

Entrepreneurial Cognition in the Lean Startup Method

ABSTRACT

The Lean Startup Method is a pedagogical process to refine a new business venture by constructing and testing assumptions. This paper explores the evolution of the entrepreneur's cognitive traits during this process. We find that several of the five dimensions of entrepreneurial orientation demonstrate a strengthened connection to both entrepreneurial intention and entrepreneurial self-efficacy for searching for new ideas. This provides indirect evidence that the process increases both intention and self-efficacy.

Although the 99 students in a graduate business class did not show a significant change in their traits of aggressiveness, autonomy, and innovativeness during the educational experience, they did show a significant decline in their proclivity to take risks. These results suggest that the process impacts entrepreneurs' cognition to increase the likelihood of new venture creation and yet avoid the deleterious impacts of imprudent risk-taking on subsequent venture performance.

INTRODUCTION

Entrepreneurs have different characteristics than other business professionals (Busenitz & Barney, 1997) that drive success in creating new ventures. Entrepreneurial orientation (EO) (Lumpkin & Dess, 1996) reflects these traits in five dimensions – aggressiveness, autonomy, innovativeness, proactivity, and risk-taking – and has been linked to the entrepreneurial intention (EI) to start a new business, entrepreneurial self-efficacy (ESE) for startup activities, and the success of new ventures (Caliendo, Fossen, & Kritikos, 2009; Cramer, Hartog, Jonker, & Van Praag, 2002; Stewart Jr & Roth, 2001; Zhao, Seibert, & Hills, 2005; Zhao, Seibert, & Lumpkin, 2010).

Yet little attention has been paid to the evolution of an entrepreneur's orientation over time, and the pedagogical practices that might provoke this change. Does the Lean Startup Method (LSM)(Ries, 2011), a popular approach to refining a new venture idea taught in many business programs, change these five dimensions of EO? Do these changes influence entrepreneurial intention and self-efficacy as predictors for future new venture creation? In short, how does LSM influence the cognition of the entrepreneur?

This paper uses longitudinal survey data from 99 graduate business students as they applied LSM to creating new venture ideas. It not only sheds light on the constructs of EO, EI, and ESE, but also explores their relationship to each other over time with a specific pedagogical process.

The paper begins with a literature review on entrepreneurial orientation, intention, self-efficacy, and LSM in order to derive testable hypotheses. It then describes the method by which we empirically tested these hypotheses, and the results from this analysis. The discussion section provides explanations and implications of these results for entrepreneurs, teachers, and researchers. The paper concludes with a reflection on the limitations of this study and the opportunities for future research.

LITERATURE REVIEW AND HYPOTHESES

Entrepreneurial Orientation

Entrepreneurial orientation (EO) consists of five independently varying traits of the entrepreneur that have been linked to new entry and subsequent venture success, originated by Miller (1983) and expanded by Lumpkin and Dess (1996).

- *Aggressiveness* refers to an entrepreneur's sense of intensity and posturing during head-to-head competition. It is commonly called competitive aggressiveness.
- *Autonomy* relates to an entrepreneur's sense of independence to take strategic initiative, disengaged from bureaucracy, to lead a new venture. This autonomy may even be seen as autocratic, where the entrepreneur imposes his vision on the new venture.
- *Innovativeness* describes the entrepreneur's ability to generate new ideas, including products, processes, and technologies. It has been a durable trait in

entrepreneurial research (Schumpeter, 1942).

- *Proactivity* reflects an entrepreneur's initiative to seize the first-mover advantage in order to shape a new market. Proactivity differs from aggressiveness in that the former looks at unoccupied market space, whereas the latter assumes existing competition.
- *Risk-taking* captures the entrepreneur's desire to make resource commitments in the face of uncertainty. (This dimension will be developed in more detail below.)

The five dimensions may covary, but have been argued to be theoretically independent; each one could conceivably contribute independently to the likelihood of new entry and subsequent venture success.

This EO construct has been studied and refined extensively (Kreiser, Marino, & Weaver, 2002; Lyon, Lumpkin, & Dess, 2000), and correlated to firm performance (Wiklund, 2006; Wiklund & Shepherd, 2005). A meta-analysis by Rauch, Wiklund, Lumpkin, and Frese (2009) found a correlation of .242 between the single construct of EO to firm performance across 51 studies with a total of 14,259 cases. Correlations for the individual sub-dimensions of EO ranged from .195 to .139. (These correlations were all significant.) The correlation between EO and performance increased for micro-enterprises (1-49 employees) and for high-tech ventures, as compared to large companies or ventures in non-high-tech industries.

