(IV_3)	UBiz	Undergraduate Business Treatment vs Control	Categorical Dichotomous
Independent(IV_4)	GBiz	Graduate Business Treatment vs Control	Categorical Dichotomous
Dependent (DV_1)	Intention	Entrepreneurial Intentions	Continuous (Scale)
Dependent (DV_2)	Er Entrepreneur	In Process (Nascent) or Started a Business	Continuous Ordinal
Dependent (DV_3)	ErDichot	Self Employed or Startup Y or No	Categorical Dichotomous
Dependent (DV_4)	ErEntStartUp	Instrumental Initiator or Supporter of New Co. or Startup	Continuous (Scale)
Dependent (DV_5)	EntNonStUp	Enterprising Behaviors (Intrapren./Nonprofit)	Continuous (Scale)
Dependent (DV_6)	EntProdDevl	Instrumental Initiator or Supporter New Prd, Process, Service	Continuous Ordinal
Dependent (DV_7)	Enterprising Workplace	Employer a startup, spinoff, R&D	Continuous Ordinal
Dependent (DV_8)	RawAllContinDV	Sum of all above Entrepreneur and Enterprise DV's	Continuous (Scale)
Dependent (DV_9)	Art	Created and sold work of art	Categorical Dichotomous
Match Covariates	Gender, Age, Major etc.	Demographic	Categorical & Continuous
Statistical Covariates	Pretest, Prior SU, Later E-ed	Pre-test Prior Startup Later E-ed	Categorical Continuous
Mediator (Med_1)	BizSkills	Hard Skills Mechanism	Continuous (Scale)
Mediator (Med_2)	GenSoftSkills, GenCogCommunication Skills	General Soft Skills/Academic Knowledge Mechanism	Continuous (Scale)
Mediator (Med_3)	Network	Networking Skills Mechanism	Continuous (Scale)
Mediator (Med_4)	SESoftEship	General (Soft) Self Efficacy	Continuous (Scale)
Mediator (Med_5)	SESHardEship	Entrepreneurial (Hard) Self Efficacy	Continuous (Scale)
Contextual (IV_5)	AgeFirstJob	Age First Job	Continuous
Contextual (IV_6)	FamErScale	Family Entrepreneur	Continuous
Personal (IV_7)	FinAutonSuperRC	Autonomy Workplace	Continuous (Scale)
Personal (IV_8)	FinRiskRw	Risk Workplace	Continuous (Scale)
Personal (IV_9)	SetbackRespons	Setback Response	Nominal
Personal (IV_{10})	CreativeAdaptFactor	Creative Adaptive Personality	Continuous (Scale)
Personal (IV_{11})	ProactiveTenFactor	Proactive Tenacious Personality	Continuous (Scale)
Personal (IV_{12})	SelfConfidSk	Self Confidence	Continuous (Scale)

Independent Variables (IV's): E-ed Program

While the independent variables were collected directly from University records showing UEng, UBiz, or GBiz course enrollment on a student's official transcript, the reliability of treatment group membership was confirmed (with near perfect correspondence) on question A3 of the questionnaire (See Appendix B): "Did you take courses at NCSU with a focus on any of the following topics: product development, product/technology commercialization, entrepreneurship, intellectual property/patents, small business development?"

Dependent Variables: E-Outcome Activity Measures

As was discussed earlier, at this relatively early stage in the discipline's development, few E-ed outcome measures have been developed and rigorously tested. Given the difficulty (and paucity) of long-term studies, most of the research has focused on short-term psycho-social outcome measures ("self-efficacy" and "entrepreneurial intent", for example). The longitudinal nature of this research study allows for additional concrete entrepreneurial activity measures including: 1) entrepreneurial intentions, 2) enterprising activities, 3) venture startups (small, large, and technopreneurial businesses). In addition, several business success outcome measures (number of new businesses started, revenues generated, and jobs created) were collected for exploratory research purposes. The latter measures have all previously been developed and used extensively in the empirical research.

Chapter 1 described how the construct of entrepreneurship has been variously interpreted to include a person, a process, and an action, and as a result definitional consensus has yet to emerge. It is the opinion of the author that a distinction between

"enterprise" and "entrepreneurship" might enhance definitional clarity and facilitate the identification and measurement of the e-outcomes of E-ed. Recall the following definitions:

Enterprisers are the set of individuals who creatively initiate, evaluate, and organize to exploit opportunities under conditions of uncertainty.

Entrepreneurs are the set of individuals who creatively initiate, evaluate, and organize to exploit wealth-creating business opportunities under conditions of uncertainty.

Entrepreneurs can be either imitative (business) or innovative (technopreneurial). While other studies have either lumped enterprisers in with entrepreneurs, or have ignored enterprisers altogether, this research study proposes to identify each of the above types of entrepreneurial behavioral outcomes on the basis of self-reports. Furthermore, the 9 E-ed DV's allow for more granular analysis (albeit with small cell sizes) of the different kinds of entrepreneurs. The inclusion of a "Summative" DV measure that added each respondent's E-outcomes into a total score provided two distinct advantages. It mitigated the small cell size problem; and, by assigning each respondent an E-outcome score, it allowed for the addition of a continuous criterion variable, allowing for more advanced/higher power analysis (beyond the conventional logistic regression most commonly utilized by researchers in the field). The outcome DV measures are detailed next.

Entrepreneurial Intentions (DV_1)—The survey measured the outcome of entrepreneurial intent with a single continuous measure for those who answered "no" to having launched or currently in the process of launching a startup. While most similar

studies measure intent dichotomously, (yes or no), several have used multiple-question scales to measure entrepreneurial intentions. The Intentions measure was previously utilized and validated by Cooper & Lucas (2006). The question (See Questionnaire, Q. I.-4, Appendix B) asks about the respondent's future plans and whether they strongly disagree to strongly agree to a series of four statements including: "The idea of a high risk/high payoff venture appeals to me," and, "I often think about ideas and ways to start a business."

The responses to this continuous variable were coded from 1 (Strongly Disagree), 2 (Disagree), 3 (Neither), 4 (Agree) to 5 (Strongly Agree); 486 out of 603 respondents answered this particular question (non-entrepreneurs). Exploratory factor analysis was conducted of the 4-item "Intentions" scale to confirm the Cooper & Lucas (2006) validation. Listwise deletion was employed. Exploratory factor analysis confirmed a single factor, with the first factor explaining 69.7% of the variance. All items loaded on the single factor above .8. Cronbach's Alpha of .9 confirmed the measure's reliability, as shown in Table 7. below:

Table 7. EFA Output for "Intentions" Factor

	Item	Factor 1
Q I1	IntentSee Opportunity	.843
Q I2	IntentIdea Appeal	.843
Q I3	IntentOften Think	.835
Q I4	IntentTake Risk	.818
	Eigenvalue	2.786
	% Total Variance Explained	69.653%
	Reliability (Cronbach's α)	.855

Entrepreneurial Startups (DV_2, DV_3, DV_4)—A few research studies have employed E-activity outcome measures (Brown, 1990; Kolvereid & Moen, 1997; Charney & Libecap,

2000; and Menzies & Paradi, 2002). As a general rule, these outcome measures involved counting the number and types of businesses started, the longevity of the businesses, size of revenues/profits, and the number of employees. Only one of the studies (Charney et al., 2000) differentiated between technopreneurial businesses and other kinds of start-up ventures. The current study attempted to take a more complete and multivariate approach to measuring entrepreneurial activity.

Start up activity. The study utilized three cross-validated measures to identify alumni who have started businesses. The first measure (DV_2) identified business entrepreneurs as being individuals who were both founders and owners of a new business enterprise. Respondents were asked if they have founded and owned a small business (that was not a new division, branch office, franchise, or nonprofit)? Response choices were Yes, No, or currently in the process of starting my first business (See Questionnaire, Appendix B, Q. H5.1-3). The responses to this ordinal variable were coded: 0= (H5.3 /Non-entrepreneur), 1= (H5.1/Nascent entrepreneur), and, 2= (H5.2/Entrepreneur).

Recall from the literature that the most common hard entrepreneurial outcome is a yes/no question (dichotomous measure): have you started a business? In this study, a "yes" answer to H5.2 above, combined with a "yes" answer to Q. $B1_9$ "self employment" created the study's dichotomous "Entrepreneur" measure (DV_3):

The final Startup/Business entrepreneurship variable (DV_4) was a factor derived from the Enterprise Variable Q. H2, (see Table 8 below). Respondents self-reported whether they were an "instrumental initiator of" or "supporter of" or "not involved" in a New Company

and/or New Business Startup. 580 out of 603 respondents answered the question, and reliability of the measure was confirmed at .9 (Chronbach Alpha) as discussed next.

Enterprise/ Entrepreneurial Support Activities (DV_5)— Some authors (Cleveland & Cleveland, 2006) have suggested that individuals exposed to E-ed may become more enterprising in their occupations. In addition to entrepreneurial intentions and activities, this study attempted to assess the extent to which respondents have engaged in enterprising activities in addition to, or instead of business start-up activities. The enterprise measure (per the definition above) included supportive activities facilitating business start-ups as well as workplace function and enterprise ("intrapreneurship") and nonprofit enterprise ("social entrepreneurship") activity measures.

Respondents were asked to indicate whether or not they have ever played an instrumental initiator/originator role, or a supporting role, or no role at all in various enterprising activities over the course of their careers. (See Questionnaire, Appendix X, Q. H2.1-9). The enterprising activity response choices included: New Product, Process, or Service; New Division or Branch Office; New Business Startup; New Governmental Entity; New Business Franchise; New Nonprofit Organization; New Activist Group or Movement.

Respondents who selected Not Involved were coded "0" Non-enterpriser for that category of enterprise. Those who selected Supporter were coded "1" for that category. Instrumental Initiators were coded "2".

Exploratory factor analysis was conducted of the 9-item "Enterprise" scale, which was rationally constructed from common differentiations identified in the literature between "kinds" of startup enterprises, for example, "social"-type enterprises (including nonprofits,

activist groups, and governmental entities), and "business"-type enterprises, (including startups, spinouts, franchises, and intrapreneurial activity). Respondents were asked to indicate their level of participation in each enterprise activity on a 3-point scale, (not involved, supporter/team member, instrumental leader).

Again, 580 out of 603 respondents answered this particular question. Listwise deletion was employed. Principal component factor analysis identified two factors: Factor #1 (Enterprise) consistent with non-startup enterprise creation (including social entrepreneurship) and Factor #2 (Startups) involving business start-ups. Interestingly, Franchise creation and Spin-offs were both grouped on Factor #1, suggesting that they are more closely related to non-profit creation than to small business/startup creation. The first factor explained 25% of the variance and the second factor explained 25% of the variance. However, one item didn't load well on either factor (New product/service creation) suggesting a single-item third factor. A second item (New Division or Branch) loaded fairly evenly across the two factors and was assigned to Factor #1 because it improved that factor's Cronbach's alpha while significantly detracting from that of Factor #2.

Variance explained by the eight-item reconstituted scale was 28% on Factor #1 and 27% on Factor #2. Six items broadly loaded on Factor #1 ranging from .4 (the split New Division/Branch item) to .7 The two items that loaded on Factor #2 (Business start-ups and new company entrepreneur) loaded above .9. Cronbach's alpha of .7 (on Factor #1/Enterprise) and .9 (on Factor #2/Startups).

In sum, the factor analysis identified three entrepreneurial DV's: the two-item Startup measure discussed above (from Factor #2); the six-item Non-startup Enterprise DV (From

Factor #1); and, the new product/process/service intrapreneurial variable, which became a one-item third factor.

Table 8. EFA Output for "Enterprise" Scale

	Item	Factor #1 Enterprise	Factor #2 Startups
Q H2.2	Ent New Company		.908
Q H2.5	Ent New Biz Startup		.887
Q H2.7	Ent New Nonprofit	.704	
Q H2.8	Ent New Activist Gp	.729	
Q H2.9	Ent New Govt. Entity	.705	
Q H2.6	Ent New Franchise	.576	
Q H2.4	Ent New SpinOff	.484	
Q H2.3	Ent New DivBranch	.360	
	Eigenvalue	2.244	2.129
	% Total Variance Explained (Rotated)	28.052	26.614
	Reliability (Cronbach's α) (Both factors combined =.779)	.728	.867

Enterprise/ New Product/Service Development (DV_6)—The item that did not load on either factor in the Enterprise variable (Q. H2.1, New Product, Process, or Service) became a single-item DV measure of enterprise and intrapreneurship.

Enterprising Workplace (DV_7)—The final enterprise measure (an exploratory measure) involved measuring respondents' experiences in entrepreneurial workplaces. Respondents were asked about their current and career employment in order to determine whether they've worked in new enterprises, in organizational areas associated with technology and innovation, or in enterprising roles. Response choices included startup company, spin-off company, brand new branch or division of established firm, or none. In addition they were asked which of the following best describes the functional work area(s),

department or group you've worked in over the course of your entire career. Response options included R&D group; New Product/Process/Service Development and/or Design; among others. (See Questionnaire, Appendix B., Q. B4.1-4 and Q. B5.1-11). The above option selections were coded "1" where an innovative workplace was indicated. Any other answer was coded "0" non-enterprising workplace.

Summary All Enterprise/Entrepreneur (DV_8)—The continuous enterprise/entrepreneur variable was a constructed, summative variable. Respondent's scores on DV's 2-6 were summed, creating a continuous criterion measure.

Art Entrepreneur (DV_9)—Artistic enterprise was measured as a second, single-item DV. Respondents were asked if they have ever created an original work of art (fine art, literature, photograph, drama, music, sculpture, etc.) they have sold for profit? See Questionnaire, Appendix B, Q. H1). A yes answer was coded "1" art enterpriser while "no" was coded "0" non-art-enterpriser.

Covariates

A variety of demographic and other objective variables were collected in order to be able to evaluate whether the two conditions (treatment and comparison) were comparable and, if not, to be used as covariates in an attempt to statistically control for any differences. Covariates were identified as the demographic and stable characteristics used in the matching procedure algorithm as well as other factors that are known to be highly correlated with entrepreneurship. Additional covariate candidates included the pre-measure variables from the Freshman Orientation Survey taken by a subset of the respondents (205) when they entered the university. A number of these variables could be considered associated with

entrepreneurship KSA's. Comparing the undergraduate treatment and control groups within the pre-test cohort on these pre-measure variables offers a unique opportunity to identify differences between the groups attributable to self-selection. Having the ability/opportunity to control for any such covariates in the final analysis will strengthen the statistical validity of the results.

Matching Covariates—The first group of covariates were the objective variables used to create the matched comparison group. These data were collected from the University database. They included: Gender, Major, Year Graduated, GPA, Age, Race, and Degree. Some of these demographic covariates have been found to correlate with entrepreneurship. For example, Roberts (1991) found a young age and advanced education (less than the doctoral level) helped to predict technopreneurship. Menzies (2002) found that while older adults are increasingly likely to be entrepreneurial, those with E-ed became entrepreneurial earlier.

Also, previous research has shown gender to be highly correlated with entrepreneurship, with males more entrepreneurial than females. (Thursby & Thursby, 2005; Ding et al, 2006; Tool & Czarnitzki, 2005; Lowe & Gonzalez Brambila, 2005, etc.). Other research shows that women who do start businesses do so for different reasons than men (Boden, 1996; Carr, 1996;).

Age and gender are often moderator variables; they alter the direction or strength of the relationship between a predictor and an outcome (Baron & Kenny, 1986) such as the effect of E-ed. Since the literature review found both age and gender influences on entrepreneurship, the study evaluated the effects of both age and gender variables a number

of ways, to determine whether they served as potential covariates, mediators, or moderators. (Increased age had a moderating effect, as many studies have also shown; gender had no effect, See Results, Chapter 6).

Race (immigrant status in particular, see below) can also correlate with the e-outcome dependent variables (Fairlie, 1996) and thus the matched controls were matched to treatment alumni on these covariates as well.

Statistical Control Covariates—Statistical control covariates were also employed both to validate the matching procedure and to control for other variables that are known to correlate with entrepreneurship but that were not known when the samples were drawn. For example, the literature review identified extra curricular and post-graduation E-ed experiences as well as the existence of a business prior to enrolling in E-ed as potential confounds to E-ed outcome evaluation research (Charney et al., 2000). A number of covariate questions designed to control for both of these confounds were included in the survey instrument. Questions A4 and A5 in the Questionnaire (See Appendix B) asked if the respondent received additional formal business related education after graduating from NCSU and what kind of education? Those who said yes, and selected Entrepreneurship, were coded "1" and "0" if otherwise. (The wording of Q. A5 included multiple options to prevent social desirability bias which might occur if the respondents knew that entrepreneurship education was the particular interest).

In order to determine whether an alumni was an entrepreneur *before* taking the treatment E-ed course the respondent's answer to the open-ended question Q. J1 (What year did you launch your first business startup?) was compared to the year of their University E-

ed course. If the year entered in Q. J1 (See Questionnaire, Appendix B) was prior to the course year in the University database they were coded "1" for prior startup or "0" for no prior startup found.

Pre-measure Covariates—The research study employed pre-measures, which were collected from 205 participants who completed a freshman survey upon admission to the university. As my empirical literature review demonstrated, none of the extant E-ed evaluations included both premeasures and a comparison group. Some of the items on the freshman survey involved a self-assessment on various knowledge and skill domains that serendipitously happened to coincide with several general entrepreneurial self-efficacy domains identified in the literature

The pre-test measures included self assessments of general academic and communications psycho-cognitive skills (speaking, writing, critical analysis) as well as soft social-cognitive skills (leadership, time management, teamwork, handling stress, and coping with change). Additional pre-measures involved personal characteristics including self confidence, realizing one's potential for success, self discipline, and planning and carrying out projects independently. These endogenous mechanism variables were among the hypothesized mediators that make E-ed work, and thus each was also included on the post-test completed by all respondents. (The existence of identical pre and post measures in a longitudinal study greatly enhances the internal validity of the metrics and the overall validity and reliability of the results, as was discussed in Chapter 3). Each of these endogenous pretest-post-test variables will be described at length in the Mechanism sections below.

Hypothesized Endogenous Mechanisms: Predictors and Mediators

Self Efficacy is defined as "people's judgment of their capabilities to organize and execute courses of action required to produce given attainments." (Bandura, 2006). Self-efficacious individuals have confidence that they have the specific talents and abilities to succeed along a specific career path, as shown by Betz and Hackett's (1981) research connecting educational requirements for a specific career and graduates' expectations that they could successfully perform the requirements of a job for that career. (See Chapter 2).

A number of the studies highlighted in the empirical literature review focused on self-efficacy as a key construct: both knowing *how* to do entrepreneurship *and* knowing one will succeed are required for concrete entrepreneurial actualization. (Shapero & Sokol, 1982). Furthermore, consistent with the E-Correspondance model of bounded rationality (adapted from Lofquist & Dawis, 1969, 1991), context is also a factor. (The exogenous personality/ability workplace fit mechanism measures utilized in this study will be discussed in the Exogenous Mechanism section).

Academic Skills—The general knowledge, skills, and abilities (KSA) measures selected for the study came from the University's Freshman Survey. Because many of these metrics have been identified in the literature as associated with entrepreneurship, these measures do double-duty—both as "feasibility" mechanism measures, as well as covariates to establish comparison group equivalence, at least for the undergraduate cohort with the pre-test. Results can then be tested as a "proxy" covariate for the non-cohort group (on post-test), if required. Respondents were asked to "rate your current level of development" on general knowledge, skills, and personal abilities. (See Questionnaire, Appendix B, Q. F.1-

12). The KSA metrics included speaking skills; writing skills; ability to critically analyze events, information and ideas; ability to plan and carry out projects independently; leadership and management; being part of a team, being independent and self-reliant, etc.

Exploratory factor analysis was conducted on the 12-item "General Skills" scale. Respondents were asked to indicate their current level of development on a 5-point scale, (Very Low, Low, Average, High, Very High). Similarly, (see next measure), business-related measures of entrepreneurship (business-specific skills and abilities) were developed with the same 5-point scale. This approach allowed for a combined approach to the factor analysis (e.g. EFA could be conducted for *all* skills and abilities-related measures, both general and business-specific, at once, allowing for improved construct validation of the measures).

594 out of 603 respondents completed the general knowledge/skills self-assessment. Listwise deletion was employed. Exploratory factor analysis identified two general KSA factors, (beliefs related to soft skills (Soft Skills) and beliefs related to cognition, including speaking and writing communication skills (Cognitive/Communication (Academic) Skills). Interestingly, one of the general skills items (Q. F5 Leadership and Management skills) loaded better with the business-specific skills scale items, and thus was removed from the general skills scale. It was replaced by two items from the business-specific skills scale (Q. G2 Take Responsibility for Ideas and Decisions, and Comfort with Technology) that loaded better with the general skills scale items, creating the final general skills scale measure (13-items). The first factor (Soft Skills) explained 24% of the variance, and the second factor (Cognitive / Communication Skills) explained 19% of the variance. Eight items loaded on

the Factor #1 (Soft Skills) .4-.7, and five items loaded on Factor #2 (Cognitive/Communication Skills) .5-.7. Credibility overall was indicated by a Cronbach Alpha of .8, with subscale ratings of .8 for Factor #1 and .7 for Factor #2.

