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Putting Entrepreneurship Education Where the Intention to Act Lies: An Investigation Into the Impact of Entrepreneurship Education on Entrepreneurial Behavior

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The growing attention to entrepreneurship education has caused a debate about whether entrepreneurship education can affect entrepreneurial behavior. We use a quasi-experimental design, comparing a MSc entrepreneurship program with a comparison group from a MSc supply-chain management program to test the effectiveness of entrepreneurship education, relying on the theory of planned behavior (TPB). The findings suggest that entrepreneurship education is effective. Specifically, students participating in entrepreneurship education show an increase in attitudes and perceived behavioral control. Furthermore, they have higher entrepreneurial intentions at the end of the program. Finally, entrepreneurial intentions mediate the effect of entrepreneurship education on subsequent behavior associated with the creation of new business ventures. These results suggest that entrepreneurship education emphasizes increasing antecedents of intentions and behavior.

Entrepreneurship education has become a serious matter for university administrators, course developers, government (public) servants, and researchers (Kuratko, 2005). One reason for the increasing interest in entrepreneurship education is the impact of entrepreneurship on economic growth and employment (Audretsch, Grilo, & Thurik, 2011), even though the prevalence rate of entrepreneurship is low; for example, in high-income countries, less than 10% of the adult population is involved in entrepreneurial activities (Xavier, Kelley, Kew, Herrington, & Vorderwülbecke, 2012). By promoting entrepreneurship, economies can further generate economic growth and employment. Entrepreneurship education could be one way to increase the prevalence rate of entrepreneurs and, thereby, stimulate economic growth.

The growing focus on entrepreneurial education has resulted in a wide variety of articles evaluating the impact of entrepreneurship education (Dickson, Solomon, & Weaver, 2008; Gartner & Vesper, 1994; Henry, Hill, & Leitch, 2005; Weaver, Dickson, & Solomon, 2006). While the effectiveness of entrepreneurship education has been questioned in theoretical literature (Aronsson, 2004; Fiet, 2000; Weaver et al., 2006), a recent meta-analysis of 42 independent samples (N = 16,657) revealed that entrepreneurship education is useful, reporting an average effect size of r = .201 (Martin, McNally, & Kay, 2013), which means that the literature indicates

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that entrepreneurship education is effective. A large number of studies have indicated that entrepreneurship education is raising the positive perception of entrepreneurship, such as attitudes and intentions (Kolvereid & Moen, 1997; Liñán, Rodríguez-Cohard, & Rueda-Cantuche, 2011; Tkachev & Kolvereid, 1999). This is important, because such perceptions precede entrepreneurial activities such as starting a business venture. However, intentions do not always result in behavior. As a matter of fact, Katz (1990) pointed out that there is only a weak relationship between intentions and behavior in the area of entrepreneurship. Very few studies have investigated whether entrepreneurship education affects actual behavior, such as opportunity recognition (DeTienne & Chandler, 2004) or starting up a business venture (Souitaris, Zerbinati, & Al-Laham, 2007). While it is evident that entrepreneurship education influences perceptions about entrepreneurship, there seems to be less evidence suggesting that entrepreneurship education affects actual behaviors related to entrepreneurship. Moreover, the recent meta-analysis indicates that there are areas that need to be addressed in future research (Martin et al., 2013). First, only 11 studies included in the meta-analysis used a pre- and posttest design that included a treatment and control group. Notably, these studies found significantly lower effect sizes as compared to evaluation studies using a less-rigorous design, which means it is possible that the effects of entrepreneurship education have been overestimated in the empirical literature. Second, evaluation studies used as many as 16 variables to measure training outcomes, indicating a theoretical arbitrariness. More important, only 7 studies measured behavior as an outcome variable, assessing, for example, the number of start-up activities initiated (Souitaris et al., 2007) or the number of business ventures started (Kolvereid, 1996b). This is surprising, given that the creation of new organizations is at the core of entrepreneurship (Gartner, 1988). Moreover, behavioral outcomes revealed lower effect sizes compared to, for example, attitudes and intentions. Third, many studies are descriptive in nature and lack a stringent theoretical framework to evaluate the effectiveness of entrepreneurship education, and many studies using a theoretical framework applied it only partially. For example, even though 19 studies used the theory of planned behavior (TPB) or a related intention model to study the effectiveness of entrepreneurship education, only one evaluated entrepreneurial behavior (Souitaris et al., 2007), even though behavior is the dependent variable in the original conceptualization of TPB (Ajzen, 1988). Also important, Souitaris et al. (2007) did not find support for the hypothesis that entrepreneurship education affects people's intentions and, thereby, their behavior. We think this result may be due to the time frame used in this study. Souitaris et al. (2007) measured the effects of education over a period of approximately 5 months. However, the effect of people's intentions on their behavior may evolve over time (Kolvereid & Moen, 1997), which would mean that longer time frames are required to more thoroughly test the effects of entrepreneurship education.