The positive relationship between risk-taking and performance, while supported in Rauch et al. (2009), is sensitive to the organizational context and strategic orientation in which the actors operate. For example, Naldi, Nordqvist, Sjöberg, and Wiklund (2007) found that risk-taking in family firms is negatively related to performance due to the

unusually durable and overlapping roles of owners and managers, which lowers agency costs but also weakens rigorous analysis of decisions around resource allocation in new ventures. The authors caution that a more formal process for decision-making increases performance but paradoxically stifles risk-taking.

Zhao et al. (2010) observed this same mixed relationship between risk-taking and venture performance, and concluded that a propensity for taking risks entices people into entrepreneurship (measured as entrepreneurial intention), but subsequently causes them to mismanage resources, which undermines venture performance. Li et al. (2009) concluded that empirical support for EO is mixed, and suggested that the relationship to performance outcomes may be more complex.

Entrepreneurial Intention

Entrepreneurial intention (EI) reflects an individual's plan to eventually start a business (Bird, 1988). Such intention have been shown to predict actual behavior in general business practices (Fishbein & Ajzen, 1975) and specific entrepreneurial activities to start a new business (Zhao et al., 2010). Liñán et al. (2011) found that an individual's entrepreneurial orientation influences the level and intensity of entrepreneurial intention as well. Therefore, our first hypothesis is designed to test the existing, well-studied relationship between EO and EI when measured at the same time.

Hypothesis 1 a-e: The five dimensions of entrepreneurial orientation – a) aggressiveness, b) autonomy, c) innovativeness, d) proactivity, and e) risk-taking – are positively and significantly related to entrepreneurial intention.

Entrepreneurial Self-efficacy

Entrepreneurial self-efficacy (ESE) builds upon the notion of general self-efficacy (Bandura, 1977; Baum & Locke, 2004) to focus narrowly on an individual's confidence to successfully launch a new venture (Chen, Greene, & Crick, 1998). EO and ESE are related but theoretically distinct constructs. Whereas EO attempts to reveal an entrepreneur's existing traits, ESE delves into the individual's belief that she possesses those traits to positive affect. A person can empirically lack a trait, but still believe that she holds it, and that the trait will improve entrepreneurial performance.

ESE has been decomposed into constituent entrepreneurial processes (McGee, Peterson, Mueller, & Sequeira, 2009): searching, planning, marshaling, implementing (for both people and finances), and an over-arching attitude toward venturing. This study focuses on the initial "searching" (ESES) stage of entrepreneurship: the construction and refinement of a new idea to capture new opportunity.

Hypothesis 2 a-e: The five dimensions of entrepreneurial orientation – a) aggressiveness, b) autonomy, c) innovativeness, d) proactivity, and e) risk-taking – are positively and significantly related to entrepreneurial self-efficacy when searching for a new venture idea.

EI and ESES are distinct but related constructs. Although stated separately, our hypotheses consider them to coexist simultaneously in the entrepreneur's cognition as dependent variables in the same structural model.

The Lean Startup Method, Intention, and Self-Efficacy

The cognitive traits of EO, EI, and ESE are mutable. An entrepreneur's characteristics and beliefs change over time as a result of external stimuli (Parker, 2006). Education is

one such stimulus. It explicitly aims to alter a student's characteristics and beliefs.

Education in entrepreneurship aims to increase the number and success of new ventures founded by students. It typically aims to increase EO (Oosterbeek, Van Praag, & Ijsselstein, 2010), EI (Bae, Qian, Miao, & Fiet, 2014; Souitaris, Zerbinati, & Al-Laham, 2007) and ESE (Peterman & Kennedy, 2003; Zhao et al., 2005).

The Lean Startup Method or LSM (Ries, 2011) is a popular contemporary pedagogical approach to entrepreneurial education. Students are first instructed to declare falsifiable hypotheses about their new venture's business model, and then to test these hypotheses with conversations with customer and field experiments (Blank & Dorf, 2012). Validated hypotheses form the foundation for a new venture. Invalidated hypotheses are reconsidered, reconstructed, and retested. In LSM, these are called "pivots".