Table 9. EFA Output for "General Skills" Scale Items

	Item	Factor #1 Soft Skills	Factor #2 Academic Skills
Q F1	Speaking Skills		.660
Q F2	Writing Skills		.741
Q F3	Critical Analysis Skills		.661
Q F4	Plan/Execute Independently		.601
Q G2	Responsibility Ideas/Decisions		.456
Q F7	Independent Self Reliance	.431	
Q F8	Teamwork	.643	
Q F9	Cope with Change Skills	.731	
Q F10	Self Confidence	.652	
Q F11	Stress Handling	.720	
Q F12	Realize Potential for Success	.591	
Q G1	Comfort with Technology	.422	
Q F6	Time Management	.388	
	Eigenvalue	3.106	2.419
	% Total Variance Explained (Rotated)	23.891	18.605
	Reliability (Cronbach's α) (All factors combined =.813)	.761	.695

Business Skills—Measures of the business skills required for entrepreneurial self efficacy have been successfully developed in past research. With the exception of the first and last measures, (See Questionnaire, Q. G.1-10, Appendix B) the business skills measures used in this study were derived from specific entrepreneurship task-related capabilities

developed and psychometrically validated by Chen. (Chen et al.,1998). Respondents were asked to self assess on specific business skills and abilities that included: Ability to set and meet sales goals; ability to create new products and services; ability to perform financial analysis; ability to conduct strategic business planning, ability to take responsibility for ideas and decisions, etc.

The business skills measure for each respondent was coded on a 5-point scale, (Very Low, Low, Average, High, Very High). Exploratory factor analysis was conducted of the 10-item scale. Again, two of the items (Q. G1 Comfort with Technology, and Q. G2 Take Responsibility for Ideas and Decisions) loaded better with the general skills scale (as discussed above), while the general skills measure Q. F5 Leadership and Management item was found to be more appropriately included in the business-specific scale measure. 589 out of 603 respondents were included in the analysis of the 9-item reconstituted scale. Listwise deletion was employed (non-respondents were coded "."). Exploratory factor analysis identified a single factor explaining 51% of the variance. The items loaded .7-.8, and Cronbach's Alpha of .9 confirmed the measure's reliability.

Table 10. EFA Output for "Business Skills" for Entrepreneurs Scale

	Item	Factor #1 E-ship Biz Skills
Q G5	Business Planning	.819
Q G8	Market Research	.770
Q G7	Organizational Develop	.746
Q G3	Achieve Business Goals	.722
Q G9	Meet Sales Goals	.687
Q G4	Financial Analysis	.685
Q G10[1]	Decisions under Risk	.677
Q F5	Leadership Management Skills	.651
Q G6	Product Development	.646
	Eigenvalue	4.583
	% Total Variance Explained (Rotated)	50.925
	Reliability (Cronbach's α)	.878

[1]Labelled incorrectly as Q11on the paper questionnaire (a typo).

Networking Skills—Given the theoretical framework of this study, and its emphasis on integrating Shapero's theory with the Theory of Work Adjustment (Lofquist & Dawis, 1969, 1991), a new psycho-social measure was developed based on the work of Debo (2006). Given the maturity of the research on social networking and innovation clusters in the entrepreneurship literature, it is arguably a measure Chen should have included in his research. Respondents were asked if their personal networks included people accomplished in a variety of entrepreneurial abilities as follows:

Q. H4.1-8: Do you know someone directly or know someone who could identify someone else able to accomplish the following (Check all that apply):

- o Incorporate a business
- o Write and file a patent
- o Write a business plan
- o Conduct market research and write a marketing plan
- o Pull together a start-up team
- o Find and lease space and/or equipment for a new business
- o Introduce you to a venture capitalist, angel investor, or other source of financing
- o No; none of the above

The networking skills variable was coded "1" for skills 1-7 and "0" for skill 8. A scale with a range of 0-7 was created by summing the options selected (the total number of abilities the respondent is networked to). For example, if three of the options 1-7 were selected, the respondent's E-network score was "3"; it was "7" if all the skills were selected.

*Self Efficacy—S*elf efficacy in KSA's is critical for "feasibility." Confidence in the ability to successfully apply one's skills and attain a desired outcome is crucial. The E-self efficacy measure employed in this study was rationally constructed, based on Chen's overall successful approach. It is E-task specific, but at a higher conceptual level—e.g. I focused less on the specific business tasks (marketing, financial analysis) and more on the overarching tasks required to accomplish the launch of a business. It also incorporates Debo et al.'s (2006) psycho-social emphasis. Respondents were asked how confident they were in their ability to successfully identify new business opportunities, commercialize a new idea or new development, take calculated business risks, think creatively, incorporate a business, finance a new business, etc. (See Questionnaire, Appendix B, Q. H3.1-11).

The self efficacy measure for each respondent was coded on a 5-point scale, (Very Low, Low, Average, High, Very High). Exploratory factor analysis was conducted of the

11-item "E-Self Efficacy" scale. 585 out of 603 respondents answered this particular question. Listwise deletion was employed, and two factors were identified, with the first factor explaining 55% of the variance and the second factor explaining 13% of the variance. However, two items, (SEPatent, and SECommercialize) loaded nearly evenly on both factors. In order to avoid unnecessary overlap of the two subscales these two items were dropped.

Variance explained by the nine-item reconstituted scale was 41% and 29%. Of the nine remaining items five loaded on Factor #1 ("Hard Eship") above .7 and four loaded on Factor #2 ("Soft Eship") above .7. Cronbach's Alpha of .9 (Factor #1) and .8 (Factor #2) and .9 combined confirmed the measures' reliability.

The identification of two sorts of E-Self Efficacy was somewhat of a surprise since the literature has, to-date, commonly utilized only task-specific measures of E-Self Efficacy (Chen). The validation of two separate measures roughly along the lines of hard (tangible) task know-how and soft (conceptual) know-how is a contribution to the literature with significant pedagogical implications (See Discussion, Chapter 6).

Table 11. EFA Output for "Self Efficacy" Scale

	Item	Factor #1 Technical Eship	Factor #2 Soft Eship
Q H3.8	SEFinance NewBiz	.857	
Q H3.9	SELead Startup	.850	
Q H3.6	SEIncorp Biz	.825	
Q H3.11	SESpace and Eqpt	.778	
Q H3.7	SEPull TogTeam	.714	
Q H3.3	SEThink Creatively		.833
Q H3.2	SE New Prod/Serv		.791
Q H3.1	SEID NewOpp		.704
Q H3.4	SETake BizRisk		.647
	Eigenvalue	4.938	1.295
	% Total Variance Explained (Rotated)	40.588	28.677
	Reliability (Cronbach's α) (Both factors combined = .895)	.900	.808

Hypothesized Exogenous Factors: Personal and Contextual Predictors

In Chapter 2, I discussed the importance of Bloom's (1976) affective domain underlying Bandura's self-efficacy construct. According to Bloom, it is the dynamic interaction between the overlapping cognitive and affective predispositional domains, (the latter of which he defined as personal values, attitudes, interests, and self esteem) during the instructional process that results in both cognitive learning outcomes and associated affective outcomes. These affective outcomes help guide feelings about the future (attitudes), feelings of personal worth and success (self-esteem), motivations to become involved in various activities (interests) and personal standards (values). Consistent with this line of thought, Shapero attributes half of the formula for the affective outcome of entrepreneurship to a

personal characteristic (Desirability). Likewise, Carsrud's (2009) extensive effort to "understand the entrepreneurial mind" concludes that motivation may be the most under-researched key variable in the arena of entrepreneurship research. Unfortunately, perhaps due to a dearth of psychologists working in the discipline/the disproportionate influence of business-school-based researchers, research into the personal characteristic antecedents of entrepreneurship has fallen into disfavor. One theory as to why is that non-psychology researchers perhaps prematurely concluded that trait-based research (involving stable characteristics that largely remain unchanged over the course of a lifetime) are all there is to the discipline. In reality, many personal characteristics are psycho-social. They remain in flux over the course of a lifetime, and are subject to molding and re-molding based on contexts, events, people, and learning.

The theoretical E-Correspondence model (refer again to p. 46) depicts 4 kinds of entrepreneur x situation variable domains circumscribing the "bounded rationality" of the entrepreneur: intrinsic motivation (desire); perceived ability (self efficacy/feasibility), perceived personality workplace fit, and perceived ability workplace fit. Consistent with the model, I hypothesize that there are two kinds of personal characteristics associated with person-workplace-fit: 1) predispositions, attitudes, and values, and; 2) skills and abilities. In addition there is the correspondence of both with workplace organizational cultures. I hypothesized that both are key predictors of entrepreneurial behavior and as such represent critical antecedents of entrepreneurship. Consistent with Bloom's theory, these values and habits of mind *can* be taught.

Personality Fit Variables—The personality predispositions, values, and habits of mind identified in Chapter 2 as associated with entrepreneurs and entrepreneurial behaviors that I hypothesize to be exogenous predictors of successful E-ed outcomes (along with the endogenous knowledge/skills/ability and self-efficacy mediators discussed above) include the creative-proactive-adaptive-persistent personality. These tendencies have been shown to be among the adaptable achievement-related personality characteristics considered to be open to some influence from education (Kolb, 1965; Timmons, 1968; Mclelland & Winter, 1969; Arnoff & Litwin, 1971; Jackson & Shea, 1972 all in Stewart, 1996).

All respondents were asked to self-assess on creative, proactive, adaptive and persistent dimensions. The measures have all been used and validated in other studies and are available for research use (Goldberg et al., 2006). The constructs were defined as follows:

Creative. In the literature, innovation, invention, ingenuity and creativity are frequently used synonymously although creativity is used more often to refer to a creative personality. Some authors contend that creativity can be influenced (Woodman, Sawyer, & Griffin, 1993). Items for this scale were taken from the JPI Innovation Inventory, (JPI:Innovation: ingenuity), alpha .84.

Proactive. A proactive person is one who takes initiative, is self-motivated, industrious and achievement oriented. It is a predisposition but is subject to modification via education, incentives, and punishment in a society that frowns on sloth and laziness. Items for this scale were common to both the IPIP Six Factor Personality Questionnaire (6FPQ

Achievement Striving), alpha .82 and the IPIP derived from Clononger's Temperament and Character Inventory (TCI Industriousness), alpha .78

Adaptive. In the literature an adaptive person can adeptly handle change and uncertainty (roll with the punches). An adaptive person may be less susceptible to anxiety and stress-related afflictions. This construct is associated with tolerance for ambiguity. Items for this scale were common to both the IPIP derived from Clononger's Temperament and Character Inventory (TCI Variety-seeking), alpha .80 and the IPIP Six Factor Personality Questionnaire (6FPQ Openness to Experience), alpha .80.

Persistent. In the literature a persistent person has tenacity and resolve. He/she won't give up easily on an attempt to meet a goal or objective, and will persevere in finishing what they start in spite of difficult obstacles. Items for this scale were taken from IPIP-Values in Action (VIA): Peterson & Seligman, 2004 Industry/Perseverance/Persistence Index, alpha .81.

Respondents were asked to characterize themselves by using a likert scale (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree) in response to a series of items. Creative subscale items included: "It takes me longer to recognize possibilities"; "I think up more new ways of doing things," etc. Proactive subscale items included: "I set high standards for myself and others"; "I do more than what's expected," etc. Adaptive subscale items included: "I dislike beginning new things"; "I prefer routine to variety," etc. Persistent subscale items included: "I finish things despite obstacles in the way"; "If I make a decision I stick with it" etc. (See Questionnaire, Appendix B, Q. E1-12).

Some of the measures were reverse-coded (questions were constructed in both the affirmative and negative) in order to avoid test-taking fatigue bias. Exploratory factor analysis was conducted of the 12-item "Personal Predisposition" for entrepreneurship scale, and 575 out of 603 respondents answered this particular question. (The relatively larger number of missing data on this question compared with the others was due to this item being the last bank of questions on a fairly long survey). Listwise deletion was employed. Principal component factor analysis identified two factors with Eigenvalues >1, although a third, weaker factor was suggested by a third Eigenvalue just below 1 (.980). The two main factors combined the hypothesized 4 constructs (Proactive, Tenacious, Creative, and Adaptive). The first factor consisted of the Proactive and Tenacious items while the second factor consisted of the Adaptive and Creative items, (with the exception of item E9 "I am less concerned with the possibility of failure when taking on something new," which loaded with the Adaptive and Creative items, requiring a correction of the item's underlying construct from Tenacious to Adaptive/Creative). A second item (Creative, "I think up more new ways of doing things") loaded fairly evenly across the two factors and was assigned to Factor #2 because it improved that factor's Cronbach alpha while detracting from that of Factor #1. A single hypothesized Tenacious item (Decisiveness--When I make a decision I stick with it) loaded strongly (.834) on the third factor. The first factor explained 23% of the variance, the second factor explained 18% of the variance, and the third factor explained 9% of the variance. However, because the third factor consisted of only a single measure, the decision was made to discard it from the scale, given that it would be better suited as a single measure in the analysis. Variance explained by the 11-item reconstituted scale was 23% on Factor #1

(Proactive/Tenacious) and 21% on Factor #2 (Creative/Adaptive). Four items (3 Proactive, 1 Tenacious) loaded on Factor #1 at .6-.8 levels. Seven items loaded on Factor #2 (3 Adaptive, 3 Creative, 1 Adaptive-Creative) at .4-.7 levels. Credibility overall was indicated by a Cronbach Alpha of .8; the subscale alpha ratings were .7 for Factor #1 and .7 for Factor #2.

Table 12. EFA Output for "Personal Predisposition" Scale

	Item	Factor #1 Proactive-Tenacious	Factor #2 Creative-Adaptive
Q E1	Proactive High Standards	.761	
Q E3	Proactive More Than Expected	.718	
Q E12	Proactive Achieve Goal	.701	
Q E7	Tenacious Finish Despite Obstacles	.636	
Q E2	Adaptive Routine vs. Variety		.666
Q E4	Creative Recognize Possibilities		.650
Q E6	Adaptive Dislike Beginning New		.621
Q E10	Creative No Structure, Supervision		.594
Q E11	Adaptive New Situations		.495
Q E9	Adapt/Creative Possibility Failure		.442
Q E8	Creative More New Ways		.436
	Eigenvalue	2.549	2.316
	% Total Variance Explained (Rotated)	23.171	21.051
	Reliability (Cronbach α) (Both factors combined =.754)	.710	.693

Work Preference Fit Variables—Recall from Chapter 2 that the contextual literature suggests that the immediate social and environmental context an individual finds him/herself in can influence entrepreneurial proclivities and activities. Entrepreneurial orientation (EO) research suggests that e-conducive organizational climates are more important than

entrepreneurial personalities in generating entrepreneurial activity (Aamo, 2003 & Jelinek & Litterer, 1995). In another example, Kashdan & Yuen (2007) found that whether highly curious Hong Kong school children thrive academically depends on student beliefs that the school environment supports their values about growth and learning; these benefits can be disabled by perceived person-environment mismatches. Stephan & El-Ganainy (2007) blame context for much of the differences between men and women to engage in entrepreneurial activity and technology transfer activities in university settings. National institutional contexts are also cited for causing differences between nations in entrepreneurship (Hofheinz and Calder,1982; Tan, 2002).

A number of researchers have drilled down on the construct of "Entrepreneurial Orientation" in measuring the characteristics of entrepreneurial organizations. For instance, Coven and Slevin (1991) showed that EO has three dimensions: proactiveness, innovativeness, and risk taking. This conceptualization has been furthered by others including Lumpkin and Dess (1996) and Tan (1996). Since I have hypothesized that E-ed might promote some individuals to pursue or at least prefer enterprising roles within enterprising types of organizations, this line of research appears to have some relevance for my study, especially given it's theoretical interconnectedness with workplace-fit correspondence. Unfortunately, although Coven and Slevin's EO measure has been widely used it had a number of shortcomings for my purposes. First, it's been employed objectively, not preferentially, at the firm-level of analysis. Second, recent research has raised concerns pertaining to the psychometric properties of the measure, specifically, according to Kreiser et al's 2002 study, the dimensionality of the measure (Knight, 1997; Lumpkin & Dess, 1996;

Zahra, 1999) and the independence of the sub-dimensions have been called into question (Lumpkin & Dess, 1996). Second, while Davidsson (2004) endorses using the measure due to its wide adoption, he also expresses serious concerns about its reliability and validity and recognizes some researchers might want to modify or create their own version of EO. Given my interest in developing a psycho-social metric that captures individual preference for a type of work climate, I chose to develop my own EO/person-work fit preference scale utilizing principles of rational construction.

In this study, the EO workplace preference scale includes additional items derived from Hornsby's at al. EO measure (that includes measures of autonomy and work/management climate). (Hornsby et al., 2002) and asks about the respondents preference for a type of work organization.

The constructs underlying the EO preference measure for this study are thus derived from both Covin & Slevin and Hornsby as follows:

Proactiveness. Proactiveness is a workplace that is out in front of the competition in anticipating changes in the market. The construct has both a superior analytical aspect as well as the ability to act quickly so as to be in the position to first and best meet new consumer needs.

Innovativeness. Innovation, which Drucker considered to be the specific instrument of entrepreneurs, was defined by West and Farr (1989) as the implementation of new and different objectives, methods, working relationships and skills in the workplace. Olson (1985) considered invention analogous to innovation (in Stewart, 1996). Again, in the

literature, at the firm level of analysis innovation, invention, ingenuity, and creativity are frequently used synonymously.

Risk Taking. Risk taking propensity is the degree to which the firm is willing to make decisions under conditions of uncertainty; usually this involves taking a calculated risk in order to potentially profit in the long term by investing resources (human, capital, time) that risk downside loss.

Autonomy. Recall from Part V that preference for autonomy, or the preference to work independently with little or no supervision is commonly associated with people who engage in entrepreneurial thinking and action (Lumpkin & Dess, 1996).

The EO workplace preference scale thus measured innovation by a strong emphasis on research and development, technological leadership, and innovation; attaching importance to product and service innovation, and keeping ahead in technology. A Risk Taking workplace climate was measured by a strong tendency for high-risk projects bearing a chance of very high returns, for example. Proactiveness was measured by a preference for long-term proactive goal setting to fulfill potential opportunity, while a climate of Autonomy was measured by preferences for bureaucracy, normative social codes, (Janssen, 2000), and teamwork. Innovativeness was measured by work preferences for radical new ideas rather than the tried-and-true.

Two innovation items, 2 proactive measures, 2 risk-taking measures, and 3 autonomy measures were used, all but three inspired by Covin & Slevin or Hornsby. (See Questionnaire, Appendix B, Q. D.1-9).

The contextual EO work preference measures were coded 1(low) to 5 (high) on a continuum between two opposing constructs. As a semantic-differential scaled variable, the measure did not allow for conventional factor analysis. Scale items were used in the analysis as single measures.

Setback. Given the research prominence of risk-taking propensities both at the firm level and individual levels of analysis an additional personal exogenous item (Setback Response) measured a second component of risk-taking not measured above. The metric was developed not as a self assessment of risk-taking, but as a self assessment of the *outcome* of risk-taking, specifically, and the individual response to taking a risk that results in failure. The measure was developed in response to a great deal of discussion in the literature (see Part V) that entrepreneurs do not differ from others in their willingness to take on risk; they differ in their perspective of risk in terms of fear of adverse outcomes.

Risk taking propensity, or the propensity for assuming risk, is most often defined as comfort level in making decisions under conditions of uncertainty. (Whether this it is a stable or variable personality trait is still in question (Sitkin & Weingart, 1995 in Stewart, 1996). Risk-averse social values have been widely shown to constrain entrepreneurship at any level of analysis (Cleveland & Cleveland, 2006). At the individual level of analysis risk tolerance has also been hypothesized as being related to other personality characteristics such as "optimistically persistent" outlooks (Acs & Audretsch, 2003). "Setback Response" was developed in accordance with logical metric construction methods in consort with similar measures (the Silver Lining Questionnaire, Sodergren & Hyland, 1997; Cardon & McGrath, 2000) to identify optimistically persistent failure response tendencies and silver-lining or

utility response tendencies. IO knowledge theory suggests that while entrepreneurs may be more optimistically persistent, they may also be more likely to "effectuate" and change direction rather than persist in trying the same unsuccessful strategy again and again.