In light of the methodological weaknesses inherent in entrepreneurship education studies, some authors concluded that there is little evidence as to its effectiveness (Fiet, 2000; Weaver et al., 2006). Our aim here is to contribute to this debate by investigating the impact of entrepreneurship education on entrepreneurial behavior. To achieve our goal we select a well-validated theory to ensure that the mechanisms, centrality of intervention techniques, generalizability, and limitations involved can be more easily delineated (Glaub, Frese, Fischer & Hoppe, 2014). TPB (Ajzen, 1988) meets this requirement. Its validity has been proven in meta-analyses in organizational behavior (Sheppard, Hartwick, & Warshaw, 1988), as well as in the domain of entrepreneurship (Krueger, 2009; Krueger, Reilly, & Carsrud, 2000; Schlaegel & Koenig, 2011). Moreover, TPB provides a defined set of criteria and instruments. Finally, TPB has been used to evaluate the effects of entrepreneurship education (Fayolle, 2006). The theory is probably particularly useful in explaining entrepreneurial behavior because it addresses processes that can be influenced by way of an entrepreneurship education program (Katz & Gartner, 1988; Liñán et al., 2011). For example, the primary determinant of entrepreneurial intentions is a person's conviction that starting a business is a suitable career alternative (Davidsson, 1995). This means that it would be plausible to assume that the short-term objective of an entrepreneurial education is to create a positive attitude toward entrepreneurship. In addition, the belief that becoming an entrepreneur is a realistic possibility is also a key predictor of people's intentions. This perception of the difficulty of becoming an entrepreneur, also known as perceived behavioral control, is something that can be influenced by entrepreneurship education (Liñán et al., 2011). As such, intentions are assumed to be a motivation to engage in certain behavior, and intentions can be influenced.

We also evaluate the effectiveness of entrepreneurship education with regard to entrepreneurial behavior, which is behavior that is geared toward venture creation (Gartner & Carter, 2003). Entrepreneurship has been defined broadly and narrowly and, accordingly, entrepreneurship education has focused on different educational outcomes. Some definitions of entrepreneurship emphasize the recognition and exploitation of opportunities (Shane & Venkataraman, 2000) and the pursuit of opportunities regardless of resources being controlled (Stevenson & Jarillo, 1986). These definitions are relatively broad, as they include various types of entrepreneurship, such as corporate entrepreneurship, social entrepreneurship, nascent entrepreneurship, or family businesses. Entrepreneurship education complying with such broad definitions of entrepreneurship would not only emphasize the creation of new business ventures, but also emphasize attitudes and behaviors that are valuable in various contexts (Gibb, 2002). A more narrow definition of entrepreneurship emphasizes the creation of new organizations (Gartner, 1988). There is a debate in entrepreneurship education literature as to whether behavior related to the start up of an enterprise is an appropriate outcome of entrepreneurship education (Fayolle, 2006). In particular, mandatory entrepreneurship courses cannot demand students start a business, but their aim is rather to increase awareness about entrepreneurship (von Graevenitz, Harhoff, & Weber, 2010) or provide the required knowledge and necessary skills for entrepreneurship (Oosterbeek, van Praag, & Ijsselstein, 2010). However, a number of courses and programs aim to educate students in the area of entrepreneurship and, as such, prepare students to set up their own businesses (Gibb, 2002). The outcome of this type of entrepreneurship education is entrepreneurial behavior—an area that is as yet underresearched (Bird, Schjoedt, & Baum, 2012; Pittaway & Cope, 2007).

Finally, we examine the effectiveness of entrepreneurship education by conducting a quasi-experiment, relying on a pre- and posttest comparison group design (Cook, Campbell, & Peracchio, 1990). In particular, we evaluate the effectiveness of a Master of Science (MSc) program in entrepreneurship and new business venturing, using an 18-month time lag to test the effectiveness of entrepreneurship education in a longitudinal design. Thereby, our design has high external validity and allows for causal inferences, generating new insights into the question of whether previously identified intentions actually lead to entrepreneurial behavior.

Below, we describe the theoretical framework used in our study, after which we develop hypotheses regarding the effects of entrepreneurship education on intentions and entrepreneurial behavior.

THEORETICAL FRAMEWORK

In designing an evaluation study, it is important to consider the aims of the entrepreneurship education. One important distinction has been made between education *about* entrepreneurship and education *for* entrepreneurship (Jamieson, 1984). Education about entrepreneurship focuses primarily on raising awareness about entrepreneurship by teaching students about the various aspects of starting and running a business. Courses in this tradition often focus on acquiring knowledge relevant to entrepreneurship (information; e.g., Oosterbeek et al., 2010; von Graevenitz et al., 2010). The second category, education for entrepreneurship, deals with the preparation of setting up a business for potential entrepreneurs, and usually emphasizes a practice- and action-oriented learning philosophy. Courses in this tradition emphasize obtaining knowledge and skills that increase the likelihood of starting a business and success of entrepreneurs (capability development; e.g., Boyles, 2012), identifying and stimulating entrepreneurial drive and talent (personal development; Gibb, 2008; Glaub et al., 2014), coaching in preparing a business proposition, and developing, promoting, and supporting new venture creation (Rasmussen & Sørheim, 2006). While this distinction between education about and education for entrepreneurship is simplified and has been criticized (Gibb, 2002), it is important with regard to the evaluation of education outcomes.