LSM has a long genealogy in academic theory. It is an example of discovery-driven planning (McGrath, 2010; McGrath & MacMillan, 1995), and a manifestation of a dynamic capability (Eisenhardt & Martin, 2000; D. J. Teece, Pisano, & Shuen, 1997) that is designed to generatively sensing new opportunities (Dong, Garbuio, & Lovallo, 2016; D. Teece, Peteraf, & Leih, 2016).

The stated objectives of LSM are to improve the likelihood of venture success. Since EI and ESES are empirically reliable and immediate indicators of eventual venture creation and success, we posit that students who follow LSM should show the same strong connections between EO and EI, and between EO and ESES, after they conclude an education experience, controlling for their EO traits before the class started.

Hypothesis 3 a-e: The five dimensions of entrepreneurial orientation – a) aggressiveness, b) autonomy, c) innovativeness, d) proactivity, and e) risk-taking – are

positively and significantly related to entrepreneurial intention for a new venture idea after following the Lean Startup Method, controlling for their initial orientation.

Hypothesis 4 a-e: The five dimensions of entrepreneurial orientation – a) aggressiveness, b) autonomy, c) innovativeness, d) proactivity, and e) risk-taking – are positively and significantly related to entrepreneurial self-efficacy when searching for a new venture idea after following the Lean Startup Method, controlling for their initial orientation.

Again, our hypotheses, although stated separately, assume that EI and ESES exist co-exist in the entrepreneur's mind.

The Lean Startup Method and Orientation

Proponents of LSM contend that its simplicity makes it accessible to all types of people, even those who formerly thought they lacked entrepreneurial verve (Blank, 2013). This contention can be translated into a testable hypothesis by comparing the relationships between pre-course and post-course EO dimensions as they relate to EI and ESES. The relationship between *post-course* Aggressiveness and EI, for example, are expected to be stronger than the relationship between *pre-course* Aggressiveness and EI.

Hypothesis 5 a-e: The significance of the relationship between the five dimensions of entrepreneurial orientation – a) aggressiveness, b) autonomy, c) innovativeness, d) proactivity, and e) risk-taking – and entrepreneurial intent is higher after an educational experience with the Lean Startup Method than at the beginning of the experience.

Hypothesis 6 a-e: The significance of the relationship between the five dimensions of entrepreneurial orientation – a) aggressiveness, b) autonomy, c) innovativeness, d)

proactivity, and e) risk-taking – and entrepreneurial self-efficacy for searching is higher after an educational experience with the Lean Startup Method than at the beginning of the experience.

These hypotheses presuppose significance in Hypotheses 1 and 2. If a specific hypothesis with H1 or H2 is rejected, then it cannot be tested in H5 or H6.

The Lean Startup Method and Uncertainty

The emerging literature on the role of LSM as a process for analytical learning (Harms, 2015; Bosch et al., 2013) suggests that LSM has little impact on three of the five dimensions of entrepreneurial orientation. We posit that the Lean Startup Method's emphasis on new venture creation has no impact on an entrepreneur's sense of competitive aggressiveness because the market is new; there are no competitors yet. Similarly, we posit that LSM has no influence on an entrepreneur's sense of autonomy, since there is no organization or bureaucracy yet. We also posit that LSM does not influence the entrepreneur's sense of innovativeness, because the innovation typically occurs before hypothesis testing. This literature contends that LSM is not intended to be a creative process within entrepreneurial cognition. Instead, it is treated as an analytical process for interpreting evidence. Therefore:

Hypothesis 7 a – c: There is no significant change to a student's EO traits of aggressiveness, autonomy, or innovativeness as the result of an educational experience with the Lean Startup Method.

However, the two remaining EO traits of proactivity and risk-taking are indeed shaped by the Lean Startup Method. Proactivity relates to an entrepreneur's proclivity to shape a

new market. LSM's emphasis on market creation suggests that a student should experience an increase in proactivity during the course.

Hypothesis 7 d: There is a positive significant change to a student's sense of proactivity as the result of an educational experience with the Lean Startup Method.