The Setback Response question (See Q. G12.1-7 in Appendix B) asks respondents to describe how they most often deal with devastating setbacks and failures. The response choices included: Focus on the part I did well; Seek comfort from friends and family; Get inspired to try harder; Give up; it was not meant to be; Find a diversion/distraction; and Find a silver lining/way to capitalize on the situation. In this study I hypothesize that entrepreneurs will be more likely to select the latter strategy more often than all of the other strategies, while non-entrepreneurs will be more likely to most often select from the other strategies.

Exogenous Contextual Predictors— Other exogenous measures included contextual psychosocial and known demographic variables that, based on the literature review, are associated with entrepreneurship. Recall that an entrepreneurial family member—e.g., living in a household with an entrepreneurial parent, specifically—is the *most* powerful predictor of entrepreneurship. Roberts (1991), among others, found parents who were self employed significantly increased the likelihood of entrepreneurial offspring. Respondents were asked about parent/family entrepreneurship. Specifically, (See Questionnaire, Appendix B., Q. C4.1-5) respondents were asked to check each family member (mother, father, sibling, or grandparent) who have founded, owned, and managed one or more businesses. This metric allowed for a continuous measure of family entrepreneurship by summing the entries. It also

allowed for drill down research into parental entrepreneurship and whether that parent role model was a father and/or a mother.

Additional contextual metrics included parental education levels (Did not complete high school, High school grad, Some college, Associates degree, Bachelors degree, Advanced degree) and whether the respondent or his/her parents were first generation Americans. (See Questionnaire, Appendix B., Q. C1 and C3.1-6). Recall the research findings of high rates of entrepreneurship among first generation immigrants (Fairlie, 1996).

Because of conflicting research about birth-order, the respondents were asked to indicate their birth order (Only child, first born, second born, third, fourth and beyond). (See Questionnaire, Appendix B., Q. C5.1-5). And to get an idea of the respondent's childhood autonomy in the family home, respondents were asked how old they were when they independently got their first wage-paying job (that was not a job their parents got for them). (See Questionnaire, Appendix B., Q. C6.1-5).

VIII. Hypothesized Model

All of the above measures (Independent Variables, Dependent Variables, Covariates, and Endogenous and Exogenous predictors) have some support in the literature for influencing entrepreneurship. But how do they all work together? If it were possible to develop and empirically test a hypothesized model of their inter-relationships, we would be one step closer to better understanding the workings of the entrepreneurial behaviors that drive economic growth and prosperity.

If entrepreneurship is subject to influence from a number of antecedents, (individual psycho-social-cognitive characteristics and external/contextual technological, economic, cultural, and organizational factors), presumably, each of the conditions of individual/internal and contextual/external antecedent mechanisms reinforce each other and either motivate or impede entrepreneurial proclivities and subsequent action taking.

The study of entrepreneurship is the study of a multi-level construct and systems phenomenon, which calls for a mixed theoretical approach. The operating hypothesis of this study is that *the effects of E-ed on entrepreneurial proclivity, behaviors, and activity is mediated by a number of other factors, including personal predispositions, values and beliefs and other internal variables malleable to education such as attitudes about desirability and feasibility, skillsets, and experiences, as well as by a number of external social and environmental variables including workplace perceptions and preferences.*

Very little is known about how E-ed may or may not influence E-outcomes. This study supports the development of a process theory of E-ed (how it works as an antecedent of entrepreneurship). To the degree E-ed pedagogy can cultivate agentic capabilities — competencies, self regulatory skills, enabling values and beliefs, as well as self-confidence in one's ability to succeed —individuals will be more willing to identify and pursue entrepreneurial activities and careers. Human capital/career theory suggests that knowledge and cognitive skillsets predict career patterns. From the theorized E-correspondence model I further theorize that e-cognition, person-workplace fit characteristics and other contextual variables may predict entrepreneurship. Some of the other antecedent factors grounded in the literature that may also influence entrepreneurship include contextual factors such as family,

culture, outsiders' perceptions, social norms and conventions, institutional and other environmental factors that may be less amenable to educational influence.

In sum, the research suggests that a hypothesized model consisting of a combination of personal predispositions, cognitive skills, knowledge, and abilities, and contextual variables will most significantly leverage E-ed outcomes. For example I hypothesize that increased skills/knowledge competencies and increased self-efficacy will mediate the impacts of E-ed on E-intentions, behaviors, and actions. Further, E-outcomes will vary not only between treatment and control groups but also within the groups as a result of individual differences and contextual factors that can both augment and impede entrepreneurial behaviors

Figure 3 represents a testable model based on the review of the literature, of the inner workings of how E-ed may work through endogenous and exogenous process mechanisms to facilitate E-outcomes. The model contains the factors that are most likely to affect e-outcomes, that are readily measurable, and are hypothesized to be malleable to educational influence. The variables, each of which is extensively supported in the literature as associated with entrepreneurship, are aligned with the boxes in the Bounded Rationality E-Correspondence Model on p. 46 and include: predispositions, person-workplace fit, context, and the knowledge, skills, and abilities (KSA's) that support general and entrepreneurship-specific self-efficacy, as well as KSA "fit" in the workplace. Desire and motivation (both intrinsic and extrinsic) data were also collected on an exploratory basis.

Note that the personal characteristics and their fit in the workplace (the top half of the model) all have exogenous effects on entrepreneurial action (the center box). The bottom

half of the model also operates exogenously on entrepreneurial action; however, E-ed operates exclusively through the lower left feasibility box (the endogenous mechanisms). The testable model is diagrammed below (See Figure 3).

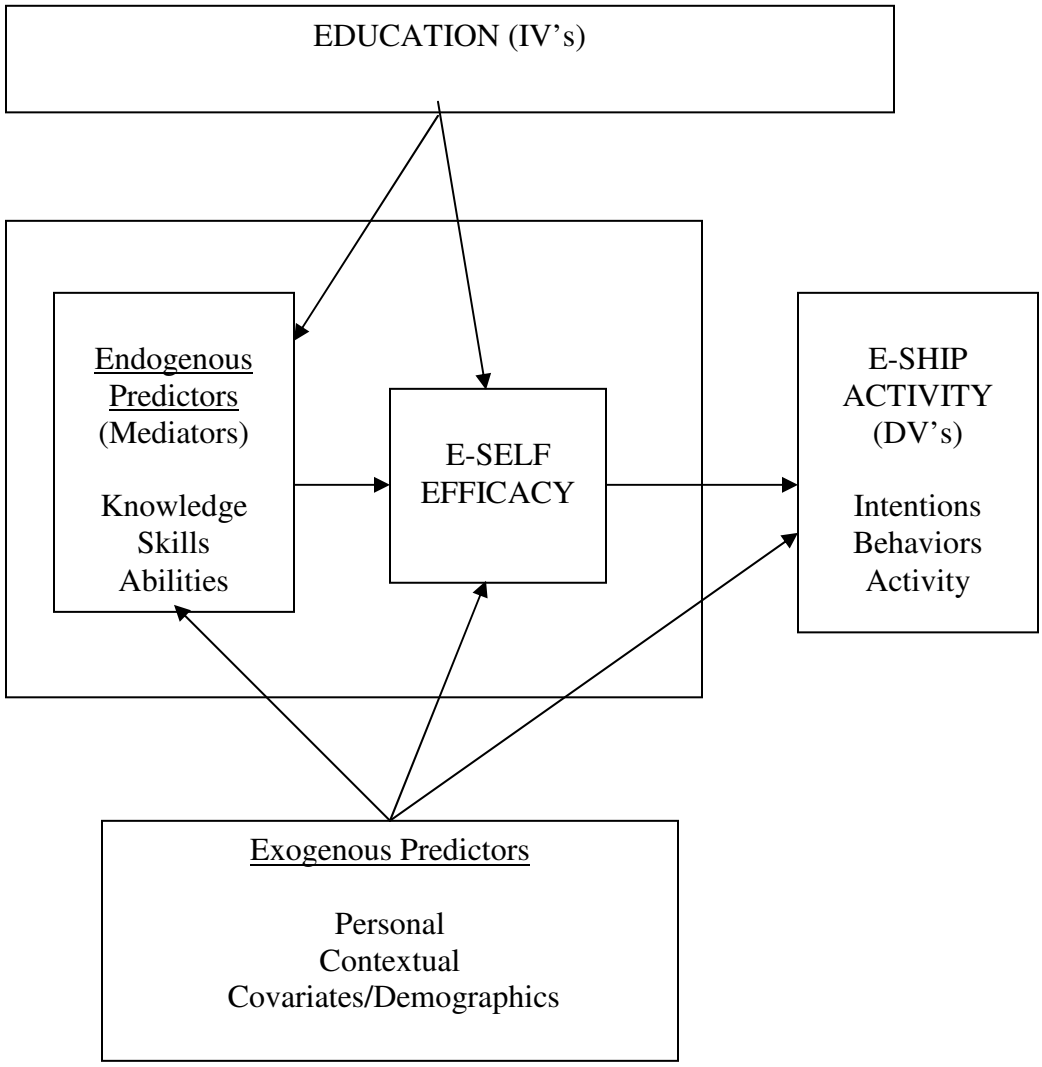

Figure 3. Hypothesized E-ed Process Mechanisms: Testable Model

A. Data Analysis

Answering the research questions first involved bivariate analysis to identify significant predictors across three variable domains (endogenous cognition variables, and exogenous personal and demographic/context variables). Next, each question required a customized regression analysis procedure. The results informed the development of exploratory structural equation models (SEM) which were tested. Insignificant paths were deleted, resulting in a final SEM path analysis/causal model that best fit the data. The process of analysis produced a best-fit predictive model. Quantitative procedure and analysis and exploratory qualitative analysis and results are discussed next.

Chapter 5. Results

I. Data Analysis Overview

Data analysis began with data cleansing, coding, cross-checking, and verification. This included the examination of missing data, evaluation of data reliability, and validating sampling (selection) validity and response rates for non-response bias.

The nature of the research question and scaling properties of the independent and dependent variables determined the appropriate analysis strategy. Given the multifaceted nature of the research questions, the data analysis involved descriptive and various multivariate group difference and predictive analyses. In order to address scaling issues, all variables were subjected to descriptive analyses to examine distributions and check for outliers and unbalanced distributions. Correlational analyses was used to examine the level of relationship between the various dependent variables and to evaluate multicollinearity between the criterion measures. In addition, exploratory factor analysis was used to assess the psychometric properties of the scale measures, as described above.

Hypothesis 1, the impact of E-ed on various continuous outcome measures was assessed via linear regression (single DV), or multivariate regression (MANOVA/MANCOVA) where uncorrelated continuous DV's were combined, or multinomial logistic regression where uncorrelated categorical DV's were combined. In addition, the hypothesis was assessed via binary logistic regression for the dichotomous E-outcome measure. The same procedure was used for evaluating Hypothesis 1a-c.

Likewise, Hypothesis 2, the effect of E-ed on outcomes after controlling for various covariates, was assessed via univariate GLM, hierarchical regression, or multiple logistic regression with regard to the dichotomous dependent variable.

Mediation was initially identified by a series of three-step regression analysis as recommended by Baron and Kenny (1986) and confirmed via Sobel tests. The results, along with bivariate analysis between the IV's, predictors, and DV's informed the development of the hypothesized Structure Equation Model, which was used to test Hypothesis 3 (the mediating and direct effects of various cognition, personal, and contextual variables on E-outcomes).

The two exploratory research questions: 1)"what factors influenced entrepreneurs' willingness to establish a new business?" and; 2)"what factors and influences do successful entrepreneurs attribute their success to?" were addressed by qualitative analyses involving coding and summarizing various themes.

II. Data Procedures

A. Missing Data, Data Cleaning, and Preliminary Analysis

The survey was successfully mailed or emailed to approximately 4,000 respondents (3,976) with 635 responses collected. The database was evaluated for missing data. Respondents who quit the online survey prematurely, leaving a large amount of missing data, were deleted, leaving a final N of 603 subjects. Of the 603, 18 had one or more missing data elements, leaving 585 complete responses (with the exception of the last question where an additional 10 respondents missed one or more cells of the scale). In addition, the "Scale"

components were examined to determine whether any variable appeared to be incorrectly reverse-coded. The process used was to examine scale variables for anomalies (a score of "6" when selections were "1-5" for example), and none were found.

The "Intentions" scale DV was missing data because *only* non-entrepreneurs answered this question. The variable was not recalculated (rating entrepreneurs highest on "intentions") because of the beneficial logic of keeping the "Intentions" variable associated exclusively with the non-entrepreneur population.

Additional data analysis consisted of a check for variables with extreme distributions (for example, a question that had no variance in response). Of all the variables required to answer the research questions, only Race had insufficient cell numbers at the program level, requiring the categories to be collapsed. The race variable was recoded as "Caucasian vs. Other" for program level analysis.

III. Representativeness of Sample

In 2010, the subject university student population was 75.5% white and 24.5% other. The survey sample frame of 4,113 was 76% white and 24% other. The nonrespondent group was 75% white and 25% other. The respondent group was 77% white, 21% other, 2% unknown. On gender, the sample frame was 78% male and 22% female; Nonrespondents were 79% male and 21% female; and respondents were 75% male and 25% female. No significant differences were observed between these groups.

In order to determine how representative of the university population overall the final database was, "useable" responses (after the database was cleaned for missing data) were

compared to the population on race and gender characteristics. The final sample of 603 was 81% white, 19% other, 74% male and 26% female. To further confirm external validity, the response bias analysis statistically compared the differences between respondents and non-respondents on the additional demographic variables that were known for both groups via the University Alumni database (recall that the "match" variables included: Gender, Major, Degree/Level, Race, Age).

Statistical analysis was conducted to determine whether those who responded were comparable (similar) to those who did not on these variables. This analysis involved simple cross tabulations (chi-square, for gender for example) and analysis of variance (t-tests, for age for example) to determine if there were significant differences between the two groups. The two groups were compared on each of the five demographic variables and no significant differences were found. In addition respondent/nonrespondent groups were compared for their distributions of recently graduating alumni and earlier cohorts to check for recency bias. The distributions were nearly identical; ($\chi^2 = 8.9$, p=.92).

IV. Descriptives

A. Frequencies by Group (IV's)

Preliminary descriptives were gathered at the whole-group and program levels (percentages and frequency counts, means, SD's, range, etc.). Response distributions were double-checked for consistency (skewness and kurtosis). The frequencies by group, treatment/control are shown in Table 13 below:

Table 13. Frequencies: Programs #1(UEng), #2(UBiz), #3(GBiz)

UEng 1, UBiz 2, GBiz 3 * Tmnt 1, Cntrl 0 Crosstabulation					
			Tmnt 1, Cntrl 0		Total
			0	1	
UE 1, UB 2, GB 3	1	Count	168	107	275
		% within UE 1, UB 2, GB 3	61.1%	38.9%	100.0%
		% within Tmnt 1, Cntrl 0	46.8%	43.9%	45.6%
		% of Total	27.9%	17.7%	45.6%
	2	Count	93	58	151
		% within UE 1, UB 2, GB 3	61.6%	38.4%	100.0%
		% within Tmnt 1, Cntrl 0	25.9%	23.8%	25.0%
		% of Total	15.4%	9.6%	25.0%
	3	Count	98	79	177
		% within UE 1, UB 2, GB 3	55.4%	44.6%	100.0%
		% within Tmnt 1, Cntrl 0	27.3%	32.4%	29.4%
		% of Total	16.3%	13.1%	29.4%
Total		Count	359	244	603
		% within UE 1, UB 2, GB 3	59.5%	40.5%	100.0%
		% within Tmnt 1, Cntrl 0	100.0%	100.0%	100.0%
		% of Total	59.5%	40.5%	100.0%

B. Bivariate Analysis: Examine Inter-Variable Correlations

A correlation matrix of predictors was created in order to evaluate collinearity; were any of the predictors too highly correlated and/or should they be combined? All coefficients .7 or above were flagged, confirming the descriminant validity of all measures with the exception of the Startup outcome DV's.

The Startup DV's (dichotomous, ordinal, and continuous DV measures as well as the ordinal Start-up Enterprise measure) all had significant correlation coefficients ranging from .7-.9 when correlated with each other, confirming convergent validity (See Table A.1). Construct validity was supported by the collinearity patterns cross-validating the measures.

Given the collinearity between the four startup DV's, a decision was made to select only *one* of them for use at any one time in the analysis. The dichotomous measure was selected to analyze first, given that it is the variable that is most commonly used by researchers. However, the continuous measure of entrepreneurial outcomes, which correlates closely with the dichotomous and ordinal E-outcome measures, was used as a cross-check since standard regression models can be developed to confirm the results of logit analysis.

The continuous "Intentions" DV proved to be troublesome, however, because it could only be logically asked of those who had NOT already started a business. But this meant the population for this question was reduced below that of the population used for the rest of the analysis, as discussed above. Because "intentions" variables are only used as a "proxy" for entrepreneurial action in the literature (usually because they tend to be administered immediately following the E-ed treatment) the decision was made to drop the variable from the preliminary analysis—it only applies to a subset of the data, anyway-- in order to focus

on the concrete entrepreneurial outcome DV's. Analysis will be conducted with this variable later in that it might be interesting to compare those with intentions and those without against the treatment/control grouping as well as against premeasures and personal characteristics.

The elimination of the Intentions DV left four minimally correlated DV's for the final analysis: the dichotomous startup DV, the ordinal Product Development DV, the continuous Enterprise NonStartup Scale DV, and the Art dichotomous DV (the latter being primarily for exploratory analysis). The overall summary-level continuous DV was used for development of the SEM exploratory path analysis, and to cross-check the results of the logistic analysis.

Because of the diverse scaling properties of the above DV's, no multivariate statistic (such as MANOVA) was available for omnibus analysis. As a result the DV's were analyzed separately. The frequency statistics of the DV's for the whole group and by program is shown in Table 14 below:

Table 14. Frequencies of E-Outcomes at Program Level

	UEng Program #1				**UBiz Program #2**				**GBiz Program #3**				**Total All Programs**			
	Treatment (N=107)		Control (N=168)		Treatment (N=58)		Control (N=93)		Treatment (N=79)		Control (N=98)		Treatment (N=244)		Control (N=359)	
Outcome DV	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Started New Company	27	25%	26	16%	20	35%	27	29%	24	30%	16	16%	71	29%	69	19%
	Treatment (N=105)		Control (N=163)		Treatment (N=58)		Control (N=88)		Treatment (N=75)		Control (N=95)		Treatment (N=238)		Control (N=346)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Created new Products/Services	39	37%	42	26%	21	36%	25	28%	33	44%	36	38%	93	39%	103	30%
	Treatment (N=105)		Control (N=163)		Treatment (N=58)		Control (N=88)		Treatment (N=75)		Control (N=95)		Treatment (N=238)		Control (N=346)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Started New Division Branch Office	8	8%	13	8%	7	12%	9	10%	16	21%	3	3%	31	13%	25	7%
	Treatment (N=105)		Control (N=162)		Treatment (N=58)		Control (N=88)		Treatment (N=75)		Control (N=95)		Treatment (N=238)		Control (N=345)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Started Non Profit/Activist Group	8	8%	4	3%	8	14%	10	11%	9	12%	8	8%	25	11%	22	6%
	Treatment (N=104)		Control (N=163)		Treatment (N=58)		Control (N=88)		Treatment (N=74)		Control (N=95)		Treatment (N=236)		Control (N=346)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Art Enterprise	10	10%	12	7%	11	19%	9	10%	6	8%	13	14%	27	11%	34	10%

V. Hypotheses Test of Research Question #1

E-ed Treatments will exhibit significantly higher entrepreneurial outcomes (intentions, enterprise, startups, and composite of all of the former) than controls.

The dichotomous Startup DV was selected for conducting the test of Hypothesis I--that the E-ed treatment group (regardless of program) will demonstrate higher entrepreneurship outcomes than the matched control group. A baseline Binary Logistic regression (Group x DV) comparing E-ed and controls on outcome was found to be significant (see Table 15).

Hypothesis Ia-c was also tested, again utilizing the dichotomous Entrepreneur DV as a DV. Hypothesis Ia-c stated that, if Hypothesis I was true, there would be program-level differences in outcomes. Again, a Binary Logistic Regression found significant differences at the program-level. Two of the programs (UEng and GBiz) had significant differences between their treatments and matched controls on outcomes. One program (UBiz) showed no differences. (See Table 15).