We focus on entrepreneurship education that aims to educate people for entrepreneurship and prepare them for an entrepreneurial career. Evaluating this kind of education requires the development of a theory about the training outcomes. In general, there are two broad approaches to training effectiveness: human capital theory and TPB. Approaches focusing on human capital theory emphasize training outcomes such as knowledge, skills, and abilities (e.g., Fayolle, 2006), based on the assumption that such outcomes make entrepreneurs more effective in starting and running a business. Accordingly, they tend to focus on

providing knowledge about planning, start-up, venture growth, and related subtopics, such as financing new ventures, developing innovative business models, feasibility analysis, and so forth (e.g., Kolvereid & Moen, 1997; Matlay, 2008; Robinson & Sexton, 1994). This is a causation approach that has been criticized in entrepreneurship literature (Honig, 2004; Sarasvathy, 2001). For example, a content analysis of 24 entrepreneurship textbooks revealed that there is a limited overlap between what educators teach about relevant start-up activities and what budding entrepreneurs actually do (Edelman, Manolova, & Brush, 2006). Consequently, educators more recently developed alternative teaching formats that actively involve students in courses with a greater emphasis on action, experimentation, and practice. Such approaches include a portfolio of different teaching techniques, including starting ventures as course work, games and simulations, and design-based thinking (Kuratko, 2005; Mustar, 2009; Neck & Greene, 2011). The aim of these approaches is to engender activities that create effects on a market (Sarasvathy & Venkataraman, 2011). As such, they are in line with a socioeconomic focus on entrepreneurship education (Béchard & Grégoire, 2005). These approaches not only emphasize the acquisition of knowledge, but also try to inspire and increase the perception about available resources and, ultimately, aim to stimulate entrepreneurial behavior. The TPB is concerned with beliefs and perceptions about entrepreneurship, and as such provides opportunities to evaluate such training outcomes.

Theory of Planned Behavior

The understanding of behavior is a core concern of psychology (American Psychological Association, 2013) and, accordingly, the discipline has developed models of how to predict behavior. A model particularly useful for understanding behavior that is to some extent under volitional control is the TPB (Ajzen, 1988). The theory assumes that a behavior is best explained by an intention to try to perform the behavior (Ajzen, 1988: 132). Intentions, in turn, are shaped by attitudes, subjective norms, and perceived behavioral control. Attitudes are determined by beliefs that a certain behavior will lead to a favorable outcome. Subjective norms are determined by beliefs of important others (friends, family) about a certain behavior and the degree to which one tends to comply with these beliefs. This independent variable measures the value that people place on the opinion of people close to them. Finally, perceived behavioral control reflects perceptions regarding behavior as personally controllable as well as notions relating to the ease or difficulty of initiating a behavior. Perceived behavioral control reflects past experiences as well as the presence or absence of resources and opportunities, which means that this dimension recognizes that many behaviors are not completely under volitional control. A meta-analysis indicated that the TPB accounted for 27% and 39% of the variance in behavior and intentions, respectively (Armitage & Conner, 2001).

The theory has been applied to the context of entrepreneurship because engaging in entrepreneurship is a behavior that is under volitional control. Various studies have used the theory to explain intentions to become an entrepreneur (Krueger et al., 2000; Liñán & Chen, 2009) and entrepreneurial behavior (Kautonen, van Gelderen, & Tornikoski, 2013), as well as the effects of entrepreneurship education (Athayde, 2009; Ferreira, Raposo, Rodrigues, Dinis, & do Paço, 2012; Liñán et al., 2011; Mwasalwiba, 2010; Peterman & Kennedy, 2003). A meta-analysis evaluating the TPB in the context of entrepreneurship reported that attitudes, subjective norms, and perceived behavioral control accounted for 39% of the variance in entrepreneurial intentions (Schlaegel & Koenig, 2011). Thus, the TPB provides a valid framework for studying the relationship between entrepreneurship education and entrepreneurial behavior.