The argument for risk-taking in the literature on entrepreneurial uncertainty gets to the core of what we believe is the most salient and interesting of the EO dimensions as it relates to LSM. An entrepreneur contemplating the creation of a new venture may be unsure about the state of the marketplace, the effect of changes in the marketplace on the proposed venture(s), or the impact of the entrepreneur's response to these changes (Milliken, 1987). Uncertainty is defined as a "known unknown" (Knight, 1921). For an entrepreneur, uncertainties may manifest as lingering questions about a proposed business idea, but without knowledge of the boundaries or potential impacts of the question. Once these are understood, the question is no longer uncertain; it can be classified and managed as a quantifiable risk, or a "known known".

Uncertainty undermines entrepreneurial action, in part through hesitancy, indecision, and procrastination (Dewey, 1933), which in turn undermine the recognition and exploitation of opportunities (Casson, 1982; Kirzner, 1979). Entrepreneurial action requires both the realization of uncertainty and a willingness to bear the revealed uncertainty (Knight, 1921; McMullen & Shepherd, 2006). The former is a process. The latter is related to the trait of risk-taking.

LSM is described by its founder as a process to perceive and resolve uncertainty: "validated learning is the process of demonstrating empirically that a team has discovered

valuable truths about a startup's present and future prospects" (Ries, 2011, p. 39). It has been heralded as "evidence-based entrepreneurship" (Blank, 2013).

An entrepreneur practicing LSM finds that what were previously considered unmanageable uncertainties are actually manageable risks. Those risks that entail substantial exposure or management are often reformulated and replaced by business ideas that entail less risk as part of the pivoting process. As a result, we posit that entrepreneurs schooled in LSM are willing to take less risk, because they have learned that they can achieve their goals with few uncertainties and fewer high-risk elements of the business idea. Students of LSM become risk-averse. Therefore:

Hypothesis 7 e: There is a positive significant change to a student's sense of risk-taking as the result of an educational experience with the Lean Startup Method.

METHOD

We conducted an empirical study to test these hypotheses.

Sample

In the Spring of 2016, 176 students enrolled in an online course on applied entrepreneurship. These students resided on one of six campuses: San Francisco, Boston, New York, London, Shanghai, and Dubai. They were undertaking one of five graduate business programs: master in business administration, master in international business, master in social entrepreneurship, master in marketing, and master in finance. Few students had already rigorously followed LSM prior to this course.

Students formed teams to design new ventures that created an online platform to connect people who owned assets with people who would like to use those assets. These business models are typical of the Sharing Economy, similar to Uber and AirBnb.

These teams constructed hypotheses and conducted interviews with potential customers. Validated hypotheses were the basis of their business pitches. Invalidated hypotheses were rejected and reconstructed. Teams met with an instructor weekly to review their progress. Although the instructor did not formally check each student's completion of the assigned interviews, each member of the team evaluated their teammates. Along with the score on a midterm exam and the grade for the pitch, these teammate evaluations formed a final score for each student. This score was used as a control variable.

Measurement

Students were offered an online survey a week before class began, and six weeks later, immediately after the course concluded (but before they had received their grades). The survey was administered with Qualtrics. Students were given two reminders, each two days after the preceding email.

The scales (Table 1) for the five dimensions of Entrepreneurial Orientation originated from Hughes and Morgan (2007) and was refined by Covin and Wales (2012). We adapted the scale for individuals, not teams, and based it on a 5-point Likert scale from Strongly Disagree to Strongly Agree. Several of the items were negatively worded to reduce response acquiescence (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). These were reverse coded in the dataset.

The scales for Entrepreneurial Intention were derived from Chen et al. (1998) and Zhao et al. (2005). The scales for Entrepreneurial Self-Efficacy emanated from De Noble, Jung, and Ehrlich (1999), narrowed per McGee et al. (2009) to just the searching function

of entrepreneurial action. These, too, relied on a 5-point Likert scale. Items within each scale were averaged into a single composite variable for each dimension.

As a control, we used the students' final scores for the course, which ranged from 3 (High Pass) to 0 (Fail). The analysis was conducted using SPSS and AMOS.

RESULTS

Of the 176 students in the class, 99 (56%) provided complete responses to both the pre-course and post-course surveys. Means and standard deviations for each variable are reported in Table 2.