Table 15. Estimated Probability of Creating Entrepreneurial Startup (Dichot DV)
Treatment vs. Control Overall and Treatment at Program Level
Binary Logistic Regression Estimates

Analysis	Coefficient (B)	Wald	Std Error	Sig. (Chi Sq.)	Odds Ratio (Exp(B))	CI (95%) Lower	CI (95%) Upper
All Groups x DV	.545	7.861	.194	.005**	1.725	1.178	2.525
Subgroup 1 (UEng) x DV	.612	3.935	.308	.047*	1.843	1.007	3.373
Subgroup 2 (UBiz) x DV	.252	.494	.358	.482	1.287	.637	2.598
Subgroup 3 (GBiz) x DV	.805	4.815	.367	.028*	2.236	1.090	4.589

* p<.05 ** p<.01 ***p<.001

In sum, the null hypothesis for Hypothesis I was rejected. Overall, those who took E-ed were significantly more likely (at the $p<.05$ level) to become entrepreneurs than their matched controls. The odds ratio (Exp(B)) of 1.749 means that, overall, the odds of starting a business were 75% higher for treatment group members compared to their matched controls (Exp(B)=1.749; p=.004). At the program levels, Hypothesis Ia, Ib, and Ic showed mixed results. The odds of starting a business for UEng group members was 91% higher than their matched controls (Exp(B)=1.912; p=.034). UBiz group members' odds were 29% higher, but this difference was not significant (Exp(B)=1.287; p=.483). The odds of GBiz group members starting a business, in comparison with their matched controls was over 2 times more likely (Exp(B)=2.236; p=.026).

As a result of the frequency data that showed substantial entrepreneurial activity beyond just startups (See Table 13), Hypothesis I a-c was also tested against the other enterprise DV's. While there were no significant impacts of E-ed on the Art and Social Entrepreneurship DV's, there were significant Intrapreneurship outcomes, and they showed similar group effects. Again two of the programs (UEng and GBiz) had significant differences between their treatments and matched controls on new product/service creation E-outcomes (although the GBiz group significance dropped to the 10% level). One program (UBiz) showed no differences. (See Table 16).

Table 16. Estimated Probability of Creating New Product/Service Entrepreneurial Outcome (ProdDevl DV)
Treatment vs. Control Overall and Treatment at Program Level
Linear Regression Estimates

Analysis	Coefficient (B)	Wald	Std Error	Sig. t	Stand. (B)	CI (95%) Lower	CI (95%) Upper
All Groups x DV	.218	3.22	.068	.001***	.132	.085	.352
Subgroup 1 (UEng) x DV	.267	2.77	.096	.006**	.167	.077	.456
Subgroup 2 (UBiz) x DV	.108	.723	.149	.471	.060	-.187	.402
Subgroup 3 (GBiz) x DV	.209	1.75	.120	.082	.134	-.027	.445

* p<.05 ** p<.01 ***p<.001

The finding of nonsignificance for the UBiz group across the DV's was curious, and unexpected, in that even with the smallest N (response rate), the group demonstrated the largest number E-outcomes percentage-wise on three of the DV's—Startups, Social entrepreneurships (Nonprofits/Activist Group), and Art. The reason: the UBiz control group members were also unusually entrepreneurially productive. So while the raw numbers suggest that the UBiz approach worked well, something else was clearly occurring with the matched controls to offset the effect of this E-ed program on E-outcomes. It's possible that the group (N) was just too small for useful analysis. Perhaps the individual learning focus (as opposed to a team approach), or the smaller dosage (typically only one semester while the other programs involved two) were important differences. Conversely, other undergraduate business courses may have equipped the control students with entrepreneurial "soft" skills, enhancing Soft E-Self Efficacy, even though these courses were not "Business Entrepreneurship" per se. If UBiz students came into the course as juniors with previous soft-skills learning experiences, perhaps they had already reached a point of saturation that would be difficult for the UBiz treatment to push further. Further analysis, perhaps comparing the UBiz group to the other groups and their controls on pre-measures and personal characteristics, might suggest further explanation. For additional discussion on the UBiz findings, please refer to Chapter 6, Discussion and Conclusions.

VI. Covariate Identification and Hypothesis Test of Research Question #2

The effect of E-ed on entrepreneurial outcomes will still be statistically significant after controlling for various demographic or other covariate characteristics that are known to be correlated.

While the response bias analysis comparing differences between respondent and non-respondent groups on determinate demographic variables found no differences, additional tests were conducted to identify covariates required to ensure group equivalency. Shadish et al. (2002) recommends a pre-test on known or suspected correlates, especially in self-report studies that may involve selection bias. In this study, limited pre-test data did exist in university archives for most of the undergraduate respondents. No pretest data were collected for graduate students, however. For those respondents who did not have pre-test data, Shadish et al. (2002) advises researchers to decrease the odds of selection biases by matching or stratifying on likely correlates of the post-test (in this case gender, major, year graduated, GPA, age, race, and type of degree). Optimal matching, (where populations being matched overlap completely on stable and reliably measured matching variables), and where additional variables are employed to prevent undermatching (4-7 variables in this case) create greater equivalence between treatment and control groups. (Shadish, 2002).

Therefore, two sets of analyses were performed to test for covariation—examination of the pre-test variables for that cohort; and, a bivariate analysis of the determinate demographic variables (including the match variables gender, race, age, and degree) against the condition (grouping) independent variables to identify whether there were significant

group differences requiring the employment of a covariate, since significance could suggest problems with group equivalency in the final analysis.

A. Covariate Analysis I

The ability to test for self selection using entrepreneurship-related pre-measures, taken when the students were entering college as freshman, *before* they enrolled in E-ed or became entrepreneurs, is an opportunity unique to this study. Unfortunately only 205 (34%) of the respondents (the undergraduate cohort of the study and not even all of these students—some transferred into the university and others never completed the test) had pre-measures. The pre-measures selected included many of the personal characteristics (both psycho-social and psycho-cognitive) that are suspected to be antecedents of entrepreneurial activity or otherwise correlated. They included self assessments on self confidence, leadership, critical analysis, planning and carrying out projects independently, teamwork, self-discipline, time management, coping with change, being independent and self-reliant, etc.

Chi-square analysis was conducted comparing the pre-test measures to the grouping variable (taking E-ed) for the premeasured population, and one of the premeasures, Coping with Change had a significant Chi-square relationship with the IV (χ^2=12.36; p=.015). The treatment group self assessed significantly higher on their ability to Cope with Change.

In order to determine the effect of the potential self selection on this potential covariate, I ran a bivariate analysis against the dependent variables (Chi-square for the dichotomous Startup DV, Pearson Correlations for the other DV's), for the premeasured subgroup. No significant relationship was found. To double-check this result, the above pre-

measure was included as a covariate in a re-run of the regression (Univariate GLM) conducted to test Hypothesis I (Group x Continuous DV) to see if the significant relationship found had changed. The test was conducted at both the N=205 subgroup and at the whole group level (with the identical post measures), and the inclusion of the Coping with Change covariate did not change the earlier result. (See Table A.2 Appendix). The procedure was repeated (multiple logistic regression) with the dichotomous DV with identical results—e.g., nothing changed. Apparently while students may self-select into E-ed on this psycho-cognitive characteristics (or perhaps they coincidentally shared this proclivity), the significant relationship between E-ed and E-outcomes still holds, even while controlling for the one significant pre-test variable.

B. Covariate Analysis II

Given that the premeasures were only available for a limited (N=205) cohort of the sample, a second covariate analysis was conducted that involved a bivariate analysis of the determinate demographic variables (including the match variables gender, major, race, age, and degree) against the condition (grouping) independent variables. Bivariate analysis results are shown in Table A.3.

At the whole group level, no demographic variables were significantly (.05 level) correlated with the Treatment vs Control grouping variable. Thus no covariates were required in testing Hypothesis I (the whole group level).

However, because Hypothesis I a-b-c requires program level groupings, the group equivalency analysis was also conducted at the subgroup (program) level: UEng, UBiz,

GBiz, and the UEng+GBiz combined grouping. Again, no significant correlations with the demographic match variables were identified at the program level, suggesting that the match procedure was effective across groups. However, the UEng group variable was significantly correlated (.038) with a related demographic variable, Parent Education. Likewise, although not a demographic variable, the possible confounding covariate "took later Entrepreneurship course" (Later E-ed) was evaluated, and although it was not significantly correlated with the whole group (.053), it *was* significantly correlated at the subgroup level with the UEng group (.043) and the UEng/GBiz combined group (.018). Thus these covariates (Parent Ed and Later E-ed) were included as covariates in re-testing Hypothesis I for these two subgroups (UEng only and UEng/GBiz combined).

Multiple logistic regression in the aggregate (all groups) was re-run, comparing E-ed and controls on the dichotomous DV measure while controlling for Parent Ed (first) and Later E-ed (second), with no effect on the results of Hypothesis I. Likewise, the inclusion of the covariates on the program level analysis (UEng, UBiz, GBiz, and UEng/GBiz combined) did not change the results (Hypothesis 1a,1b, and 1c).

Next, the analysis was repeated for confirmation utilizing multiple regression (Univariate GLM) with the continuous Entrepreneurship DV, with identical results in terms of no covariate impact, significance for Program levels 1 (UEng) and 3 (GBiz), and insignificance for Program level 2 (UBiz).

In sum, the covariate analysis 1 & 2 procedures identified a number of possible covariates. Hypothesis II retested Hypothesis I using two of the covariates (Later E-ed and Parent Ed) as controls, and found no covariate impact. Even when controlling for significant

covariates, the probability of starting a business is significant for alumni to who took the high-dosage, experiential courses (Program levels 1(UEng) and 3(GBiz). However, the entry-level business course alumni group had no increased likelihood of entrepreneurial outcomes in comparison with their matched controls.

For this reason, all remaining analyses conducted at any group level (whether whole-group or subgroup) reported results without covariates.

VII. E-ed Process Mechanisms and Hypothesis Test of Research Question #3

The effects of the successful E-ed programs (UEng and GBiz) on entrepreneurial outcomes will be mediated by endogenous mechanisms, including knowledge, skills, entrepreneurial self-efficacy, and other exogenous personal and contextual characteristics.

Research Question 3 examined how E-ed programs work. Since results for Research Questions 1 and 2 revealed that two of the three E-ed programs (the UEng and GBiz experiential programs) had a significant effect on entrepreneurial activity when compared to their controls while the third program, UBiz, did not differ significantly from matched controls, the analysis for this question focused on the subset of the data (N=452) represented by the statistically significant programs (treatment groups 1 and 3) and their matched controls. (E.g., all subjects associated with the undergraduate Business group 2 were dropped from the analysis).

Since the empirical literature provides no basis for hypothesizing a comprehensive predictive model for how E-ed works, I elected to follow an exploratory strategy, guided by the theorized E-Correspondence conceptualization, to develop my causal model. In order to

take advantage of the flexibility provided by structural equation modeling, I choose to use the continuous DV, (RawAllContDV), to construct and test the model. Then the model would be confirmed against the dichotomous and other E-outcome DV's. This strategy involved several steps: evaluate the correlation among various predictors for collinearity and eliminate or consolidate suspect variables; use bivariate regression (binary correlation) to screen potential predictors for inclusion in the model; use multivariate regression to identify predictors that might be candidates for direct and/or mediated effects; build by initially adding possible E-ed mechanisms (e.g., knowledge, skills, networks) and then adding demographic and personality variables to constitute a comprehensive model.

A. Identify Potential Mediators

First, the relationships between the hypothesized predictor variables (exogenous and endogenous) were explored via bivariate regressions against the DV's to identify which were the best path analysis candidates for SEM analysis. The hypothesized predictors included E-ed mechanisms, personal characteristics, and contextual variables. These variables were evaluated against the continuous DV for significance ($p<.05$) (See Table A.4).

The significance levels of the hypothesized predictors revealed by the bivariate analysis were consistent across the DV's. Based on these bivariate results, the hypothesized model shown on p. 129 was re-specified into a testable model--eliminating Group 2 participants, eliminating covariates, and reducing the number of likely predictors to those with significant relationships with the DV. Then the remaining hypothesized mechanism predictors were tested in accordance with the revised testable model (See Figure 4) below:

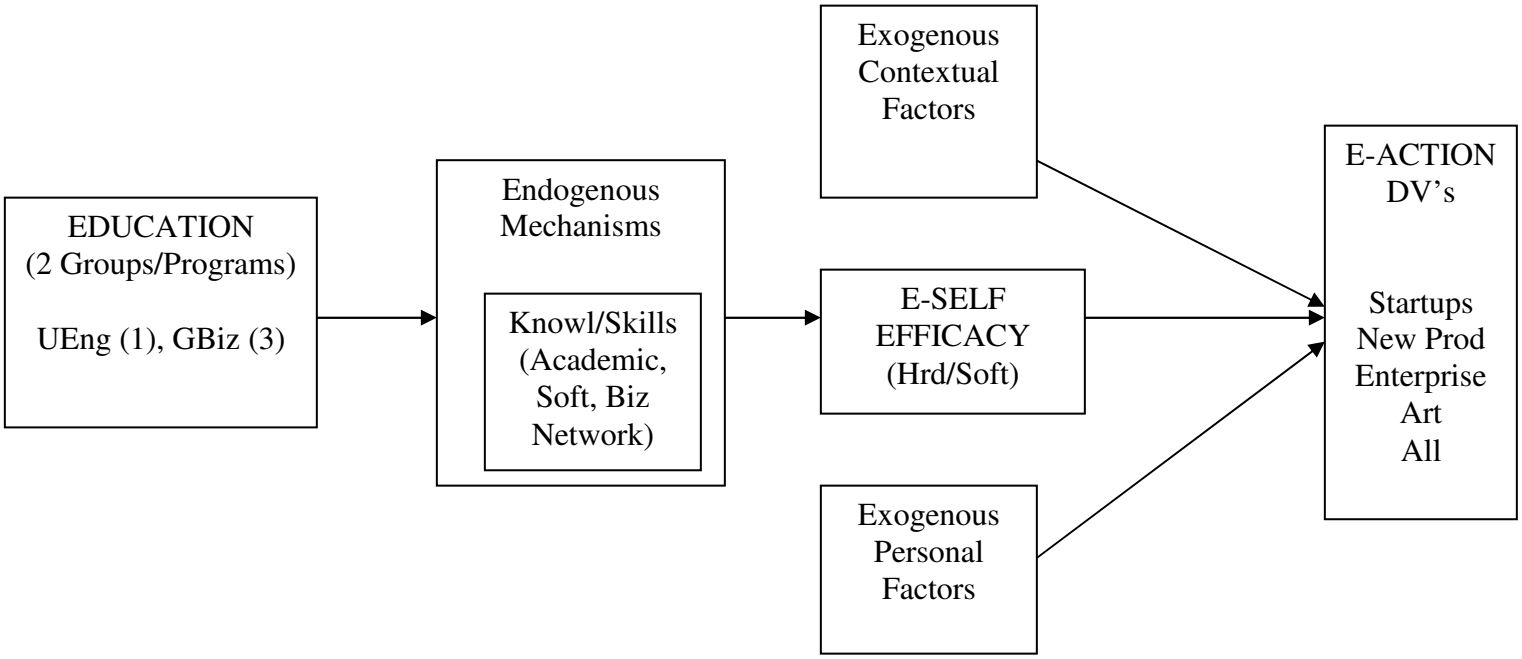

Figure 4. Hypothesized E-ed Process Variables: Testable Model Revised

The inter-correlations between all the variables in the testable model were mapped so that the strength of the associations could be visually assessed. The significant inter-variable relationship patterns between self-efficacy and all of the other variables suggested that the Soft and Hard E-Self Efficacy variables be tested for mediation.

B. Mediation Analysis: E-Self Efficacy

As hypothesized, the proposed mediation variables (Soft E-Self Efficacy and Hard E-Self Efficacy) were significantly correlated with the grouping (IV) variable and the DV's as shown for the continuous outcome measure in Table A.5.

A hierarchical regression was conducted (continuous DV) with the two self efficacy variables entered one-by-one into the second step. All by itself in step 1, Group was a significant (.000) and positive predictor of Entrepreneurship. While the treatment effect remained significant in step 2, a small beta weight reduction from .2 to .1 suggested partial mediation. (See Table A.6).

Results from follow up Sobel tests (1982) for mediation were: 3.856, p=0.000 for Hard Self Efficacy and 3.765, p=0.000 for Soft Self Efficacy. (Details can be found in Baron and Kenny (1986), Source: http://www.people.ku.edu/~preacher/sobel/sobel.htm).

C. Regression-based Screening for Endogenous Mechanisms and Paths

If self efficacy is only partially mediating between IV and DV, what about the other hypothesized mediators (the endogenous mechanism variables-- skills, knowledge, and networks). How do they work with respect to self efficacy?

Again, bivariate regression (binary correlation) analysis (UEng/GBiz groups, only, N=452) identified the following endogenous cognition variables that are significantly related to the dependent E-outcome variable (the continuous DV shown below):

Table 17. Bivariate with DV: Endogenous Cognition Variables

Domain: Skills Mechanisms	Pearson R Coefficient	Significance
Soft Skills	.183	.000
Biz Skills	.362	.000
Academic Skills	.299	.000
Networking Skills	.317	.000

The bivariate analysis above identified all the significant predictors and, conversely, eliminated the predictors that were non-significant. Additional hierarchical regression analysis was conducted with the above endogenous mechanism variables in order to shed specific light on answering the research question: Given that E-ed has, as shown, a significant effect on Entrepreneurial outcomes, what are the causal mechanisms? As was done with the self efficacy mediation analysis above, the endogenous mechanism domain variables were added in Step 2 of a hierarchical regression against the continuous DV to test

for mediation effects. Group significance remained unchanged in Step 2, suggesting that these variables do not appear to mediate between the IV and DV.

While the mechanisms do not appear to mediate between the IV and DV, as self efficacy has been shown to do, the fact that each one of the mechanisms is highly and significantly correlated (.000) with each of the self efficacy mediators suggests they may have a secondary role mediating between the IV (group) and self efficacy, as the hypothesized model suggests. Further analysis was conducted to determine whether the mechanisms mediate between the IV and the Self Efficacy predictor. A full mediation effect was found with the Network mechanisms (See Tables A.7 and A.8), indicating that E-ed influences Self Efficacy *indirectly*, via the Network variable.

A path analysis diagram with paths between the IV and the network mechanism variable, which mediates between group and Self Efficacy, itself a mediator of the DV, was suggested. Based on this information a path diagram was constructed, and tested, and the non-significant paths eliminated with the following result:

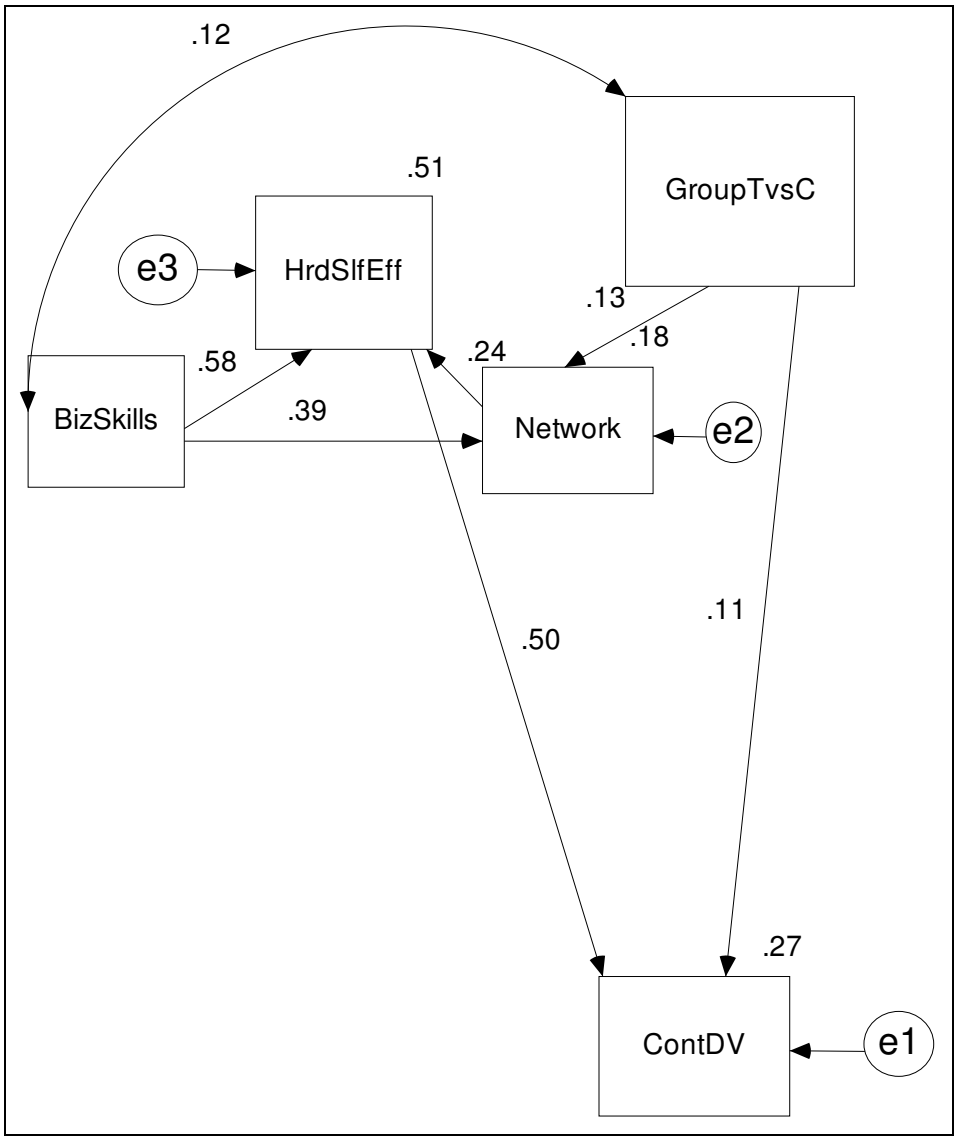

Figure 5. Exploratory Path Diagram:
Endogenous Mechanism Variables and Continuous DV
(All paths significant p<.05)

The causal model fit the underlying data fairly well: Model χ^2 (3,452) = 4.460, p=.216, CFI=.997, TLI=.986, RMSEA=.033. All the paths were highly significant (<.005), and the standardized coefficients are shown. The variance of the E-outcome DV explained (R^2) was 27%. The analysis showed an R^2 value of .18 for the Networks mechanism predictor and an R^2 value of .51 for Hard Self Efficacy. The most interesting thing about the model was the relative size of Hard Self Efficacy predicting E-outcomes, although the lack of a significant path from the IV to Hard Self Efficacy is also interesting. Hard self efficacy itself was a function of two E-ed mechanisms: Business Skills and Networking ability. The effect size of Biz Skills on the latter was roughly double that of the Network variable, and Group (E-ed) had a small, positive direct effect on the DV (β =.11, p=.005), similar in size to its independent effect on Network. The model was also tested by substituting the dichotomous DV in for the continuous DV, and all the tests had similar Chi Square and significance results. For example, the dichotomous DV fit was: Model χ^2 (3,452) = 4.387, p=.223, CFI=.997, TLI=.986, RMSEA=.032.