HYPOTHESES

Davidsson (1995) has argued that the TPB is a model with which the all-pervading question within the field of entrepreneurship—"How does a person become an entrepreneur"?—can be answered. Accordingly, intention models provide a good framework for looking at the influence of entrepreneurship education on entrepreneurial intentions and subsequent behavior. Specifically, entrepreneurship education programs can increase people's intentions and behavior by influencing the antecedents of their intentions to start up a business venture (Fayolle, 2006). Figure 1 describes the research model of our study. The model does not consider subjective norms, which are part of the original TPB, because the beliefs of friends and family cannot be influenced directly by entrepreneurship education. Rather, entrepreneurship education should affect attitudes and perceived behavioral control and, thereby, affect intentions and entrepreneurial

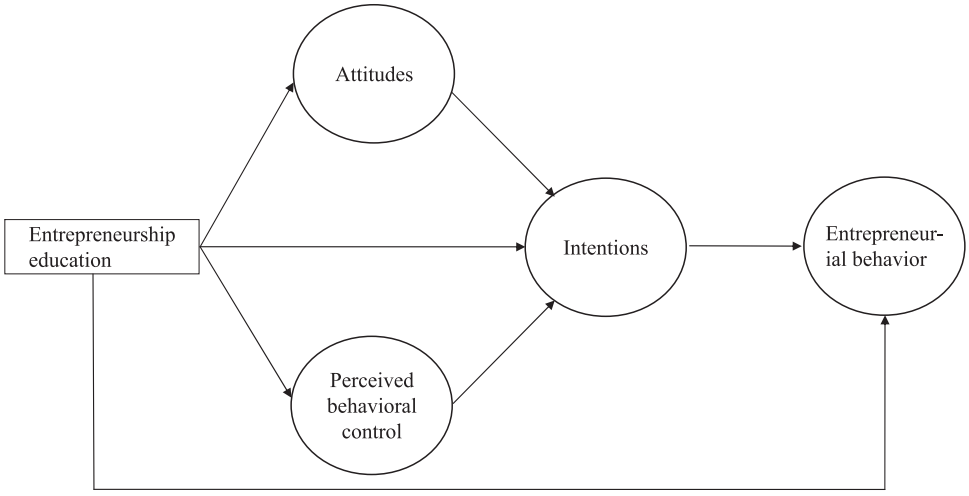

FIGURE 1
Research Model

behavior. For example, attitudes can be changed by changing people's beliefs about the favorable outcome of entrepreneurial behavior. Entrepreneurship education, therefore, often stresses how rewarding entrepreneurial behavior is, explaining the merits of innovation and opportunity exploitation. Moreover, positive attitudes toward entrepreneurship can be enhanced by downplaying spurious beliefs about the downside of business venturing and failure. In addition, entrepreneurship education should reduce expectancies of disappointment and regrets by reducing personal costs and expectations (Markman, Baron, & Balkin, 2005; Markman, Balkin, & Baron, 2002). Finally, the financial insecurity associated with entrepreneurship can be addressed by teaching risk-reduction strategies (van Gelderen, Brand, van Praag, Bodewes, Poutsma, & van Gils, 2008). In short, entrepreneurship education can enhance people's attitudes toward entrepreneurship by inspiring and stressing the rewards of entrepreneurial behavior and by removing ego threats associated with entrepreneurship (Souitaris et al., 2007). Perceived control can be changed by modifying people's beliefs about the availability of resources. This can be accomplished by providing knowledge about accessing resources and dispelling spurious experiences of infeasibility (van Gelderen et al., 2008). Moreover, entrepreneurship education increases competencies and, thereby, increases perceived feasibility (Krueger et al., 2000). Finally, entrepreneurship education can increase perceived behavioral control by enhancing beliefs about the ability to engage in entrepreneurial behavior, for example, by providing mastery experiences in entrepreneurship-related tasks (Kuehn, 2008). Since entrepreneurship education affects the antecedents of intentions, it should also increase people's behavioral intention (Fayolle, 2006) and entrepreneurial behavior. Although different scholars suggest various levels of entrepreneurial behavior, there is some common ground, which includes business planning, creating a new legal business entity, and providing and acquiring funding (Carter, Gartner, & Reynolds, 1996). With the help of these criteria, it is easier to draw the line between serious attempts to start a venture, and simply considering starting a business. At this point, we hypothesize that:

Hypothesis 1: Participation in entrepreneurship education will have a positive effect on the attitude toward an entrepreneurial career.

Hypothesis 2: Participation in entrepreneurship education will have a positive effect on the perceived behavioral control.

Hypothesis 3: Participation in entrepreneurship education will have a positive effect on intentions.

Hypothesis 4: Participation in entrepreneurship education will have a positive effect on entrepreneurial behavior.

Our research model assumes a causal chain from entrepreneurship education to the intervening constructs and then to the outcomes of entrepreneurship education (Figure 1). This means that people's attitudes and perceived behavioral control will be

changed by entrepreneurship education and that this change subsequently generates entrepreneurial intentions (Fayolle, 2006). Moreover, the intentions are particularly valid for predicting deliberate, goal-directed behavior that is hard to observe, rare, and involves unpredictable time consumption (Katz & Gartner, 1988). Entrepreneurial behavior is the kind of planned behavior for which an intention model is suited. Thus, changing entrepreneurial intentions subsequently affects entrepreneurial behavior. Accordingly, we assume the existence of mediation processes that are causal in nature and that require longitudinal analysis.

Hypothesis 5: The effect of entrepreneurship education on people's intentions is mediated by attitudes and perceived behavioral control.