Model for Post-Course Data

The first model contains the five dimensions of EO, EI, and ESES from data collected entirely in the post-course survey. The model fit is excellent: CMIN/DF=1.214, CFI=.998, RMSEA=.047, PCLOSE=.327 per Hair, Black, Babin, and Anderson (2013). The results of the structural equation model are depicted in Table 4. Entrepreneurial intention (EI) is positively and significantly related to Aggressiveness and Risk-taking, supporting H1a and H1e. Entrepreneurial self-efficacy for searching (ESES) is positively and significantly related to Aggressiveness, Innovativeness, and Risk-taking, supporting H2a, H2c, and H2e. All other aspects of H1 and H2 are rejected.

The EO dimension of Autonomy is weakly negatively related to ESES. The EO dimension of Proactivity is not significantly related to EI or ESES. Moreover, it showed poor reliability (Cronbach Alpha of .103 in Table 3.)

Model for Pre- and Post-Course Data

The second model includes the five dimensions of EO for both before and after the courses, as well as EI and ESES from after the course. Model fit is adequate for the

structural equation model with the composite constructs (CMIN/DF=1.543; CFI=.939; RMSEA=.074; PCLOSE=.133). Disattenuation of the composite constructs using calculated reliabilities generates a non-positive covariance matrix, the result of insufficient sample size or collinear constructs. In order to overcome the poor reliability of the Proactivity construct, we hypothesized in this model that Proactivity would manifest in Risk-taking.

Unsurprisingly, all five dimensions of EO show a significant relationship between their pre-course and post-course measures (Table 5). Entrepreneurial intention (EI) is significantly and positively related to Aggressiveness and Risk-taking, supporting H3a and H3e. Entrepreneurial self-efficacy for searching (ESES) is positively and significantly related to Aggressiveness, Innovativeness, and Risk-taking, supporting H4a, H4c, and H4e.

The results between H1 and H2 on the one hand and H3 and H4 on the other hand are identical. This suggests that the partial variance from the pre-course survey has no impact on the conclusions we draw about the relationship between EO, EI, and ESES.

Model for Pre-Court Data

The third model (Table 6) contains the pre-course EO dimensions and the post-course EI and ESES constructs. The model fit is poor (CMIN/DF=5.054; CFI=.879; RMSEA=.203; PCLOSE=.006), prompting caution for extracting definitive conclusions.

The relationship between Innovativeness and ESES is strongly significant. The relationship between Risk and ESES is weakly significant. All other relationships are nonsignificant.

Hypotheses 5 and 6 compare the relationships between pre-course EO dimensions, EI, and ESES with the relationships between post-course EO dimensions, EI, and ESES. This can be accomplished by contrasting the significance of the pathways in the first model (Table 4) with the pathways in the third model (Table 6). We find that all of the significant pathways in the first model are nonsignificant in the third model, with only one exception: the relationship between Innovativeness at ESES is significant in both models.

We thus find support for all of H5 and H6, except for H5c.

Comparison of Pre- and Post-Course Means

Hypothesis 7 explores the differences in means between the pre- and post-course traits for EO. Table 7 contains the results of a pair-sample t-test. There is no significant change in the traits of Aggressiveness, Autonomy, and Innovativeness, supporting H7a, H7b, and H7c. The trait of Proactivity demonstrated a significant increase during the course. While this supports H7d *prima facie*, the low reliability of the Proactivity construct prompts us to reject H7d for lack of sufficient evidence.

The trait of Risk-taking shows a small significant decline during the course ($p > .076$).

Table 8 provides a summary of the hypotheses and our conclusions based on these results.

DISCUSSION

The results of this study have several explanations and implications.

Orientation, Intention, and Self-Efficacy

First, several dimensions of entrepreneurial orientation (EO) are connected to both entrepreneurial intention (EI) and entrepreneurial self-efficacy for searching for new

ideas (ESES). One way to explain this configuration of relationships is to assume that all five dimensions of EO predict future venture success, but that only a few of these traits predict self-efficacy, and fewer still predict intention. Even though all of those with strong EO characteristics would have generated high-performing ventures, only a subset of those promising entrepreneurs have confidence in their entrepreneurial abilities, and a smaller subset of promising entrepreneurs would choose an entrepreneurial career.

An alternative explanation of these relationships is that EO is imperfect. Some of its dimensions might not reliably predict entrepreneurial success. Students' self-confidence in their ability to search for a successful idea may be misplaced. And many of those with an intention to start a new venture might lack the necessary characteristics to create a successful venture.

A third alternate explanation might lie in weakness for the scales that comprise these constructs. They might not be reliable or valid reflections of the underlying ideas. The sample size of this study undermines our ability to improve these measures.