D. Regression-based Screening for Exogenous Factors and Paths

What are the effects of the exogenous personal and contextual predictors and are their effects direct on the DV or indirect through self efficacy as was the case with the cognition variables? As was done with the endogenous mechanisms, bivariate regression (binary correlation) analysis (UEng/GBiz groups, only, N=452) identified the following exogenous personal characteristics that were significantly related to the dependent E-outcome variable (the continuous DV shown below):

Table 18. Bivariate with DV: Exogenous Personal Variables

Domain: Personal Char	Pearson R Coefficient	Significance
Creative Adaptive	.256	.000
Autonomy	.240	.000
DecisionsRisk	.230	.000
Setback Response	.152	.001
Proactive Tenacious	.146	.002
Self Confidence	.176	.000
Riskrw Climate	.214	.000

Their bivariate relationship with Self Efficacy was also examined to assist in constructing paths for modeling these predictors' relationship between the Self Efficacy variables and the DV:

Table 19. Bivariate with Hard Self Efficacy: Exogenous Personal Variables

Domain: Personality	Pearson R Coefficient	Significance
Creative Adaptive	.279	.000
Autonomy	.209	.000
DecisionsRisk	.439	.000
Setback Response	.103	.031
Proactive Tenacious	.224	.000
Self Confidence	.269	.000
Riskrw Climate	.283	.000

Table 20. Bivariate with Soft Self Efficacy: Exogenous Personal Variables

Domain: Personality	Pearson R Coefficient	Significance
Creative Adaptive	.480	.000
Autonomy	.245	.000
DecisionsRisk	.567	.000
Setback Response	.119	.013
Proactive Tenacious	.349	.000
Self Confidence	.339	.000
Riskrw Climate	.391	.000

The personal characteristic variables were tested for mediation of the Self-Efficacy-DV relationship (See Tables A.9-A.17) with the result that three of the personal characteristic variables appear to work through (and share variance with) both hard and soft self efficacy. Interestingly, the personal characteristics Risk, Self Confidence, and Proactive-Tenacious personality were all highly correlated at the .000-.002 level with the continuous DV in step 1, became *non* significant when self efficacy (either hard or soft) were entered in step 2. One of the personal characteristic variables, however, (Creative Adaptive personality) was *only* mediated by soft self efficacy but not by hard self efficacy. This result suggested that, for the exogenous personal variables, Soft Self-Efficacy would be the better, more parsimonious candidate for inclusion in a domain-level model. Based on this information a path diagram was constructed and tested, and the non-significant paths eliminated with the following result:

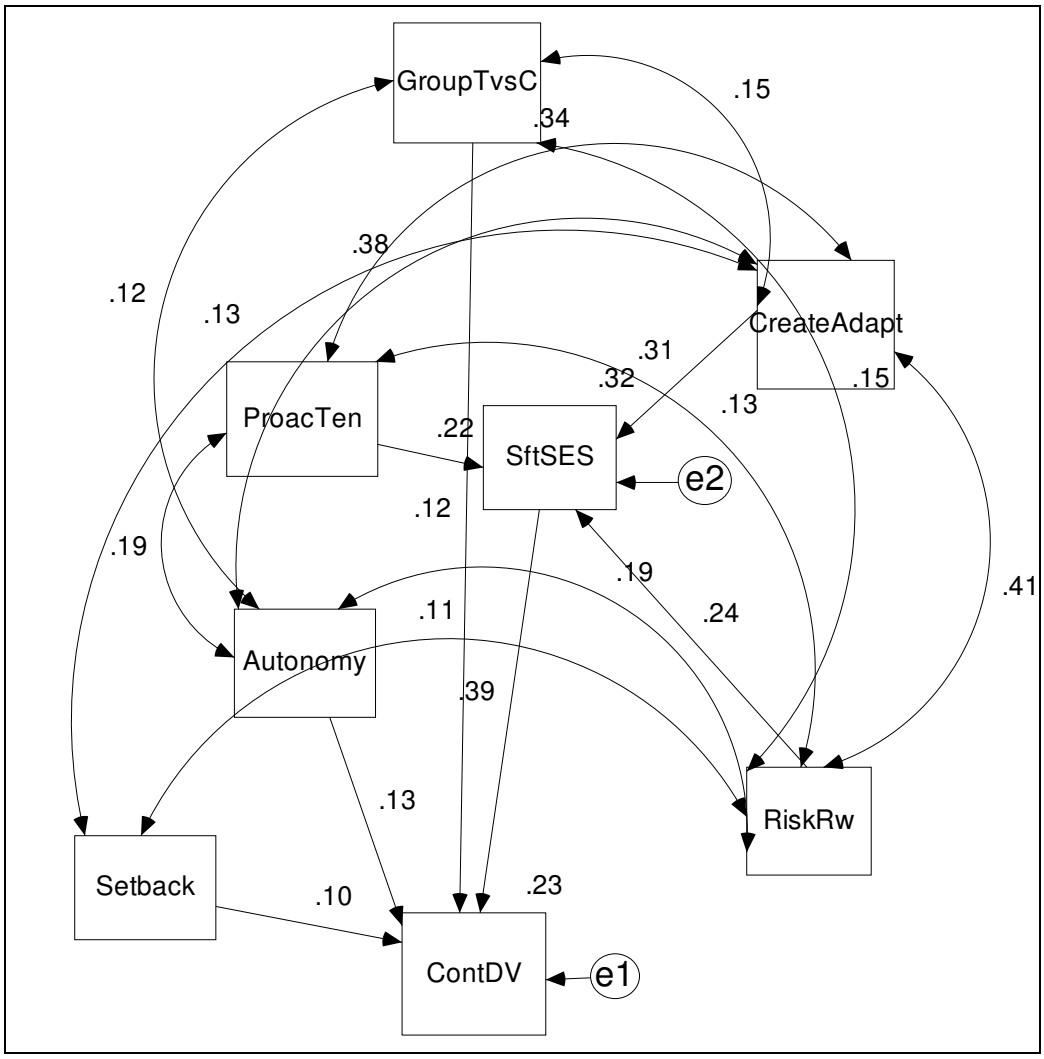

Figure 6. Exploratory Path Diagram: Exogenous Personal Variables
(All paths significant p<.05)

Two of the significant mediating variables (Risk (decisions) and Self Confidence) had small paths/effect sizes (β< .05) and thus were eliminated for parsimony. The reconstituted causal model fit the underlying data even better than the first model. Model χ^2 (10,452) = 6.738, p=.750, CFI=1.000, TLI=1.024, RMSEA=.000. The paths were all significant (p<.02), and the standardized coefficients are shown. The variance of the E-outcome DV explained (R^2) was 23%. The analysis showed an R^2 value of .32 for Soft self efficacy, which itself was a function of three personal characteristics: Risk (workplace-fit), Creative-Adaptive, and Proactive-Tenacious personality characteristics. Of these, Creative-Adaptive had the largest relative impact on Soft Self-Efficacy (β =.31, p=.000). Again the relative size of the effect of Self Efficacy on the E-outcome DV (.39) was most interesting. The small, positive direct effect of Group (E-ed) was virtually identical to that shown in the previous model (β =.12, p=.003), similar in size to the direct independent effects of Autonomy (β =.13, p=.003), and Setback (β =.10, p=.022) The model was also tested by substituting the dichotomous DV in for the continuous DV, and all the tests had similar Chi Square and significance results.

Note in particular that the exogenous personal characteristic variables either work indirectly through Soft Self Efficacy or directly on the DV. As was expected, all of the personal characteristics were correlated (but not excessively so), and generally uncorrelated with E-ed/Group (three variables—Autonomy, Risk (work-fit), and the Creative-Adaptive personality were slightly correlated .12-.15). These correlations hint at a small self-selection effect into E-ed on these personal characteristics. (While the pre-test that was available did

not address the latter two characteristics, it did include a proxy for the first ("planning and carrying out projects independently," and "being independent and self-reliant") and no self-selection effect was found). The significance of the model suggests that personal characteristics work alongside of E-ed in predicting E-outcomes. While the personal characteristics model fit better, the difference between the two models' Chi Squares was not significant (7.8233E-91).

The most interesting thing about comparing the two models is that only the first (endogenous E-ed mechanisms) model answers the research question—if E-ed works, how does it work? Because of the direct, non-mediated, relationship between the IV and DV, the second model doesn't explain how E-ed works, but it does suggest that E-ed is among a number of factors that predict E-outcomes. It suggests that a sizeable share of the variance between non-entrepreneurs and entrepreneurs, whether treatment or control, can be explained by personal characteristics working both directly and through Soft Self Efficacy. Since this model is an intermediate step to a full-domain model, it will not be further evaluated here, but it is a very interesting finding and will be further investigated in a subsequent analysis.

E. Structural Equation Model (SEM) Construction and Testing—All Domains

The by-domain exploratory models were useful in that only the endogenous domain model (with Hard Self Efficacy) included the E-ed grouping variable in a significant capacity, explained how E-ed may work, and directly addressed Research Question #3. (The endogenous skills mechanisms work *only* through Hard Self Efficacy).

Therefore, the Soft Self Efficacy mediated variables (Proactive, Creative,and Risk) were unlikely candidates for inclusion in a final, cross-domain model. On the other hand, the exogenous and personal characteristics that work directly on the DV *are* likely candidates for a full predictive model. With the decision to exclude Soft Self Efficacy in favor of Hard Self Efficacy and its linkages, the remaining personal characteristic predictor paths were examined for their significance, and a new, All-Domain (person x context) causal model was constructed that also included the final domain--exogenous contextual variables. The important contextual variables were identified via bivariate analysis with the continuous DV:

Table 21. Bivariate with DV: Exogenous Context Variables

Domain: Context/ Demographics	Pearson R Coefficient	Significance
Age First Job	-.170	.000
Parent Entrepreneur	.122	.010
Number Job Changes	.243	.000
Number Career Changes	.295	.000
Age	.259	.000

The insignificant and least-weighted significant pathways ($\beta<.05$) were removed to allow for the most parsimonious combination of variables with the following result:

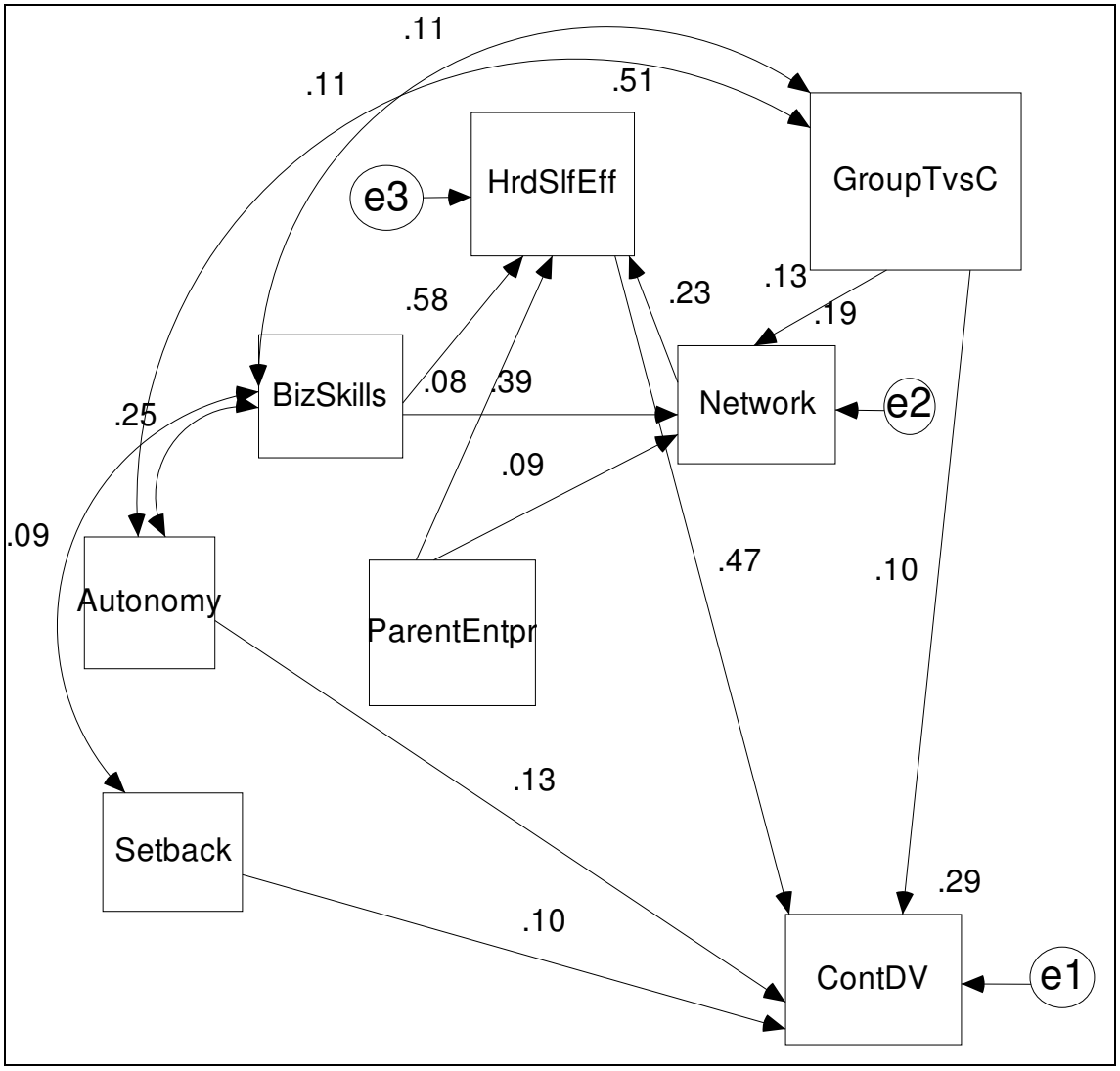

Figure 7. Full Model Path Diagram: Endogenous Mechanism,
Exogenous Personal and Contextual Variables
(All paths significant p<.05)

The all-domain model fit was good: Model χ^2 (14,452) = 13.593, p=.480, CFI=1.000, TLI=1.002, RMSEA=.000. The paths were all significant below the .02 level, (except Parent p=.045), and standardized coefficients are shown. The R^2 of the E-outcome DV variance explained was highest of all the models at 29%. As expected, the R^2 of Hard Self Efficacy

was sizeable (.51). The analysis showed an R^2 value of .19 for Networks. Again, the effect size of Biz Skills on Hard Self Efficacy was more than twice that of Networks (β =.58, p=.000) and Biz Skills also had a sizeable relative impact on Networks (β =.39, p=.000). Interestingly, Biz Skills did not directly predict E-outcomes, nor was there a significant path between E-ed and Biz Skills. Most interesting was the impact of Parent Entrepreneur which had nearly as strong a relative impact on Network (β =.09, p=.045) and Hard Self Efficacy (β =.08, p=.022) as Group (E-ed) had independently on the DV (β =.10, p=.012). Note also that in this model, the effect size of Group on the Network mechanism variable was identical to that in the first model (β =.13, p=.002). Also of interest, Autonomy (β =.13, p=.001) and Setback (β =.10, p=.017) maintained their moderately-sized independent direct effects on the DV.

This final model explained the largest variance on the DV, and was the most parsimonious (PCFI=.389) predictive model. It was also the most all-inclusive across domains, and it most precisely answered the research question, if E-ed works, *how* does it work? The model included two key endogenous mechanism variables (Biz Skills and Networks) working through Hard Self Efficacy, two key personal variables (Autonomy work-fit and Setback) and one key demographic/contextual variable (Parent Entrepreneur). The model was also tested by substituting the dichotomous DV in for the continuous DV, and all the tests had similar Chi Square and significance results.

VIII. Qualitative Analysis

The motivational aspects of the E-Correspondence model, (Desirability, top left box p. 46) were explored via exploratory qualitative analysis in two open-ended questions asked of all entrepreneurs (both treatment and control) about their motivation, "What factors and/or influences most motivated you to establish a new business?" and, "What factors and/or influences do you attribute your entrepreneurial success to?" (See Appendix B).

A content analysis was conducted on the 78 open-ended responses to the Motivation question and the 71 open-ended responses to the Success question. The responses were divided into content categories and number-of-mentions were tabulated. Each item was further categorized as either an intrinsic or extrinsic construct (e.g., the motivation responses were identified as either intrinsic motivation or extrinsic motivation, while the success responses were identified as either intrinsic success factor or extrinsic success factor). Inter-rater reliability was conducted to confirm the coding, with 95% agreement on motivation factor codings; 94% agreement on success factor codings; and, 100% agreement on extrinsic/intrinsic categorizations (four raters).

The responses were tabulated and broken down between groups (E-ed and Control), although cell sizes were too small to draw granular conclusions between the groups below the top frequency categories. Most notably, there were a total of 26 mentions of Education as a motivation or success factor by the E-ed group compared to only 15 mentions made by controls. (See Tables A.18 and A.19 for the frequencies of comments by category).

Sample Education motivation responses included: "capitalizing on skills;" "my individual skill-sets;" "the learned and achieved experience over the first 10 years of my

career;" "a class assignment;" "apply skills and abilities;" and, "putting newly acquired skills and knowledge to work." Sample Education success factors included: "my willingness to learn;" "ability to create solutions to problems;" "creativity and intelligence;" "my superior communication, interpersonal, social, and negotiation skills;" "entrepreneurial courses, seminars, trade shows, etc.;" "mock business projects in college;" "business and entrepreneurial materials throughout my youth;" "background and education;" and "(the university) entrepreneurship program."

It is notable that Achievement factors (these included goal-oriented behaviors—meet a challenge, obtain leadership, create and build a product or business, as well as dedicated perseverance and personal drive/work-ethic) were the most frequently sited factors behind *both* personal motivation to start a business *and* personal business success.

Sample Achievement motivation responses included: "desire to lead;" "to see if I could;" "the challenge of starting a business from scratch;" "the challenge of attempting to do something never done before. Afterwards the challenge to do it better;" and, "make an idea of my own real and share it with others." Sample Achievement success responses included: "hard work;" "go getter;" "self motivation;" "drive;" "hard work;" "ambition and drive;" "ability to go from idea to execution;" "my work ethic;" and "I wanted to make something with my own effort that I could sell."

In the motivation category, money was the second most commonly sited motivator, followed by Autonomy ("tired of working for others;" "desire to manage my time") and Opportunity Identification ("perceived unmet need;" "attractive new challenge;" "opportunity to work for myself."). Interestingly, half of these top motivators were intrinsic

(Achievement and Autonomy) while the others were extrinsic motivators (Money and Opportunity). Given that the data was derived from qualitative analysis, little can be concluded from this fact other than it appears that *both* intrinsic and extrinsic factors motivate entrepreneurs to start businesses.