Hypothesis 6: The effect of participating in entrepreneurship education on behavior is mediated by people's intentions.

METHODOLOGY

Design

Our study relies on a pre–posttest comparison group design. Since we cannot randomly assign students to entrepreneurship education (treatment condition) and to the comparison group, our study relies on a quasi-experimental design, which allows us to examine the effect of entrepreneurship education as well as to determine whether there are differences in the pre- and posttest in the absence of a training intervention.

Both treatment and comparison groups participated in a pretest (T1), a posttest (T2), and a follow-up assessing entrepreneurial behavior (T3). Designing such a study requires developing hypotheses about the timing of effects. Usually (quasi) experimental studies evaluating the outcomes of entrepreneurship education assess the training outcomes directly after course or program completion. As a matter of fact, time frames in these studies range between 11 weeks and 1 year (DeTienne & Chandler, 2004; Friedrich, Glaub, Gramberg, & Frese, 2006; von Graevenitz et al., 2010; Oosterbeek et al., 2010; Peterman & Kennedy, 2003; Souitaris et al., 2007). Because such short time frames should be fine for training outcomes that can be affected in the short term, such as attitudes, perceived behavioral control, and intentions, we conducted the posttest directly after the Foundation of Entrepreneurship course in Week 9. The effects of entrepreneurship education on behavior are delayed, however (Kolvereid, 1996a). Although studies examining alumni using a posttest design introduced long time lags of 8–14 years (Charney & Libecap, 2002; Kolvereid & Moen, 1997), we did not identify any experimental study using such long time frames. Since the study aims to test behavior toward venture creation, we used a time frame in which students were at a stage where they actively start pursuing their careers. We chose a follow-up 18 months after the posttest was conducted because the master's program is a 12-month program, but because many students do not manage to complete their master's degree within 12 months, we chose a longer time frame to make sure that most of the students included in our study completed this program.

Treatment and Comparison Groups

The treatment group consisted of students participating in the 1-year MSc Entrepreneurship program at Rotterdam School of Management, Erasmus University, the Netherlands. The comparison group consisted of students of a 1-year MSc in supply-chain management. The entrepreneurship program aims to prepare students for an entrepreneurial career, specifically to prepare them for establishing their own businesses. As Table 1 describes, the program starts with a course emphasizing knowledge and understanding of relevant theories on entrepreneurship, providing a theoretical foundation of the domain of entrepreneurship (The Foundations of Entrepreneurship). The theories discussed address the contribution of the different disciplines (psychology, economics, sociology, and geography) relevant for entrepreneurship and, thereby, introduce individual-, firm-, and societal-level explanations for the phenomenon of new business venturing. Concurrent to the foundations course, a field project (Titans of Venturing) encourages students to relate their theoretical insights to practical examples on the basis of the analysis of the (auto) biography of distinctive entrepreneurs. Thereafter, the students apply their knowledge in two case teaching courses (Entrepreneurial Start Up and Entrepreneurial Growth). Both courses rely on active participant-centered learning philosophies, forcing students to accomplish judgment and decision making related to the context of entrepreneurial firms. Simultaneously, the students analyze four existing young ventures in the field project, again with the aim that they actively apply their knowledge to actual cases.

TABLE 1
The Most-Important Goals and Learning Methods Applied in the Entrepreneurship Program

Course name	Timeline	Goals/content	Teaching method
Foundations of Entrepreneurship	Weeks 1–8	Providing a theoretical foundation of the domain entrepreneurship.	Structured lectures, individual assignments for each class.
Titans of Venturing	Weeks 3, 5, 8	Biography assignment. Applying theory and research to life course of actual entrepreneurs.	Biography analysis; written group assignment; presentation of results.
Entrepreneurial Start-up	Weeks 9–12	Focusing on choices and analysis of opportunities; solving critical and practical problems that pertain to (pre-) start-up phase of business creation	Case teaching method and interactive session with entrepreneurs in class are applied. Participant-centered learning.
Entrepreneurial Growth	Weeks 12–15	Focus is on developmental challenges that entrepreneurial ventures experience when growing and maturing.	Case teaching method and interactive session with entrepreneurs in class are applied. Participant-centered learning
Field Project Start-up and Growth	Weeks 10–16	Studying pre-start, start-up, and growth stages of multiple successful/unsuccessful young ventures. Understanding discrepancies between theory and practice.	Field project, active learning, group assignment.
New Venture Planning (Program elective)	Weeks 19–26	Developing plan for new enterprise: from idea generation to feasibility analysis to a fully conceived report.	Multiple methods: Structured lectures, group assignments, experiential learning, mentoring session with entrepreneur (guided learning), trial and error, pitches.
New Business Development (Program elective)	Weeks 19–26	Pursuit and commercialization of an opportunity for an established business.	Multiple methods: Structured lectures, group assignments, experiential learning, mentoring session with entrepreneur (guided learning), trial and error, pitches.
Master Thesis	Weeks 34–49	Individual effort in which students empirically evaluate a problem recognized in entrepreneurship literature.	Field study.
Graduation	Week 52		

In Weeks 19–26 students have to choose between two program electives, both aiming to develop a tangible opportunity into a valuable business proposition. Thus, the program provides theoretical knowledge about entrepreneurship and subsequently utilizes more and more practice-oriented classes involving active and participative learning philosophies.