Intention, Self-Efficacy, the Lean Startup Method

Students who follow LSM show several connections between their traits on the one hand and their intentions and self-efficacy on the other. More powerfully, students showed a stronger relationship between their traits, intentions, and self-efficacy after they have completed LSM than before. From this constellation of results, we conclude that LSM is the causal driver behind the connections between EO traits and the outcomes of EI and ESES.

Because we did not conduct a controlled experiment in which some students followed LSM and other students did not, we cannot make a claim on the differential impact of

LSM on intention or self-efficacy. Moreover, because we did not test for EI and ESES before the course in t1, we cannot directly track the changes in the entrepreneurs' cognition in these constructs.

However, we can interpret the improved connection between EO, EI, and ESES during LSM as indirect evidence that LSM increases EI and ESES.

Orientation and the Lean Startup Method

Students who applied LSM did not show any changes in their entrepreneurial orientation for the dimensions of aggressiveness, autonomy, or innovation. This suggests that LSM does not alter the entrepreneur's cognition in these domains.

We cannot draw any firm conclusions about the impact of LSM to the EO dimension of proactivity. However, we recommend further research on this scale is warranted, especially since our results point to a marked increase in this construct.

Finally, the Lean Startup precipitated a significant decrease in entrepreneurs' proclivity to take risks. Perhaps this occurred because LSM emphasizes that both uncertain and high risk portions of a business idea can be revealed and avoided through hypothesis testing and pivoting. Alternatively, it is possible that LSM prompts students to lose some of their desire for entrepreneurial ventures as they become more familiar with the process and perceived risks. Because this study did not query students before the course about their entrepreneurial intent or self-efficacy, we have no baseline from which to draw conclusions.

CONCLUSION

This empirical study of 99 students concludes that the application of the Lean Startup Method enhances the relationship between several dimensions of entrepreneurial

orientation on the one hand and entrepreneurial intention and entrepreneurial self-efficacy for searching for new ideas on the other hand. Students who apply the Lean Startup Method (LSM) do not experience a shift in their proclivity towards competitive aggressiveness, autonomy, and innovativeness. However, they strengthen the connection between entrepreneurial orientation, intention, and self-efficacy for searching giving indirect evidence that LSM increases intention and self-efficacy for searching.

The entrepreneurial orientation dimension of risk-taking also exhibits the same strengthened positive significant relationships to intention and self-efficacy, where entrepreneurs who score high in risk-taking also show a greater intention and self-efficacy for venture creation. However, over the duration of a class that incrementally and deliberately followed LSM, students reduced their mean scores for this trait. As a group, they became more risk-averse.

These two results resolve a problem of practice, where risk-takers are more likely to start a new venture, but less likely to lead the venture to success because they would take unnecessary, imprudent, dangerous risks. Entrepreneurs who apply LSM show an increase in their intention to start a business, an increase in their self-efficacy to search for good ideas, and a reduction in the risk-taking that might lead to poor managerial decisions within the subsequent venture.

Implications for Teachers

The decrease in risk-taking is provocative for educators in entrepreneurship. Most educators attempt to change the beliefs of students towards risk-taking because it is theoretically and empirically linked to starting a new venture. This relationship still stands in our study, but with an added nuance.

Zhao et al. (2010) found that entrepreneurs with high measures of risk-taking were more likely to start new ventures, but less likely to succeed with those ventures because their managerial decisions were overly precarious. The authors concluded that contemporary educators of potential entrepreneurs should avoid emphasizing the classic image of an entrepreneur as a risk-taker, because risk-taking was not correlated to firm success.

This study shows that LSM dissipates mixed implications of risk-taking. Students who have followed LSM still maintain a significant relationship between risk-taking and intention. And yet their average drop in measures of risk-taking suggest that their subsequent managerial decisions would not unnecessarily jeopardize venture performance.

Implications for Entrepreneurs

First, following LSM increases an entrepreneur's intention to start a new venture, and self-confidence in his ability to search for a new idea. Second, students who are already risk takers are more likely to start new ventures. LSM does not alter this relationship. Third and more important, LSM not ask entrepreneurs to become comfortable with taking even more risk. To the contrary, LSM seems to reduce the risk appetite of its followers.