This contrasts with the Success factors, where intrinsic factors had greater support. Again, while Personal Drive/Achievement was the top-mentioned success factor, "Another Person" ranked second with 33 mentions. Education (KSA's) and attitudes ranked third and fourth respectively.

While the qualitative analysis asked respondents to identify, in an open-ended question, the factors or influences most responsible for motivating them to launch a business and most responsible for their success, not all respondents bothered to complete the question which was expected, given the length of the survey and the fact that this question was nearly the last question. In order to address this likelihood, an earlier "intrinsic vs. extrinsic" question asked respondents who were entrepreneurs to indicate whether they were motivated to create their business more as a response to a perceived market need (an external stimulus), or was it based more on a personal talent, skill, ability or competitive advantage you believed you had (internal stimulus). This question was a single measure, developed from the literature (the theorized E-Correspondence model and IO E-cognition theory), and respondents were allowed to select only one choice.

Of the 97 entrepreneurs who answered the question, 60% selected internal stimulus (intrinsic motivation) while 40% said they were externally motivated. This compares with 95 (57%) intrinsic mentions on the open-ended questions and 73 (43%) extrinsic mentions. The

results were surprisingly similar and strongly suggest that when it comes to Desirability, intrinsic motivation (like Achievement and Autonomy) are stronger motivators than extrinsic motivation (like Opportunity and Money) when it comes to starting a business. The preference for intrinsic factors in attributions for success is even more striking with 124 intrinsic mentions (74%) and 43 extrinsic (26%) mentions.

The importance of intrinsic factors to both entrepreneurial motivations and success reiterates the importance of additional research into the individual/personal characteristics of entrepreneurs, which unfortunately have been under-researched by psychologists. While the intrinsic/extrinsic measure utilized in this study is only a single measure (albeit bolstered by the qualitative results), it is a first step toward operationalization of the effectuation construct (Sarasvathy, 2001); respondents had to indicate whether they relied more upon personal characteristics, KSA's/other inputs at hand in creating their businesses, or whether they acted more in response to perceived external causes/market conditions. Further research will need to be conducted to confirm these findings that intrinsic motivators are more important than extrinsic motivators in the creation of entrepreneurial ventures, and to test the psychometrics involved.

Next I will discuss the conclusions and implications of the study from an empirical, theoretical, and practical standpoint.

Chapter 6. Discussion and Conclusions

Technopreneurial activity and Schumpeter's creative destruction, at the center of Romer's (1986, 1990) theorized endogenous growth alternative to neoclassical economics, is increasingly being accepted as the root source of economic productivity and growth (van Stel et al., 2005; Acs & Varga, 2005; Audretsch & Keilbach, 2007; Acs et al., 2009; Baumol, 2010). As a result, the "supply side" of entrepreneurship is becoming a topic of universal interest. Conventional wisdom has long presupposed that the supply of entrepreneurs in any society is a fixed commodity, limited to the number of unusual (even deviant) individuals born with anomalous personality characteristics. David Birch, author of the seminal research implying the enormity of the contribution of the small business sector to the overall economy, once said, "If you want to teach people to be entrepreneurs, you can't." (Aronsson, 2004, p. 289).

Nonetheless, the generation born as the industrial age transitioned into the information age, who watched with alarm as their parents' jobs moved overseas and their skills became obsolete, began to demand course offerings in entrepreneurship. Today, millions of dollars are spent every year on E-ed programs, courses, centers, workshops, and seminars, based on the assumption that E-ed works to generate entrepreneurship, new companies, and new jobs.

But what if David Birch is right? What do we really know empirically about whether E-ed works, and if it does, how it works? This research study is the first, controlled, longitudinal, predictive research study to attempt to answer both questions. Results suggest

that Entrepreneurship is more complex than commonly believed; it is a dynamic that involves Personal characteristics, Cognitive characteristics, and Contextual characteristics.

The review of the extant research into the antecedents of entrepreneurship suggested that E-ed may be just one of many antecedents of entrepreneurship. Thus this research study had to consider *all* of the likely antecedents of entrepreneurship that might confound the effects of E-ed on creating hard economic impacts. The study did a thorough review of the personal, cognitive, and contextual antecedents of entrepreneurship that might be influenced by or have influence on E-ed, and critiqued the empirical literature specific to E-ed.

The study attempted a robust methodology, using matched comparison groups and powerful statistical techniques (SEM) in an attempt to disentangle the effects of E-ed on a variety of E-outcomes (enterprise, business entrepreneurship, and technopreneurship) from the effects of other known and suspected personal, cognitive, and contextual antecedents.

The data collected was grounded in psychosocial theory—the individual entrepreneur x situational context perspective that has gained nearly universal acceptance in the field. Shapero & Sokol's entrepreneurial event theory grounds the study. However, from the antecedent research I concluded that their "desirability and feasibility" constructs needed to be expanded to include the second half of the person x situation equation—the contextual element—based on Lofquist & Dawis' Theory of Work Adjustment. Based on the E-cognition literature, I updated the "Abilities" portion of their model to include Knowledge and Skills (as well as Abilities). The result was the E-Correspondence model of entrepreneurship, which conceptualizes the bounded rationality of entrepreneurs (although the model can be applied to anyone making decisions with insufficient information). The

model also puts Schumpeter's assertion that all entrepreneurship is *local* (Schumpeter, 1934) squarely at the center of the entrepreneur construct. The E-Correspondence theoretical model (below) was developed to identify the variables likely to be predictive of entrepreneurship, and, for this analysis, those also related to E-ed. The testable model arranged the variables to better determine *how* E-ed works (endogenous mechanisms) alongside important exogenous and contextual factors; the model held up well to its first empirical test as a predictor of entrepreneurial production. Note that the "personality fit" in the workplace (top right) has exogenous effects on entrepreneurial action (the center box). While the "ability fit" (bottom right) also operates exogenously, E-ed works through the "feasibility" (endogenous KSA mechanisms/self efficacy) box (lower left).

The E-Correspondence Model (Figure 2) is re-created below but this time including the antecedent variables (in bold) that the causal (SEM) model found to be both related to E-ed and significant statistical predictors of entrepreneurship. (Recall that Desirability/Motivation (top left) and intrinsic/extrinsic motivation mechanisms were the qualitative aspect of the study).

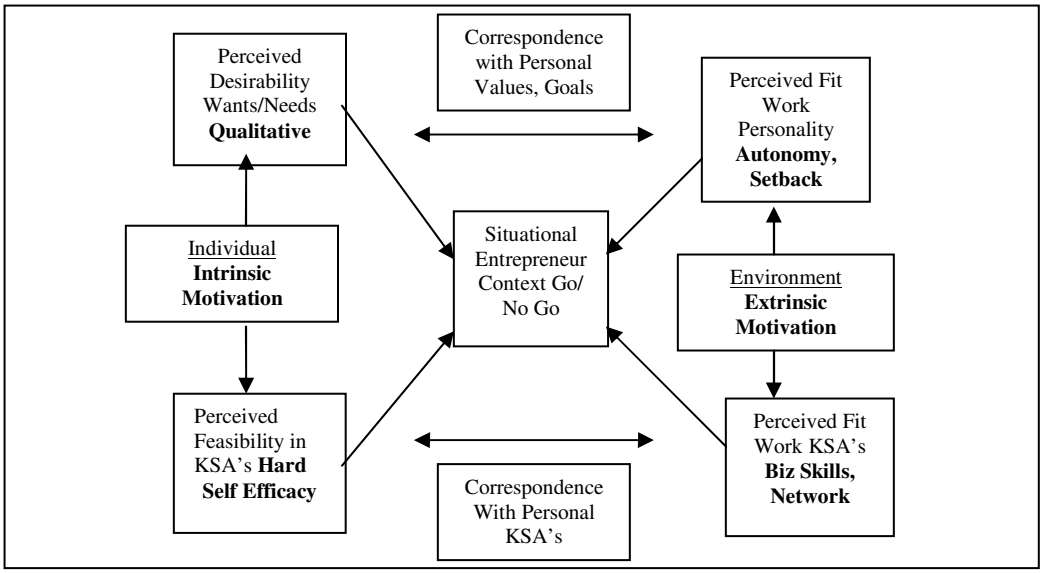

Figure 8. Bounded Rationality of the Entrepreneur:
Entrepreneurial Event in Context with Intrinsic/Extrinsic Correspondence Feedback
(Adapted from Shapero & Sokol; Lofquist & Dawis)

I. Causal E-ed Conclusions

Entrepreneurship is a dynamic system, influenced by social cognition, psycho cognition, individual differences and circumstance. In a complex system, you must study the component with the largest variance first to affect the output of the system, (Jenkins, 1981). The primary pedagogical conclusion revealed the inner workings of Sokol's "black box" of Feasibility (lower left in the model), the focus of the causal study (Shapero & Sokol, 1982). E-Self Efficacy is by far the most important psycho-social mechanism for creating E-outcomes. Not only must students perceive that they have the knowledge, skills, and abilities to launch a business, they also must perceive that they have the ability to succeed. The measure of the first aspect of "feasibility"—know-how—was the BizSkills variable. This variable, which asked respondents to self-assess on E-specific business skills, was the most

significant predictor of E-Self Efficacy. But business know-how was not sufficient, in and of itself, to catalyze entrepreneurship.

The endogenous variable most important to the successful E-ed programs, in that it mediated the relationship between group and E-self efficacy, was Networking. This measure asked respondents if they knew someone or knew how to find someone who could accomplish a number of tasks specific to starting a business. While the study found robust support for past research, finding Self Efficacy to be the most critical antecedent of entrepreneurship, this study provides insight into the psycho-cognitive and social cognitive forces required to produce self efficacy sufficient enough to produce the new products/services and businesses that generate economic growth.

This research study found that not all types of E-ed succeed in producing new business startups as well as new products and services. The study found no difference between the alumni of the UBiz courses and their matched controls on any of the DV's *or* on Self Efficacy. Thus, despite having taken E-ed, the UBiz treatment group did not differ in their entrepreneurial abilities from their matched controls. This finding was surprising because the UBiz program alumni demonstrated high levels of entrepreneurial activity (as did their matched controls). The opposite was the case for the UEng and GBiz alumni, where the differences between treatment and their matched controls on Self Efficacy and both the Startup and New Product/Service DV's were statistically significant. *Group still had a significant impact, even when controlling for all study covariates.* While each of the programs catered to different groups of students, it is also true that the two predictive E-ed programs took a higher-dosage, team-based, more highly robust andragogical approach to E-

ed while the UBiz course utilized more traditional teacher-directed, individual-oriented pedagogy, albeit with some andragogical components.

Andragogy is concerned with "relevance"--what are students most interested in learning that can immediately be applied in their day-to-day lives? Andragogical learning involves problem-based curricula, rather than content-based assignments. Andragogy, as opposed to pedagogy, is experiential, where students learn by doing (and being allowed to fail). Thus, andragogy is the ideal educational modality when it comes to teaching a subject that involves *tacit* knowledge and bounded rationality.

Tacit knowledge is the central construct behind Knowledge Spillover Theory that seeks to explain why technopreneurial activity tends to cluster in and around universities and in close proximity to other, similar startups. Tacit knowledge is different from explicit knowledge which is usually both rational and codified and thus searchable and knowable. Tacit knowledge is the implicit knowledge associated with experience, it may be knowledge so new it has not yet been codified, and it can even include the psychological conscious and subconscious modes of knowing (intuition), (Polanyi, 1967; Honig, 2004).

The andragogical approach utilized by the two successful E-ed programs were strikingly similar in that both involved real-world simulations. (The UBiz pedagogy was somewhat less andragogical in that it focused on inculcating entrepreneurial mindsets and business planning, as opposed to a prototype and/or business startup deliverable). UEng and GBiz student teams applied their individual skills in the building of actual companies in both courses--the potential existed that the companies would continue beyond the conclusion of the class for motivated participants, thus making the courses exceptionally relevant to

students and motivating them to engage at higher levels than they would an ordinary class. (Students routinely complained that 3-4 credit hours were insufficient for the time and effort they put into the class). Students identified problems, ideated solutions, created new technologies, and prototyped new products and services.

In particular, the UEng alumni excelled in terms of the latter outcome against their fellow (matched) engineers. This alone is a highly significant finding of the study (not found elsewhere) in that it suggests that an engineering education, does not in itself drive new product development—it's the andragogical E-ed component that helps transform engineers into the supply-side producers of technology innovation.

In addition, UEng and GBiz students conducted real market research, sales calls, raised real money, and met with countless experts. It was the latter aspect that appears to have made the biggest difference, since the Network variable was the endogenous mechanism that tied E-ed indirectly to Self Efficacy—the most important predictor of Entrepreneurial production.

The causal model thus attributes the success of the UEng and GBiz programs to their most tacit aspect. While constructivist approaches to E-ed may be more effective than case-based lecture approaches, as many scholars suppose, the best approach appears to be *authentic* learning where the line between class exercise and student-become-CEO is blurred, if not absent. This type of experience provides invaluable tacit learning that enhances perceived self-efficacy by boosting confidence in feasibility: both know-how (entrepreneurial psycho-social skillsets and mindsets) and know-who (support networks), and success.

The andragogical approach providing authentic learning experiences either outright or via simulations also validates emerging research suggesting that entrepreneurial cognition is developed by replacing "novice" entrepreneurial schemata with "expert" mental schemata. Schemata is defined by Gioia as "built up repertoires of tacit knowledge." (Vaghely, 2010). When individuals have the expert schemata developed as part of an andragogical simulation, for example, they have the mental frameworks in place that easily allow for new product/service/company innovation. They catalog new information and formulate cognitive scripts, which are the automatic responses that experienced entrepreneurs can draw upon to make decisions under conditions of uncertainty.

II. Theoretical and Exploratory Conclusions

While the endogenous mechanism predictors empirically support a theory of E-Cognition based on input/output mental shortcuts, (IO theory), the exogenous (personal) predictor findings lend support to the person x situation E-Correspondence typology, and the notion of bounded rationality. Entrepreneurs act based both based on perceptions of desirability and feasibility/self efficacy, but they also act based on their perceptions of "fit" in the work context, both with regard to their values, goals, and work personality, as well as with their perceptions about the efficacy of their knowledge, skills, and abilities (KSA's) in the workplace. I will discuss the former first.

A. E-Cognition Conclusions

In addition to teaching tacit entrepreneurial skillsets in an authentic fashion, this research suggests that andragogical techniques should support the teaching of entrepreneurial

mindsets, including the numerous cognitive strategies that entrepreneurs use expertly under conditions of bounded rationality. These strategies help to mitigate risk, which includes strategies of dealing with setbacks and failures so they seem less scary. One of the more interesting results of the study was the prominence of "Setback Response" in the final causal model. Entrepreneurs could be predictably distinguished from non-entrepreneurs on the way they perceived major setbacks and failures. Entrepreneurs were not distinguishable on tenacity and persistence (contrary to some other research findings). While non-entrepreneurs were more likely to try again, harder, entrepreneurs were more likely to learn from what happened and try to capitalize on the situation.

One of the key findings of the study lends support to the idea that entrepreneurs creatively manipulate inputs as a risk management strategy. The entrepreneur's motivational preference for intrinsic resources (see Qualitative findings) and more creative response to a setback input (they learn and pivot rather than keep trying over again) conforms to the definitional creative aspects of entrepreneurial thinking.

Another way to look at risk mitigation is to turn it around and talk about perceived "control." IO knowledge theory postulates that entrepreneurial cognition involves talented management of inputs (resources and information at-hand) as a strategy to better manage uncertainty and control risk. IO knowledge theory suggests that entrepreneurs are particularly adept with inputs, both perceiving them more acutely than others (Kirzner's "alertness" to opportunity), and processing them and responding to them in creative ways. These input management strategies include bricolage (Baker & Nelson, 2005), as well as "effectuation" —which focuses not on desired end-results but on the given set of inputs and

focuses on selecting among the possible effects that can be created with that set of inputs (Sarasvathy, 2001).

Bricolage, effectuation, expert schema, scripts, heuristics, self belief/efficacy and setback competence are all techniques to enhance perceived control. Having a robust social support network is a critical component to enhancing perceived control as well. In sum, entrepreneurs are not necessarily risk takers; they are risk attenuators, (even if this attenuation is only in their own mind).

While the causal model was the focus of this study, and its key investigative questions related to the efficacy and impacts of E-ed, exploratory analysis was also conducted to test the overall goodness of fit of the IO theoretical construct that grounded my E-cognition research (Sokol's "black box" at the bottom left of Figure 8). Overall, goodness of fit with IO theory was further suggested by the Critical Analysis self assessment pre-post measure correlation. If entrepreneurs are talented input preceptors, managers, and interpreters, you might expect them to self-assess high on the basis of this talent.

The significance of the Critical Analysis measure on the dichotomous Startup DV was tested via binary logistic regression (N=593). Sure enough, the odds of high self-assessed abilities in critical analysis skills were 67% higher for entrepreneurs than for non-entrepreneurs. (Exp(B)=1.667; p=.001).

Similarly, the significance of a related input variable, self-assessment of Coping with Change was also tested against the dichotomous Startup DV via binary logistic regression, (N=593). Again, in support of the IO cognition theory, odds of high self-assessed input-

associated abilities "coping with change" were 56% higher for entrepreneurs than for non-entrepreneurs. (Exp(B) = 1.559; p=.001).

Finally, the E-cognition variable "Ability to Plan and Carry out Projects Independently" was assessed via binary logistic regression against the dichotomous Startup DV (N=593). The odds of high self-assessment on ability to plan/execute was 74% higher for entrepreneurs than for non-entrepreneurs, (Exp(B) = 1.738; p=.000).

These exploratory findings, while correlational and not causal, call for additional research into whether IO is comprehensive and robust enough to ground a new theory of entrepreneurial cognition.

B. Personal Characteristics Conclusions

If entrepreneurship is a dynamic person x situation phenomenon, as this study confirms, it is important that the field not leave individual differences out of the equation. The final, predictive model conclusively indicated that work personality and workplace fit play a significant role in creating entrepreneurs. The two most important individual differences were individual attitudes and needs for personal autonomy. Group membership (Entrepreneur vs. Non-entrepreneur) was predictable based on respondents' responses to this question, which asked them to rate their workplace fit preferences between "Employee Autonomy" and "Close Employee Supervision."

(Other personality-fit variables were also predictive of the DV in models that did not include the E-ed variables, including workplace risk, rules, and planning horizons; this result will be further explored in subsequent analysis).

Further research will need to be conducted to determine whether psycho-social personal variables like Autonomy and SetBack Response are modifiable by educational interventions, or whether they are hard-wired personality traits (like optimism vs. pessimism). However, given the obvious logical connection between both personal Autonomy and Setback Response with Self Efficacy, it seems likely that andragogical approaches that boost confidence in personal abilities (less need to rely upon others) as well as overcoming adversity (even if I lose I still win) will support the predictive personal characteristics that drive successful E-ed outcomes.

The research concludes that personal predispositions and individual differences in outlook and perspective impact entrepreneurship, perhaps as much as knowledge and skills preparation. In educating the prospective entrepreneur, both skillsets *and* mindsets matter. In addition to desirability (again, a personal preference), feasibility ultimately depends on confidence in ability which is lacking for those less independent or developed in their personal risk management strategies.

C. Contextual Conclusions

The theoretical model's suggestion that social and contextual factors influence entrepreneurship was also supported. Having an entrepreneurial parent was the most critical contextual variable, (See Q. C4.1-5, Appendix B) in the causal model. Other contextual variables, such as independently obtaining a first paying job in elementary school were also significant differentiators between entrepreneurs and non-entrepreneurs.

Exploratory research was conducted to test the fit of the E-Correspondence model overall. The model's underlying premise is that individuals leave paid employment (the Go/No Go at the center) to become entrepreneurs because of poor personality/skills correspondence in the workplace. Thus I would expect to find overall support for the model if entrepreneurs were significantly different from non entrepreneurs in their numbers of job and career changes. Exploratory regression analysis found the odds of having high numbers of job changes was 87% higher for entrepreneurs than for non-entrepreneurs. (N=603; Exp(B)=1.866; p=.000). Likewise, having a large number of career changes was 57% higher for entrepreneurs than for non-entrepreneurs, (N=603; Exp(B)=1.566; p=.000).

This exploratory finding, while correlational and not causal, calls for additional research into the suitability of the E-Correspondence model as a theory for better understanding (and predicting) the entrepreneurial event within the context of the boundedly rational entrepreneur.

III. Limitations

The foregoing results should be considered conditional on study limitations. First, this study mixes relatively new theoretical constructs with established constructs and from this relatively new perspective performs research on several exploratory constructs in an entrepreneurship research context that is still in the early stages of development.

Because the study was conducted at only one University, the generalizability of the results is limited to other similar institutions with similar E-ed populations and programs.