The comparison group consisted of students from the supply-chain management program (logistics). We selected this comparison group for two reasons: First, we needed to choose a program that did not contain elements related to the domain of entrepreneurship. For example, both strategy and innovation management programs focus on corporate entrepreneurship and on innovative and entrepreneurial firms. In contrast, the overlap between entrepreneurship and supply-chain management is very limited. Second, the supply-chain management program has a different teaching methodology than the entrepreneurship program. While the latter accentuates effectuation and experimentation, the former highlights causation, a predictive and planning logic, and is supported by a more traditional educational philosophy. The supply-chain management program applies a more traditional teaching model, where teachers have the active role and students are more passive and learn in a scheduled and organized environment by reading, listening, and taking notes. The program starts with a course introducing supply-chain management and then teaches students to develop capabilities needed to analyze and fine-tune

supply-chain structures as well as to anticipate and respond to new developments.

Sample

Our sample included the entire cohort of the two master's programs. In all, 96 Entrepreneurship students and 57 Supply-Chain Management students participated in the pretest (T1), while the posttest (T2) was completed by 88 Entrepreneurship students and 54 Supply-Chain Management students (experimental mortality 8.3% and 5.3%, respectively). Finally, the assessment of start-up behavior was collected from 62 Entrepreneurship students and 12 Supply-Chain Management students (T3), representing a response rates of 69.3% and 22.2%, respectively.

Measures

All independent variables were measured in the pretest, the posttest, and the follow-up. Table 2 provides a summary of the variables included in our study and the descriptive statistics for each.

Intentions

Entrepreneurial intentions were measured by the extent to which people seriously considered becoming an entrepreneur. We used six items from Liñán and Chen (2009). A sample item was "I am ready to do anything to be an entrepreneur." The responses ranged from 1 (*absolutely disagree*) to 7 (*absolutely agree*). We also used one single item to cover the behavioral expectation associated with intentions. Behavioral expectations are useful measures of intentions, because they include considerations regarding alternative choices of behavior (Kautonen, van Gelderen, & Tornikoski, 2013). Therefore, we used the single item suggested by Davidsson (1995), Krueger et al. (2000) and van Gelderen et al. (2008): "How likely do you consider it to be that you will be running your own firm within five years from now?" The respondents indicated the likelihood between 0 and 100. The seven items were standardized. The computed scale was internally consistent (Cronbach's α of .95, .97, and .97 at T1, T2, and T3, respectively).

Attitude

Attitude toward entrepreneurship is an independent variable and represents how an individual evaluates a certain behavior in terms of its consequences (Ajzen, 1991). We measured attitude using five items from Liñán and Chen (2009). A sample question was "Being an entrepreneur implies more advantages than disadvantages to me." The responses were given on a 7-point scale. The scale to measure attitude was internally consistent with Cronbach's alphas of .94 (T1), .97 (T2), and .94 (T3).

TABLE 2
Study Variables

Variable	Definition	Type of variable	Observation	Time	*M*	*SD*	Min	Max
Behavior	Activities associated with creation of a new business venture.	Continuous	73	T3	0.37	0.29	0.00	0.89
Intention[a]	Extent to which individual seriously considers becoming an entrepreneur.	Continuous	142	T1	0.00	0.89	−2.56	1.21
			142	T2	0.00	0.94	−2.66	1.07
			73	T3	0.00	0.89	−2.86	0.97
Attitude	Degree to which person has favorable/ unfavorable appraisal of a behavior.	Continuous		T1	5.30	1.30	1.60	7.00
				T2	5.43	1.36	1.60	7.00
				T3	5.71	1.17	2.00	7.00
Perceived behavioral control	Perceptions of controllability; of ease or difficulty of performing the behavior.	Continuous	142	T1	5.09	1.08	1.00	7.00
			142	T2	5.23	1.09	1.00	7.00
			73	T3	5.05	1.01	2.00	7.00
Entrepreneurship	Entrepreneurship (TG) vs. supply-chain management (CG)	Dummy	142		0.62	0.49	0	1
Age	In years	Continuous	142		23.54	1.79	21	31
Gender	Female/male	Dummy	142		0.79	0.41	0	1
Parent entrepreneur	Yes/no	Dummy	142		0.62	0.49	0	1

[a] Variable is *z*-standardized.

Perceived Behavioral Control

We assessed perceived behavioral control by the extent to which people rate a business opportunity as feasible and by the extent to which they feel they can influence the outcome. We used three 7-point items from Tkachev and Kolvereid (1999). One item was "As an entrepreneur I would have sufficient control over my business." The answers ranged from 1 (*absolutely disagree*) to 7 (*absolutely agree*). Cronbach's α for this measure was .69 (T1), .83 (T2), and .69 (T3).