Implications for Researchers

This study has several implications for researchers in the field of entrepreneurial cognition and entrepreneurial education. Some of these implications emanates from the strengths of this study. Longitudinal analysis reveals a significant evolution to the cognition of entrepreneurs as they apply a framework like LSM for venture creation. Yet this approach would be even more powerful if it were embedded in a controlled

experiment to determine how LSM differs from other approaches, such as the construction of a formal business plan, or an immediate launch with an emphasis on post-launch experimentation and adaptation. Expanding the number and consistency of longitudinal observations would similarly improve the ability to draw direct conclusions.

Some of these implications emanate from the weaknesses of this study. The construct for Proactivity was found to be unreliable. This might offer an opportunity to enhance the scale or deconstruct the composite into constituent factors.

Our analysis resolved a problem of practice around risk-taking, where the proclivity to take risks increases venture starts but reduces venture performance. LSM presents an opportunity to entrepreneurs to maintain the former while attenuating the latter. Yet, we question the capability of the risk-taking construct to differentiate between an entrepreneur's ability to manage known but risky aspects of a new business venture and the ability to tolerate the discomfort of unknown uncertainties.

Finally, Liñán and Chen (2009) tackled the thorny problem of cultural differences for entrepreneurial intention. Insufficient sample size thwarted our attempts to explore cultural differences in the application of LSM. Such an analysis would allow refinement of the process for entrepreneurs with different cognitive aptitudes and expectations.

TABLES AND FIGURES

Table 1: Scales

Construct	Item
Aggressiveness (Aggress)	I am intensely competitive
	I am bold and aggressive
	I let others do as they think best.
Autonomy (Auton)	I prefer to act and think without interference.
	I work independently.
	I do not like authority.
	I prefer to work in a team.
Innovativeness (Innov)	I actively improve and innovate in my professional career
	I am creative
	I seek new ways to do things
	I emphasize solutions that have already been tried and proven successful. (Reverse coded)
Proactivity (Proact)	I try to speak and act first when working with others.
	I excel at identifying novel ideas or business opportunities.
	I initiate actions which other people then respond to.
	I am proactive.
	I respond to actions from competitors. (Reverse coded)
	I look to others for new ideas. (Reverse coded)
Risk-taking (Risk)	I take calculated risks with new ideas.
	I enjoy exploring for new ideas.
	I prefer low-risk projects. (Reversed coded)
	I am cautious. (Reverse coded)
Entrepreneurial Intention (EI)	I am ready to do anything to be an entrepreneur
	My professional goal is to eventually become an entrepreneur
	I will make every effort to start and run my own company
	I have the firm intention to start a new venture some day
Entrepreneurial Self-Efficacy for Searching (ESES)	Brainstorm (come up with) a new idea or service?
	Identify the need for a new product or service?
	Design a product or service that will satisfy customer needs and wants?

Table 2: Construct Means and Standard Deviations

	Mean	SD
t1Aggress	3.394	0.910
t2Aggress	3.455	0.904
t1Auton	3.073	0.707
t2Auton	3.157	0.636
t1Innov	3.694	0.574
t2Innov	3.732	0.525
t1Proact	3.175	0.424
t2Proact	3.311	0.392
t1Risk	3.535	0.611
t2Risk	3.434	0.597
EI	3.929	1.027
ESES	4.081	0.700

Table 3: Construct Correlations and Reliability

		t1					t2						
	Construct	Aggress	Auton	Innov	Proact	Risk	Aggress	Auton	Innov	Proact	Risk	EI	ESES
t1	Aggress	<i>0.616</i>											
	Auton	-0.029	<i>0.521</i>										
	Innov	.284**	-0.192	<i>0.571</i>									
	Proact	.261**	0.048	.401**	<i>0.304</i>								
	Risk	0.14	0.035	.529**	.327**	<i>0.474</i>							
t2	Aggress	.611**	0.007	.300**	.214*	.308**	<i>0.593</i>						
	Auton	0.007	.498**	-0.103	0.134	0.041	0.012	<i>0.481</i>					
	Innov	0.159	-0.149	.714**	.427**	.556**	.246*	-0.064	<i>0.559</i>				
	Proact	.296**	-0.089	.352**	.497**	.215*	.317**	0.091	.428**	<i>0.103</i>			
	Risk	0.189	0.042	.452**	.365**	.569**	.330**	0.054	.621**	.359**	<i>0.482</i>		
	EI	0.049	0.063	0.128	0.083	0.139	.274**	-0.087	.310**	0.047	.356**	<i>0.914</i>	
	ESES	.214*	-0.182	.475**	.254*	.369**	.353**	-0.141	.478**	.267**	.473**	.330**	<i>0.761</i>