In terms of sampling, the study utilized a purposeful sample (all alumni who had completed an E-ed course since the inception of the course). However, the carefully constructed, matched control group should help to mitigate this concern, which is generally unavoidable in E-ed evaluation studies (since random selection is not possible).

There were also sample size limitations. Analysis within program groups, comparing entrepreneurs to non-entrepreneurs for example, was conducted on an exploratory basis only, given small cell sizes (<50). Future research comparing alternative E-ed pedagogies should seek out larger cell sizes. This may require multi-university collaborations (a resource-intensive endeavor) given that university programs have limited numbers of alumni given the relative recency of the programs.

At the other end of the spectrum, the quantitative analysis frequently found small effect sizes at the Treatment vs Control levels (N=603 for the whole group; N=452 for the two successful programs). In many cases beta weights were small but significant. While power analysis indicates that the sample size of 603 provides adequate power to reliably detect a p of .8, larger sample sizes can have the downside of significance with minor differences between groups, thus suggesting population level differences when none in fact exist (Type I error). For this reason, confidence intervals have been reported at every opportunity to fully disclose the magnitude of the effects found. Also, each of Shadish et al's (2002) suggested methodologies to strengthen inferential power have been employed in this study (large N, matching, covariates, similar cell sizes, unrestricted measurement ranges (to confirm dichotomous measure findings), attention to dosages, and the use of powerful statistical tests (SEM)).

With regard to dosages and construct reliability, like all longitudinal education program studies, construct reliability is subject to program fidelity over the years. Given that professors and courses come and go, the three programs studied had a remarkable degree of fidelity in that they either involved long-term faculty or new faculty who continued to implement a consistent overall course philosophy. Additional analysis might be instructive, documenting in detail tangible curricular changes over time across the programs. Dosages involving the two significant programs were similar, (2 semesters), although they involved different types and levels of students (undergrad engineers vs. graduate business). The UBiz students had an opportunity to receive an equivalent dosage only the last two survey years of the study, (very few students availed themselves of this opportunity), suggesting that dosage level differences between the significant/non-significant treatments may be an important factor in explaining program level differences.

In terms of metrics, a general lack of relevant published and validated psychometric scales made the project immensely more difficult. Several of the measures had to be developed utilizing rational construction, and while convergent validity checks and psychometric testing (of scales) suggest they accurately reflected their operational definitions, further testing will help to confirm their construct validity.

The ambitious scope of the research, which covered multiple domains with a huge body of research behind them, required the truncation of a number of complex constructs to a single item or a short battery of items. For example, the personality "fit" measures utilized semantic differential scaling (single measures on a continuum of opposites). This fairly unconventional exploratory approach was utilized in order to double the number of

constructs measured by the scale, without doubling the number of questions. While the single measure aspect of these items was a disadvantage, there were redundacies throughout the questionnaire that allowed for convergent validity checks on these measures.

The Intrinsic/Extrinsic motivation variable which operationalized the effectuation construct was a single measure, developed via rational construction from theory, and thus will require additional confirmatory research. Likewise, my measure of one of the more significant variables (Setback Response) is the first attempt at operationalizing the construct. Further research should be undertaken to better develop and refine the construct, which distinguishes among seven distinct psychological strategies for handling major setbacks and failures. Similarly, the Desirability variables were limited in terms of sample size (around 100) as well as their qualitative aspect.

Finally, much of the data is derived from self-report measures (another common deficiency in E-ed research). While social desirability can bias self-reporting, this possibility was minimized by the longitudinal aspect (which also minimized recency effects). Furthermore, the invitation to participate masked the purpose of the study. Respondents were asked to respond to a Career-Follow-up Study for Business and Engineering alumni, and many questions were included that did not particularly pertain to the subject of entrepreneurship. (For example, had they taken additional business courses in accounting, and lots of background, family, and career questions). The questions solely involved with entrepreneurship were asked at the very end of the study, and involved a skip pattern, so web respondents who had *not* started a business did not even see most of the business startup questions. Furthermore, no current students participated in the study, and no non-response or

recency response biases were found. These problems have undermined a number of similar research studies.

And last but certainly not least, the causal model was able to explain only around 30% of the variance on E-outcomes, with half of this explained by E-Self Efficacy. What explains the remainder of the variance? Some of the constructs suggested by the qualitative research, not included otherwise in this study, may help to explain some of the remaining variance and should be fruitful topics for future research: other measures of work-fit correspondence; contextual variables like job loss, mentors, other resources; personal variables like passion, corporate aversion, and security; and, cultural/societal influences.

IV. Discussion and Implications

At the beginning of this treatise the question was asked: How do we get more entrepreneurs in order to create more new jobs? This research study is a first step in answering this question. While in some other countries, cultural norms and capital access may be the biggest obstacles to entrepreneurship, in the U.S., education is the biggest barrier.

This study concluded that entrepreneurship outcomes can result from E-ed, but not all E-ed successfully produces E-outcomes. In this study, the most andragogical programs did produce successful E-outcomes, but that result cannot be attributed to E-ed alone; it results also from a complex mix of personal characteristics including predispositions and self efficacy in KSAs, social networks, and even contextual experiences (like having an entrepreneurial parent).

This study has contributed to the research in the field a number of ways. It is the first study to attempt a Storey Step 6 evaluation of E-ed, and thus it sets an example for other entrepreneurship researchers at the individual level of analysis. Generally, the psychological research conducted in the field (usually by firm-level business school researchers) lacks appropriate control groups for comparison with entrepreneurs. (To-date researchers have tended to compare Entrepreneurs to managers (Busenitz & Barney, 1997) or they compare entrepreneurs to the general population (Gartner, 2001)).

The study is the first that I am aware of to utilize a pre-measure taken prior to when respondents became entrepreneurs (2 cohorts out of 3) to test for the influence of self-selection in E-ed. Interestingly, some self-selection was found on personal characteristics but it was of no consequence. The study is the first to utilize a variety of dependent variables—categorical, ordinal, and continuous—to better take advantage of sophisticated statistical techniques like structural equation modeling (SEM). And it is the first study to demonstrate (through convergent validity) that entrepreneurship can be measured as a continuous metric along an entrepreneurial spectrum from enterprising behaviors (such as social entrepreneurship) to intrapreneurship to business entrepreneurship.

The study is the first that I know of to show differences in E-outcomes between different E-ed pedagogies, and the first to identify the mechanisms behind *how* E-ed works, when it works. Finally it demonstrates the strength of person x context research approaches and identifies personal mindsets and work-related personality variables as statistically significant predictors of E-outcomes. The study proposes and preliminarily tests several

new, and promising, theoretical frameworks for better understanding individual entrepreneurs, their skillsets, and their mindsets (E-Correspondence and IO E-Cognition).

While E-ed has been empirically shown to create entrepreneurs in this study, caution must be taken in declaring that E-ed works. In fact all that this study has shown is that a team-based simulation andragogical approach predicted entrepreneurial outcomes (new products, services, and business startups) at one particular university. Furthermore, in addition to KSA's and social network variables, personal characteristics and contextual factors were also important and significant predictors of E-outcomes at this locale.

How can educators, at all levels, utilize the results of this research? As a psycho-social, dynamic phenomenon, entrepreneurship is amenable to social and cultural forces, including education. If E-ed is to produce entrepreneurial outcomes, it needs to be customized to individuals who have a tacit work preference and who practice bounded rationality (Busenitz & Barney, 1997). Educators must understand the psycho-social-cognitive factors that determine and influence the bounds of rationality. An entrepreneurial "eco-system" approach to education should not ignore individual differences; and education modalities must take into consideration the local environments where the education takes place. One way to deal with this variation is to employ andragogical approaches that embed the entrepreneur in local context, instill tacit knowledge and entrepreneurial mindsets, while also facilitating the development of each student's entrepreneurial network.

While further research is needed, perhaps students should be explicitly taught IO risk-attenuation techniques. Interestingly, the two E-ed programs studied do this implicitly. Both programs employ an andragogical approach that has a strong emphasis on "iteration."

Students learn something, they apply it, they learn something new, they go back and "iterate" the new information into their previous work. As a result many students completely change course several times throughout the semester. Students gain practice in entrepreneurial Setback strategies as they begin to learn that this kind of "failure" is tolerated and even encouraged. The approach is increasingly being adopted in andragogical E-ed curricula (Blank, 2006).

If internal motivation most often drives entrepreneurship (as this study suggests) the andragogical approach utilized by the two predictive E-ed programs make good use of this mindset. Students know that, at the end of the course, student-turned-CEO is a distinct, credible possibility. Thus they are highly internally motivated to make this happen. Interestingly, this aspect of the UBiz course, which focused on cultivating students' idiosyncratic talents and aspirations in order to channel their opportunity identification efforts into business ideas highly of interest to them, may have been one reason for the sheer number of successful E-outcomes reported by these graduates. If an in-depth focus on both mindsets *and* skillsets is required for the successful translation of E-ed to E-outcome, perhaps more than a single course is required for students to absorb and apply what they've learned.

To the degree students are introduced to entrepreneurial concepts early, (as early as elementary school, even), socialization for entrepreneurial careers can begin. Today few K-12 students know that "making their own job" is even an option for them. Students are socialized to graduate from high school, go to college, and get a job, even if this may not be the best fit for many self-starters. Even earlier, in elementary school, students could be recognized for their creativity and inventiveness with the simple addition of this rubric in the

grading of student projects. Just as students are currently taught life skills such as character education and conflict resolution, K-12 students could be taught risk mitigation skills; they could be rewarded for initiative taking, independent effort, and even allowed to fail. Just as UEng professors do, primary school teachers could encourage students to "fail fast" so they can "hurry up and succeed!" Teaching students to think creatively will help them to perceive mistakes and failure as an opportunity for learning. Spatial relations is another important talent tied to creativity that should be encouraged in American youth if we are to retain our nation's edge in innovation, technology, engineering, and entrepreneurship.

Overall, to the degree that authentic entrepreneurial teamwork and other experiences can be embedded in local context and networks, educators at all levels should feel confident that they are enhancing student entrepreneurial self-efficacy and planting the seeds for future entrepreneurial endeavor.

At the university level, the research suggests a number of prescriptive approaches for technopreneurial educators. While universities have faculty equipped to immerse students in authentic product invention, development and business development experiences, unfortunately few university faculty outside of business schools (or even in many business schools) are engaged in this type of teaching. Even fewer attempt to embed students in local entrepreneurial ecosystems and networks.

Two alternative approaches in sync with the findings of this research are possible—move business school faculty into the other schools (Engineering, Science, Medical) to help students with new technologies develop them into new products and businesses. Alternatively, business schools could become much more multi-disciplinary, employing

nurses, doctors, engineers, and scientists who also happen to be entrepreneurs to support students of any discipline enrolling in their entrepreneurship courses. While many universities promote multidisciplinary student teams in entrepreneurship programs, many of these same universities fail to acknowledge that multi-disciplinary faculty would better support technopreneurial student teams, and better embed them into local E-ecosystems.

The most exceptional University-level E-ed program, (in terms of "fit" with the research findings) that was identified over the course of this research project is the Product Development graduate program at Carnegie Mellon University. The university has managed to overcome the "silo" problem that plagues many other universities and has created a program where Business, Design, and Engineering faculty collaborate to provide students from a variety of backgrounds an andragogical entrepreneurship experience. The students have assembled toolkits in all three disciplines by the time they leave the program, which includes both launching their businesses and patenting their work.

V. Directions for Future Research

Given that entrepreneurial skillsets and mindsets are best developed and applied together, future research supporting the development of a theory of Entrepreneurial Cognition is critical. Today, E-cognition researchers are faced with a situation very similar to that faced by Gartner in the 1990s, where a number of disparate lines of research, from entrepreneurial heuristics to expert entrepreneurial scripts, (Mitchell et al., 2002; Smith et al., 2009) beg for coherence. IO Knowledge Theory presents a promising perspective and

further study should be undertaken to probe its suitability as a theory of entrepreneurial cognition.

Likewise, the significance of the four components of the Entrepreneurial Correspondance Model to this study's causal model, as well as the qualitative intrinsic/extrinsic data presented in the current study, suggest that this bounded rationality model of the entrepreneur holds promise in explaining entrepreneurial behaviors at the individual level of analysis. While many of the variables suggested by the model were key aspects of the causal E-ed model, other aspects were qualitatively evaluated and the overall model itself was subject only to correlational regression analysis; thus this aspect of the study must simply be considered to be a contribution to the theoretical research. Additional research needs to be done to rigorously test the model and determine whether this "Correspondence" conceptualization can withstand the rigor of multiple studies in diverse contexts and environments. Similarly, new metrics and instrumentation will need to be developed to test the "correspondence" aspects of the model (which were implicit, rather than explicit aspects of the current study).

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APPENDICES

Appendix A

Table A.1. Pearson Correlations and Chi Square (Dichotomous variables) Significance Between DV's

	Er (Ord)	Er (Dichot)	ErContin (RawContDV)	ErEntSU (Ord)	EntProd Develop (Ord)	EntNon StUpTr (Cont)	Intent (Cont)	Art (Dichot)
Er(Ord)	1.0							
ErDichot	4.9E2 .000	1.0						
ErContin (RwCont DV)	.760 .000	3.6E2 .000	1.0					
ErEntSU Ord	.749 .000	3.2E2 .000	.883 .000	1.0				
EntProd Develop Ord	.196 .000	21.39 .000	.542 .000	.287 .000	1.0			
EntNon StUpTr Cont	.264 .000	57.88 .000	.679 .000	.398 .000	.283 .000	1.0		
Intention Cont.	.187 .000	35.12 .004	.318 .000	.282 .000	.211 .000	.175 .000	1.0	
Art Dichot	8.19 .017	6.14 .013	28.65 .004	11.22 .024	7.52 .023	18.16 .000	21.53 .159	1.0

Table A.2. Hypothesis I Retest (Univariate GLM) Controlling for Pre-Test Measure (Coping with Change) on Premeasure SubGroup N=201

Tests of Between-Subjects Effects

Dependent Variable:RawAllContDV

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	35.183[a]	2	17.591	2.591	.077	.026	5.182	.512
Intercept	70.944	1	70.944	10.449	.001	.050	10.449	.896
PmCurCopChng	.161	1	.161	.024	.878	.000	.024	.053
Group	35.060	1	35.060	5.164	.024	.025	5.164	.618
Error	1344.290	198	6.789					
Total	2378.000	201						
Corrected Total	1379.473	200						

a. R Squared = .026 (Adjusted R Squared = .016)

b. Computed using alpha = .05

Table A.3. Chi-Square and Significance between Demographic IV's, (Match Variables) and Grouping Variable (Treatment/Control)

	Group Tmnt / Cntrol
Gender	1.003 .32
Race	1.169 .28
Age	.915 .34
Degree	.350 .55

Table A.4. Hypothesized Process Variables (IV's): Correlations with E-Outcome DV

		ContDV	CreatAdapt	ProacTen	BizSkills	AcadSkills	SoftSkills	HrdSlfEff	SftSlfEff	Network	Autonomy	RiskClim	SlfConfid	DecisiRisk	Setback	AgeFrstJob	ParentEr
ContDV	Pearson r	1															
	Sig																
CreatAdapt	Pearson r	.279**	1														
	Sig	.000															
ProacTen	Pearson r	.148**	.346**	1													
	Sig	.000	.000														
BizSkills	Pearson r	.380**	.411**	.402**	1												
	Sig	.000	.000	.000													
AcadSkills	Pearson r	.263**	.420**	.412**	.515**	1											
	Sig	.000	.000	.000	.000												
SoftSkills	Pearson r	.196**	.463**	.421**	.517**	.506**	1										
	Sig	.000	.000	.000	.000	.000											
HrdSlfEff	Pearson r	.534**	.284**	.268**	.685**	.312**	.327**	1									
	Sig	.000	.000	.000	.000	.000	.000										
SftSlfEff	Pearson r	.473**	.488**	.356**	.680**	.466**	.475**	.586**	1								
	Sig	.000	.000	.000	.000	.000	.000	.000									
Network	Pearson r	.315**	.265**	.177**	.400**	.218**	.220**	.488**	.359**	1							
	Sig	.000	.000	.000	.000	.000	.000	.000	.000								
Autonomy	Pearson r	.226**	.348**	.161**	.229**	.308**	.205**	.200**	.197**	.169**	1						
	Sig	.000	.000	.000	.000	.000	.000	.000	.000	.000							
RiskClim	Pearson r	.267**	.398**	.118**	.334**	.237**	.277**	.297**	.402**	.239**	.173**	1					
	Sig	.000	.000	.005	.000	.000	.000	.000	.000	.000	.000						
SlfConfid	Pearson r	.208**	.407**	.344**	.374**	.416**	.703**	.263**	.349**	.219**	.186**	.220**	1				
	Sig	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000					
DecisiRisk	Pearson r	.229**	.449**	.317**	.668**	.498**	.453**	.430**	.554**	.264**	.259**	.355**	.400**	1			
	Sig	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000				
Setback	Pearson r	.206**	.176**	.005	.124**	.043	.090*	.135**	.162**	.096*	.071	.160**	.082*	.118**	1		
	Sig	.000	.000	.911	.003	.294	.029	.001	.000	.021	.084	.000	.045	.004			
AgeFrstJob	Pearson r	-.154**	-.080	-.090*	-.165**	-.098*	-.062	-.151**	-.157**	-.159**	-.118**	-.022	-.058	-.132**	-.065	1	
	Sig	.000	.056	.032	.000	.017	.131	.000	.000	.000	.004	.594	.157	.001	.115		
ParentEr	Pearson r	.127**	.040	-.055	.045	.025	-.010	.132**	.058	.119**	.021	.033	.007	.018	.045	-.068	1
	Sig	.002	.333	.187	.280	.539	.800	.001	.163	.004	.616	.422	.871	.665	.279	.095	

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Table A.5. Self Efficacy Correlations with Grouping and E-outcomes

Correlations					
		Tmnt 1, Cntrl 0	SESHardEship	SESoftEship	RawAllContDV
Tmnt 1, Cntrl 0	Pearson Correlation	1	.159**	.132**	.191**
	Sig. (2-tailed)		.001	.006	.000
	N	452	437	438	452
SESHardEship	Pearson Correlation	.159**	1	.572**	.523**
	Sig. (2-tailed)	.001		.000	.000
	N	437	437	437	437
SESoftEship	Pearson Correlation	.132**	.572**	1	.451**
	Sig. (2-tailed)	.006	.000		.000
	N	438	437	438	438
RawAllContDV	Pearson Correlation	.191**	.523**	.451**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	452	437	438	452
**. Correlation is significant at the 0.01 level (2-tailed).					