Entrepreneurial Behavior

Entrepreneurial behavior is used as the dependent variable in the research model, and questions from three different sources were combined: the PSED study (Carter et al., 1996; Gartner & Carter, 2003), the Global Entrepreneurship Monitor (Reynolds et al., 2005), and the Chamber of Commerce. We created a list of 19 behaviors, covering a representative set of activities associated with the creation of new business ventures (see Appendix). The participants were asked whether they initiated each behavior. To obtain a single scale for entrepreneurial behavior, these binary yes–no questions were added up (as suggested by Alsos & Kolvereid, 1998, Carter et al., 1996; Gartner, Carter, & Reynolds, 2010; Souitaris et al., 2007) and divided by the number of items, which allowed us to determine the average number of entrepreneurial behaviors. Cronbach's α was .92.

Controls

Because previous studies have indicated that men are more likely to develop the intention to start a business venture than women (Kolvereid & Moen, 1997), we controlled for gender. Also, age has been related both to intentions (Morris & Venkatesh, 2000) and entrepreneurial behavior (Reynolds, 1987), which is why we also controlled for age, and because there is evidence that parents who are entrepreneurs serve as role models and increase entrepreneurship behavior (Bosma, Hessels, Schutjens, Praag, & Verheul, 2012; Chlosta, Patzelt, Klein, & Dormann, 2012), we controlled for having a parent entrepreneur. Finally, we controlled for Time 1 values of the dependent variable in our regression analyses, which allowed us to test for causal effects (Cohen & Cohen, 1975).

RESULTS

Table 3 displays the intercorrelations of the study variables. We tested Hypotheses 1 to 4 with analysis of covariance (ANCOVA) on the different scores, using treatment versus comparison group as an independent variable (Souitaris et al., 2007). Covariates were age, gender, and having parents who are entrepreneurs. All variables distinguished between treatment and comparison group (Table 4). Hypothesis 1 proposed that participation in the entrepreneurship training program increases attitudes toward entrepreneurship. The results displayed in Table 4 indicate that there was a significant association between group membership and the pre- and posttest difference in attitudes: Participating in the entrepreneurship education program increased people's positive attitudes toward entrepreneurship more than when they did not participate ($F = 34.34$ $p < .01$), which supports Hypothesis 1. Moreover, taking part versus not taking part in an entrepreneurship program had a positive effect on perceived behavioral control ($F = 36.65$, $p < .01$), thus supporting Hypothesis 2. Hypothesis 3, which proposed that an entrepreneurship training program has a positive effect on people's intentions, was supported as well: The mean difference scores differed significantly and in the expected direction ($F = 34.53$, $p < .01$). Finally, people who took part in entrepreneurship education showed significantly higher scores on entrepreneurial behavior compared to the comparison group ($F = 10.71$, $p < .01$), which supports Hypothesis 4.

We tested the mediation hypotheses that the effect of entrepreneurship education on people's intentions is mediated by attitudes and perceived behavioral control (Hypothesis 5) using the four equations suggested by Judd and Kenny (1981). First, the mediator variable has to affect the dependent variable (Model 1, Table 5). As the results of the regression indicated, this condition holds for attitudes ($\beta = .19$, $p < .01$), even though perceived behavioral control was not related to intentions at Time 2. As such, perceived behavioral control is not a mediator variable and was dropped from the subsequent analysis. Second, the independent variable has to affect the mediator variable. As Model 2 in Table 5 indicates, entrepreneurship education was significantly related to attitudes ($\beta = .13$, $p < .01$). Third, the independent variable has to affect the dependent variable. Model 3 in Table 5 shows that entrepreneurship education is significantly and positively related to intentions ($\beta = .17$, $p < .01$), which means that our results confirm the third condition of the mediator analysis. Finally, the independent variables should no longer have

TABLE 3
Intercorrelations of Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Entrepreneurship (1 = TG, 0 = CG)														
2. Age	.10													
3. Gender (0 = female, 1 = male)	.16	.04												
4. Parent entrepreneur	.21*	.10	-.06											
5. Intention T1	.66**	.21*	.23**	.28**	(.95)									
6. Attitude T1	.66**	.20*	.23**	.26**	.88**	(.94)								
7. Perceived behavioral control T1	.32	.01	.19	.14	.44**	.46**	(.69)							
8. Intention T2	.73**	.22**	.22**	.32**	.95**	.88**	.42**	(.97)						
9. Attitude T2	.70**	.27**	.23**	.28**	.87**	.95**	.44**	.91**	(.97)					
10. Perceived behavioral control T2	.45**	.05	.21*	.23**	.57**	.56**	.79**	.60**	.60**	(.83)				
11. Intention T3	.70**	.27*	.31**	.26*	.76**	.71**	.30*	.81**	.76**	.49**	(.97)			
12. Attitude T3	.66**	.20	.24*	.31**	.68**	.69**	.26*	.67**	.69**	.47**	.82**	(.94)		
13. Perceived behavioral control T3	.36**	.01	.09	.36**	.29**	.37**	.41**	.36**	.37**	.34**	.41**	.49**	(.69)	
14. Behavior T3	.52**	.28*	.38**	.23	.54**	.44**	.17	.58**	.54**	.29**	.67**	.57**	.38**	(.92)