**p>.01; *p>.05; Italics along diagonal are Cronbach Alpha measures of reliability

Table 4: Results from Structural Equation Model for t2

			Standardized Estimate	p-value
t2Aggress	-->	EI	0.252	0.008**
t2Aggress	-->	ESES	0.215	0.017*
t2Auton	-->	EI	-0.114	0.202
t2Auton	-->	ESES	-0.151	0.074#

t2Innov	-->	EI	0.154	0.186
t2Innov	-->	ESES	0.254	0.022*
t2Proact	-->	EI	-0.163	0.102
t2Proact	-->	ESES	0.019	0.845
t2Risk	-->	EI	0.27	0.019*
t2Risk	-->	ESES	0.252	0.021*
FinalScore	-->	ESES	-0.061	0.474
FinalScore	-->	EI	-0.266	0.003**

**p>.01; *p>.05; #p>.10

Table 5: Results from Structural Equation Model for t1 and t2

Construct		Construct	Standardized Estimate	p-value
t1Aggress	-->	t2Aggress	0.593	***
t1Auton	-->	t2Auton	0.498	***
t1Innov	-->	t2Innov	0.674	***
t1Proact	-->	t2Proact	0.459	***
t1Risk	-->	t2Risk	0.458	***
t2Proact	-->	t2Risk	0.244	0.004**
t2Aggress	-->	EI	0.252	0.005**
t2Aggress	-->	ESES	0.221	0.012*
t2Auton	-->	EI	-0.115	0.192
t2Auton	-->	ESES	-0.157	0.067#
t2Innov	-->	EI	0.15	0.132
t2Innov	-->	ESES	0.253	0.009**
t2Proact	-->	EI	-0.162	0.088#
t2Proact	-->	ESES	0.019	0.838
t2Risk	-->	EI	0.26	0.01*
t2Risk	-->	ESES	0.248	0.011*
FinalScore	-->	EI	-0.271	0.002**
FinalScore	-->	ESES	-0.063	0.465

**p>.01; *p>.05; #p>.10

Table 6: Results for Structural Equation Model for t1 EO and t2 EI and ESES

			Standardized Estimate	p-value
t1Aggress	->	EI	0.011	0.921
t1Aggress	->	ESES	0.083	0.366
t1Auton	->	EI	0.077	0.458
t1Auton	->	ESES	-0.129	0.15
t1Innov	->	EI	0.091	0.481
t1Innov	->	ESES	0.308	0.006**
t1Proact	->	EI	0.014	0.903
t1Proact	->	ESES	0.056	0.565
t1Risk	->	EI	0.082	0.493
t1Risk	->	ESES	0.18	0.083#

**p>.01; #p>.10

Table 7: Paired Sample t-test

Construct	t2 - t1 Mean	SD	SE Mean	p-value
Aggress	0.061	0.799	0.080	0.452
Auton	0.083	0.676	0.068	0.223
Innov	0.038	0.419	0.042	0.370
Proact	0.136	0.410	0.041	0.001**
Risk	-0.101	0.561	0.056	0.076#

**p>.01; #p>.10

Table 8: Summary of Hypotheses

<i>H</i>	<i>Summary</i>	<i>a)</i> <i>Aggress</i>	<i>b) Auton</i>	<i>c) Innov</i>	<i>d) Proact</i>	<i>e) Risk</i>
1	X @ t2-> EI	Supported	Rejected	Rejected	Rejected	Supported
2	X @ t2 -> ESES	Supported	Rejected	Supported	Rejected	Supported
3	X @ t1 -> X @ t2 -> EI	Supported	Rejected	Rejected	Rejected	Supported
4	X @ t1 -> X @ t2 -> EI	Supported	Rejected	Supported	Rejected	Supported
5	X @ t2 -> EI vs X @ t1 -> EI	Supported	N/A	N/A	N/A	Supported
6	X @ t2 -> ESES vs X @ t1 -> ESES	Supported	N/A	Rejected	N/A	Supported
7	X @ t1 vs X @ t2	Supported	Supported	Supported	Rejected	Supported

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