Table A.6. Mediation Analysis: both Hard and Soft Self Efficacy entered in Step 2

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	2.545	.187		13.580	.000	2.177	2.913
	Tmnt 1, Cntrl 0	1.186	.292	.191	4.060	.000	.612	1.760
2	(Constant)	-4.288	.655		-6.548	.000	-5.575	-3.001
	Tmnt 1, Cntrl 0	.630	.250	.102	2.522	.012	.139	1.122
	SESoftEship	.249	.055	.219	4.516	.000	.141	.357
	SESHardEship	.251	.032	.382	7.844	.000	.188	.314
a. Dependent Variable: RawAllContDV								

Table A.7. Cognition Mechanisms: Network Mediating Hard Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	13.390	.287		46.654	.000	12.826	13.954
	Tmnt 1, Cntrl 0	1.500	.447	.159	3.353	.001	.621	2.379
2	(Constant)	9.373	.449		20.884	.000	8.491	10.255
	Tmnt 1, Cntrl 0	.711	.404	.075	1.761	.079	-.083	1.504
	NetwkScale	.934	.086	.465	10.868	.000	.765	1.103
a. Dependent Variable: SESHardEship								

Table A.8. Cognition Mechanisms: Network Mediating Soft Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	13.957	.166		83.832	.000	13.630	14.284
	Tmnt 1, Cntrl 0	.720	.260	.132	2.775	.006	.210	1.230
2	(Constant)	12.179	.275		44.314	.000	11.639	12.720
	Tmnt 1, Cntrl 0	.371	.247	.068	1.501	.134	-.115	.857
	NetwkScale	.413	.053	.356	7.855	.000	.310	.517
a. Dependent Variable: SESoftEship								

Table A.9. Risk Mediated by Hard Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.538	.565		.951	.342	-.573	1.649
	FinRiskRw	.648	.142	.214	4.563	.000	.369	.927
2	(Constant)	-2.431	.553		-4.400	.000	-3.517	-1.345
	FinRiskRw	.216	.129	.071	1.678	.094	-.037	.469
	SESHardEship	.331	.028	.503	11.824	.000	.276	.386
a. Dependent Variable: RawAllContDV								

Table A.10. Risk Mediated by Soft Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.538	.565		.952	.341	-.572	1.648
	FinRiskRw	.648	.142	.214	4.568	.000	.369	.926
2	(Constant)	-4.503	.747		-6.026	.000	-5.972	-3.034
	FinRiskRw	.134	.141	.044	.949	.343	-.143	.410
	SESoftEship	.493	.053	.433	9.326	.000	.389	.596
a. Dependent Variable: RawAllContDV								

Table A.11. Self Confidence Mediated by Soft Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.289	.750		.385	.700	-1.185	1.763
	SelfConfidSk	.683	.183	.176	3.729	.000	.323	1.043
2	(Constant)	-4.534	.842		-5.383	.000	-6.190	-2.879
	SelfConfidSk	.102	.177	.026	.578	.563	-.245	.449
	SESoftEship	.502	.052	.442	9.714	.000	.401	.604
a. Dependent Variable: RawAllContDV								

Table A.12. Self Confidence Mediated by Hard Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.289	.751		.385	.700	-1.186	1.764
	SelfConfidSk	.683	.183	.176	3.725	.000	.323	1.043
2	(Constant)	-2.280	.684		-3.333	.001	-3.624	-.935
	SelfConfidSk	.147	.165	.038	.890	.374	-.177	.471
	SESHardEship	.337	.028	.513	12.083	.000	.282	.392
a. Dependent Variable: RawAllContDV								

Table A.13. Risk (Decisions) Mediated by Hard Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.084	.614		.137	.891	-1.123	1.292
	DecisionsRisk	.807	.164	.230	4.934	.000	.485	1.128
2	(Constant)	-1.792	.563		-3.183	.002	-2.899	-.685
	DecisionsRisk	.003	.160	.001	.020	.984	-.310	.317
	SESHardEship	.344	.030	.523	11.478	.000	.285	.403
a. Dependent Variable: RawAllContDV								

Table A.14. Risk (Decisions) Mediated by Soft Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.084	.614		.137	.891	-1.122	1.291
	DecisionsRisk	.807	.163	.230	4.940	.000	.486	1.128
2	(Constant)	-4.132	.730		-5.661	.000	-5.567	-2.698
	DecisionsRisk	-.132	.182	-.038	-.722	.470	-.489	.226
	SESoftEship	.536	.059	.472	9.084	.000	.420	.653
a. Dependent Variable: RawAllContDV								

Table A.15. Proactive-Tenacious Mediated by Hard Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-.416	1.140		-.365	.715	-2.658	1.826
	ProactiveTenFactor	.212	.070	.146	3.049	.002	.075	.349
2	(Constant)	-2.429	.997		-2.436	.015	-4.388	-.469
	ProactiveTenFactor	.043	.061	.030	.706	.481	-.077	.164
	SESHardEship	.340	.028	.516	12.220	.000	.285	.394
a. Dependent Variable: RawAllContDV								

Table A.16. Proactive-Tenacious Mediated by Soft Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-.416	1.139		-.365	.715	-2.655	1.823
	ProactiveTenFactor	.212	.069	.146	3.053	.002	.075	.348
2	(Constant)	-4.034	1.092		-3.694	.000	-6.181	-1.888
	ProactiveTenFactor	-.019	.067	-.013	-.282	.778	-.150	.113
	SESoftEship	.517	.052	.455	9.898	.000	.415	.620
a. Dependent Variable: RawAllContDV								

Table A.17. Creative-Adaptive Mediated by Soft Self Efficacy

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-2.758	1.064		-2.593	.010	-4.849	-.668
	CreativeAdaptFactor	.225	.041	.256	5.495	.000	.145	.306
2	(Constant)	-5.034	1.016		-4.953	.000	-7.032	-3.036
	CreativeAdaptFactor	.045	.043	.052	1.052	.294	-.039	.130
	SESoftEship	.484	.056	.426	8.690	.000	.375	.594
a. Dependent Variable: RawAllContDV								

Table A.18. Open-Ended Motivation Factor Frequencies
With Intrinsic/Extrinsic Categorization

Intrinsic (I) vs. Extrinsic (E)	Construct	% E-ed	% Control	Frequency (Total # Mentions)
(I)	Personal Drive/Achievement	55	45	33
(E)	Money (Need or Challenge)	42	58	31
(I)	Autonomy/Self Reliance	59	41	27
(E)	Opportunity Identification	45	55	22
(E)	Another Person or Family member	47	53	17
(I)	Knowledge/Skill/Ability (KSA)	64	36	11
(I)	Corporate Aversion	64	36	11
(I)	Emotion (Passion/Excitement/Security)	70	30	10
(E)	Resources	100	0	3
(I)	Risk	100	0	2
(I)	Age	100	0	1

Table A.19. Open-Ended Success Factor Frequencies
With Intrinsic/Extrinsic Categorization

Intrinsic (I) vs. Extrinsic (E)	Construct	% E-ed	% Control	Frequency (Total # Mentions)
(I)	Personal Drive/Achievement	42	58	57
(E)	Another Person or Family member	39	61	33
(I)	Knowledge/Skill/Ability (KSA)	63	37	30
(I)	Attitude (Luck, Faith, Gratitude)	25	75	8
(I)	Risk, Setback	33	67	6
(I)	Confidence	67	33	6
(E)	Opportunity Identification	50	50	6
(I)	Autonomy/Self Reliance	60	40	5
(I)	Creativity	25	75	4
(E)	Money (Need or Challenge)	75	25	4
(I)	Attitude (Courage, Integrity)	25	75	4
(I)	Attitude (Curiosity, Humor, Power, Flexibility)	75	25	4

Appendix B

NC STATE UNIVERSITY

This is a career follow-up research study of North Carolina State University Alumni.
Thank you for helping support your alma-mater!

You are being asked to take part in a research study. Your participation is voluntary. We are interested in your career and work related activities since graduation. In addition we are interested in your attitudes and opinions about the factors behind your career success including your knowledge, skills, abilities, family background, and personality-workplace fit. Your participation will help us assess and improve NCSU programs. This survey should take about 15 – 20 minutes to complete. This information is part of a doctoral research project on the impact of undergraduate and/or graduate education. To encourage participation, individuals who complete the survey will be entered in a drawing. The winner will receive an iPOD nano or can elect to donate the value of a nano to their favorite charity.

A. Please tell us about your education:

A1. What is the highest level of education you have completed?

❑ College but no degree ❑ Bachelor's degree ❑ Master's degree ❑ Doctoral degree

A2. In what field(s) do you currently hold college degrees in?

❑ Scientific field ❑ Engineering ❑ Education
❑ Management, Finance, Marketing or other business-related field
❑ Social science field (Psychology, Anthropology, Sociology, etc.)
❑ Other professional field (Medicine, Law, etc.).
❑ Other (please describe) _____

A3. Did you take courses at NCSU with a focus on any of the following topics: product development, product/technology commercialization, entrepreneurship, intellectual property/patents, small business development?

❑ Yes ❑ No

A4. Have you received additional formal business-related education after graduating from NCSU?

❑ Yes ❑ No

A5. If yes, what kind of business education? (Select all that apply).

❑ Management ❑ Finance ❑ Accounting ❑ Strategy
❑ Entrepreneurship ❑ Marketing ❑ Other ❑ N/A

A6. Prior to attending NCSU were you a business owner or did you start a business while you were a student?

❑ Yes ❑ No

Privacy Disclosure: *All information provided is strictly confidential based on a code number; results from the survey will only be reported in aggregate form (e.g., means and frequency counts). By taking this survey, you are giving permission for the researcher to have access to your freshman orientation survey data if you completed a freshman orientation survey at NCSU. Your responses on this survey may be compared to the freshman orientation survey; (data may include your major, demographic information and career attitudes). There should be no risk to you from participation, but you are free to skip any question if you are uncomfortable. If you have questions at any time about the study or the procedures, you may contact the researcher, Elaine Rideout, at 919/345-6619. If you have any questions about your rights as a research subject you may contact Dr. David Kaber, Chair of the NCSU IRB for the Use of Human Subjects in Research Committee, Box 7514, NCSU Campus (919/515-3086) or Mr. Matthew Ronning, Assistant Vice Chancellor, Research Administration, Box 7514, NCSU Campus (919/513-2148)*

«CODE» 1

B. Please tell us about your career:

B1. Which of the following best describes your current employment?
(check ONLY the one where you work the greatest number of hours/week)

- ❑ Manufacturing
- ❑ Retail
- ❑ Professional Services (Architect, Engineer, Legal etc.).
- ❑ Health Services
- ❑ Government
- ❑ Education
- ❑ Nonprofit
- ❑ Self (homemaker)
- ❑ Self (independent contractor or business owner)
- ❑ Student
- ❑ Currently looking for a job
- ❑ Other (please describe) _____

B2. Is your employer working on the development, production, or delivery of technology or science-based products like hardware, software, telecommunications, manufacturing equipment, chemicals, pharmaceuticals, bio-tech, and/or medical devices, etc.?

- ❑ Yes
- ❑ No

B3. Does your employer conduct and/or support research and development?

- ❑ Yes
- ❑ No

B4. Do you currently or have you in the past worked for a new start-up company, a new spin-off company, or a new branch or division of an established firm? (Select all that apply).

- ❑ Start-up company
- ❑ Spin-off company
- ❑ New branch or division of established firm
- ❑ No

B5. Which of the following best describes the functional work area(s), department or group you have worked in over the course of your entire career? (Select all that apply):

- ❑ R&D group
- ❑ New Product, Process, or Service Development and/or Design
- ❑ Engineering
- ❑ Construction, Manufacturing
- ❑ Technical Support
- ❑ Sales, Marketing, Customer Support
- ❑ Human Resources
- ❑ Management, Finance, Planning, Coordination, Strategy
- ❑ Policy and Social Welfare
- ❑ Education (teaching/communications/public relations/media)
- ❑ Other (please describe) _____

B6. Which of the following best describes your career highest management level? Note that these are generic labels and may not match exactly the terminology used in your position. Please select the one that best represents your highest level.

- ❑ Non-supervisor or individual contributor
- ❑ Supervisor
- ❑ Manager of supervisors
- ❑ Manager of managers
- ❑ Executive (including VP's and above)

B7. How many employees did you supervise in the above position?

- ❑ 0
- ❑ <5
- ❑ 5-20
- ❑ 21-100
- ❑ 101-500
- ❑ >500

B8. How many times have you changed employers over the course of your career?

- ❑ 0-2
- ❑ 3-5
- ❑ 6-9
- ❑ 10 or more

B9. How many times have you made a radical career change (e.g., between two completely unrelated fields)?

- ❑ 0
- ❑ 1
- ❑ 2
- ❑ 3
- ❑ 4 or more

B10. Looking back over the course of your career, what is the highest level of annual income you've earned (not including your spouse)?

- ❑ <$30,000
- ❑ $30,000-$50,000
- ❑ $50,001-$100,000
- ❑ $100,001-150,000
- ❑ $150,001-200,000
- ❑ $200,001-$500,000
- ❑ >$500,000

C. Please tell us about your family:

C1. Are you or either of your parents a first generation American?

❑ Yes ❑ No

C2. What is your hometown? (Name the city, state, and country where you spent the most time growing up).

❑ City _____

❑ State/Province _____

❑ Country _____

C3. What is the highest level of education of the parent(s)/guardian(s) you grew up with?

❑ Did not complete high school ❑ High School/GED ❑ Some College

❑ Associates Degree ❑ Bachelor's degree ❑ Advanced Degree

C4. Do you have family members who have founded, own, and managed one or more businesses? (Check all that apply).

❑ Yes (mother) ❑ Yes (father) ❑ Yes (sibling) ❑ Yes (grandparent)

❑ No

C5. What is your birth order?

❑ Only child ❑ First born ❑ Second child

❑ Third ❑ Fourth or beyond

C6. How old were you when you independently got your first wage-paying job (not a job your parents got for you)?

❑ <10 ❑ 10-12 ❑ 13-15

❑ 16-18 ❑ >18

D. Please tell us about your workplace preferences:

Please rate your preferred workplace on this sliding scale of contrasting values:

Value 1	1	2	3	4	5	6	Value 2
D1. Employee Autonomy							Close Employee Supervision
D2. Cooperative problem solving							Competitive problem solving
D3. Has many new lines of products or services over several years							Has few or no new product/service lines over several years
D4. Long-term proactive goal setting							Short-term goal setting
D5. Low tech, tried and true products							High-tech innovation, R&D and new inventions
D6. Accommodates Self expression (e.g., no behavior/dress codes etc.)							Normative social codes (e.g., behavior/dress codes etc.)
D7. Individual effort							Teamwork
D8. Highly structured processes, rules, and procedures							Unstructured with very few processes, rules, and procedures
D9. An emphasis on low risk projects (with normal or certain low rates of return)							An emphasis on radical new ideas with high-risk or uncertain high rates of returns

E. Now, please tell us about your personality concerning work. Indicate in the space provided how much you agree with each of the following statements: "Compared to my peers at work…"

Personal Predisposition	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
E1. I set higher standards for myself and others.					
E2. I prefer routine to variety.					
E3. I do more than what's expected of me.					
E4. It takes me longer to recognize possibilities.					
E5. If I make a decision I stick with it.					
E6. I dislike beginning new things.					
E7. I am more likely to finish things despite obstacles in the way.					
E8. I think up more new ways of doing things.					
E9. I am less concerned with the possibility of failure when taking on something new.					
E10. I work better with structure and supervision					
E11. I am more capable handling new or unexpected situations.					
E12. I am more likely to achieve my goals.					

F. Please rate your current level of development in the following general knowledge, skills, and personal abilities:

General Knowledge, Skills, and Personal Development	Very Low	Low	Average	High	Very High
F1. Speaking skills					
F2. Writing skills					
F3. Ability to critically analyze events, information, ideas					
F4. Ability to plan and carry out projects independently					
F5. Leadership and management skills					
F6. Time management					
F7. Being independent and self reliant					
F8. Function as part of a team					
F9. Coping with change					
F10. Having self confidence					
F11. Handling stress					
F12. Realizing my potential for success					

G. Please rate your current level of development in the following business-specific knowledge, skills, and personal abilities:

Business-related Knowledge, Skills, and Personal Development	Very Low	Low	Average	High	Very High
G1. Comfort with new technologies					
G2. Take responsibility for ideas and decisions					
G3. Ability to achieve business expansion goals and objectives					
G4. Ability to perform financial analysis					
G5. Ability to conduct strategic planning and write a business plan					
G6. Ability to create new products and services					
G7. Define organizational roles, responsibilities, and policies					
G8. Ability to conduct market research and write a marketing plan					
G9. Ability to set and meet sales goals					
G11. Making decisions under uncertainty and risk					

G12. What best describes how you most often deal with major setbacks and failures? (Select ONLY one).

- ❑ Focus on the part I did do well
- ❑ Blame can always be shared; it's not ALL my fault
- ❑ Give up; it was not meant to be
- ❑ Find a diversion/distraction
- ❑ Seek comfort from friends and relatives
- ❑ Get inspired to try harder
- ❑ Find a silver lining/way to capitalize on the situation

H. Please tell us about your creative achievements:

H1. Have you ever created an original work of art (fine art, literature, photograph, drama, music, sculpture, etc.) that you have sold for profit?

❑ Yes ❑ No

H2. If you were involved in the development of any of the following kinds of enterprises over the course of your career, please indicate whether you consider yourself an instrumental initiator/originator or simply a supporter. Check "not involved" if you have never been involved in such enterprises. Select ONLY one category per enterprise:

Enterprise	Instrumental Initiator	Supporter	Not involved
New Product, Process or Service			
New Company			
New Division or Branch Office			
New Company Spin-Off			
New Business Start-Up			
New Business Franchise			
New Nonprofit Organization			
New Activist Group or Movement			
New Governmental Entity			

H3. How confident are you in your ability to successfully accomplish each of the following?

Confidence in my ability to…	Very Low	Low	Average	High	Very High
H3.1. Identify new business opportunities					
H3.2. Create new products or services					
H3.3. Think creatively					
H3.4. Take calculated business risks					
H3.5. Commercialize an idea or new development					
H3.6 Incorporate a business					
H3.7. Pull together a start-up team					
H3.8. Finance a new business					
H3.9 Lead a business start-up					
H3.10 Write and file a patent					
H3.11 Find and lease space and/or equipment for a new business					

H4. Do you know someone or know how to find someone able to accomplish the following (Select all that apply):

- ❑ Incorporate a business
- ❑ Write a business plan
- ❑ Pull together a start-up team
- ❑ Write and file a patent
- ❑ Conduct market research and write a marketing plan
- ❑ Find and lease space and/or equipment for a new business
- ❑ Introduce you to a venture capitalist, angel investor, or other source of financing
- ❑ No; none of the above

H5. Have you <u>founded</u> and <u>owned</u> a small business (that was NOT a new division, branch office, franchise or nonprofit)?

- ❑ Yes I am currently in the process of starting my first business
- ❑ Yes I have started a business (SKIP TO J. BELOW)
- ❑ No (SKIP TO I. BELOW)

H6. If yes, currently in the process of starting your first business, where are you in the process of starting a small business? (Select all that apply).

- ❑ Writing a business plan
- ❑ Have filed a tax ID number
- ❑ Pulling together a start-up team
- ❑ Looking for space and equipment for the business
- ❑ Have begun saving money to invest in the business
- ❑ Other (please describe) _____

<u>I. Please tell us about your future plans. Indicate how much you agree with each of the following statements:</u>

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
I1. If I see an opportunity to join a start-up company in the next few years I'll take it.					
I2. The idea of a high risk/high payoff venture appeals to me.					
I3. I often think about ideas and ways to start a business.					
I4. At least once I will have to take a chance and start my own company.					

(SKIP TO K1 IF YOU ANSWERED THIS QUESTION)

J. Please answer the following questions with regard to your business start-ups:

J1. What year did you launch your first business start-up?

J2. How many and what kind of business(es) did you start? (Select all that apply).

❑ Manufacturing	How many?
❑ Retail	How many?
❑ Health Services	How many?
❑ Professional/Technical Services (Architect, Engineering, Legal, etc.).	How many?
❑ Consulting	How many?
❑ Other Services	How many?
❑ Education	How many?
❑ Government Services	How many?
❑ Other	How many?

If other, please describe: _____

J3. How many of the above businesses did you actively manage full-time in an executive capacity?

J4. Did any of the above firms involve the development, production, or delivery of technology or science-based products like hardware, software, telecommunications, manufacturing equipment, chemicals, pharmaceuticals, bio-tech, and/or medical devices, etc.?

❑ Yes ❑ No

J5. Did any of the above firms conduct and/or support research and development?

❑ Yes ❑ No

J6. Did you create your first business more as a response to a perceived market need (an external stimulus), or, was it based more on a personal talent, skill, ability, or competitive advantage you believed you had (an internal stimulus)? (Select ONLY one).

❑ External/market need ❑ Internal/individual advantage

J7. What was your financial objective in starting your most profitable business? (Select ONLY one)

❑ Self and family income ❑ High profit-high growth ❑ Other, please describe: _____

J8. What was/are your total annual revenues for your most profitable business?

❑ <$100,000 ❑ $100,000-$500,000 ❑ $500,001-$1,000,000
❑ $1,100,001-$10,000,000 ❑ >$10,000,000

J9. For how many years was/has your most profitable business been profitable?

❑ Not yet profitable ❑ 0-2 ❑ 3-5
❑ 6-10 ❑ >10

J10. How many employees did/does your most profitable business have?

❑ <5 ❑ 5-20 ❑ 21-60
❑ 61-500 ❑ >500

J11. How was your most profitable business initially financed? (Check all that apply)

❑ Self and family ❑ SBA Loan ❑ Partners ❑ Angels
❑ Venture Capitalists ❑ Government grants ❑ Sweat equity

J12. How much capitalization did/does your most profitable business initially require prior to your first sale?

❑ <$50,000 ❑ $50,001-$100,000 ❑ $100,001-$250,000
❑ $250,001-$500,000 ❑ >$500,000

J13. Do any of your businesses own Intellectual Property assets (trade secrets, patents, licenses)?

❑ Yes ❑ No

J14. What factors and/or influences most motivated you to establish a new business?

J15. What factors and/or influences do you attribute your entrepreneurial success to?

J16. Can we contact you directly about sharing your post-NCSU business start-up experiences with University staff and students?

❑ Yes ❑ No

J17. If yes, what is your current/best contact information? (It will not be used for any other purpose).

Name:
Mailing Address:
Telephone:
Email Address:

K1. We would welcome your suggestions for improving the career preparation provided by NCSU here:

Thank you for taking the time to participate in this study. If you are interested in obtaining the results of this study, you may access them in approximately 6-8 weeks at the following URL: http://www.ncsu.edu/project/alumnifollowup/results.html
All individual responses will remain confidential. If you have questions about this research, please contact Elaine Rideout (ecrideou@ncsu.edu or 919-345-6619) or Dr. Denis Gray (denis_gray@ncsu.edu or 919-515-1721).