Note. N = 142 (T1, T2) and 73 (T3).
Values in the diagonal in parentheses are Cronbach's alphas, where applicable.
TG = entrepreneurship students. CG = supply-chain management students.
* $p < .05$.
** $p < .01$.

a significant effect on the dependent variable after controlling for the mediator (Model 4, Table 5). As the equation indicates, the effect of entrepreneurship education remained significant ($\beta = .10$, $p < .01$) after controlling for attitudes, while increased explained variance was significant as well, which means Hypothesis 5 was not supported.

Hypothesis 6 proposed that the effect of entrepreneurship education on behavior is mediated by intentions. Again, we used the four equations suggested by Judd and Kenny (1981) to test this hypothesis (Table 6). Model 1 indicated that intention (the mediator variable) was positively related to entrepreneurial behavior ($\beta = .43$, $p < .01$). The second condition for a mediator test holds as well, as the independent variable entrepreneurship education positively affected intention (Model 2, Table 6; $\beta = .17$, $p < .01$). Moreover, as Model 3 in Table 6 indicates, entrepreneurship education is related to behavior ($\beta = .35$, $p < .01$). Finally, the effect of entrepreneurship education on behavior becomes insignificant when controlling for intentions (Model 4, Table 6; $\beta = .16$, *ns*), which means that Hypothesis 6 is supported.

TABLE 4
One-Way ANCOVA:
Mean Differences of Difference Scores Between Entrepreneurship and Supply-Chain Management Students

Variables (z-standardized)	Group	*N*	*M* pretest (T1)	*SD* pretest (T1)	*M* posttest (T2)	*SD* posttest (T2)	*F* value	*p*
Attitudes	TG	88	.45	.56	.52	.52	34.34	.000
	CG	54	-.74	.79	-.84	.77		
Perceived behavioral control	TG	88	.19	.73	.30	.72	36.65	.000
	CG	54	-.31	.78	-.49	.85		
Intentions	TG	88	.45	.56	.52	.52	34.53	.000
	CG	54	-.74	.79	-.85	.77		
Behavior[a]	TG	61			.43	.27	10.70	.002
	CG	12			.03	.07		

Note. TG = entrepreneurship students. CG = supply-chain management students.
Controls are age, gender, and having a self-employed parent.
[a] ANCOVA on mean differences, T3.

TABLE 5
Mediation Analysis: Testing the Effect of Entrepreneurship Education on Intention

	Model 1 Intention T2		Model 2 Attitude T2		Model 3 Intention T2		Model 4 Intention T2		
Step 1. Controls									
Age	.02	.02	.07**	.08**	.02	.03	-.02	-.01	
Gender	.01	.00	.01	.01	.01	.01	.00	.00	
Parent entrepreneur	.05	.05	.04	.03	.05	.05	.03	.03	
Attitude T1			.93**	.84**					
Intention T1	.93	.77			.93**	.81	.69**	.66**	
Step 2. Independent variable									
Entrepreneurship education (TG vs. CG)			.13**		.17**		.10**		
Step 3. Mediator variable									
Attitude T1		.19**					-.27**	-.27**	
Perceived behavioral control T1		-.01							
Attitude T2							.52**	.52**	
R^2	.90	.91	.92	.93	.91	.92	.94	.95	
ΔR^2		.01		.01		.01		.00	
F for R^2	329.69**		371.90**		329.69**		361.09**		
F for ΔR^2		6.11**		17.31**		28.4		11.08**	
N	142	142	142	142	142	142	142	142	

Note. Coefficients are standardized regression coefficients.
TG = entrepreneurship students. CG = supply-chain management students.
** $p < .01$.

TABLE 6
Mediation Analysis: Testing the Effect of Intention on Behavior

	Model 1 Behavior (T3)		Model 2 Intention T2		Model 3 Behavior (T3)		Model 4 Behavior (T3)		
Step 1. Controls									
Age	.21	.12.	02	.03	.21	.16	.12	.12	
Gender	.42**	.26*	.01	.01	.42**	.30**	.26*	.25*	
Parent entrepreneur	.28*	.09	.05	.05	.28*	.17	.09	.09	
Intention T1			.03**	.81**					
Step 2. Independent variable									
Entrepreneurship education (TG vs CG)			.17**		.35**		.16		
Step 3. Mediator variable									
Intention T2		.43**					.43**	.31	
R^2	.28	.40	.91	.92	.28	.38	.40	.41	
ΔR^2		.12		02		.10		.01	
F for R^2	8.84**		329.69**		8.84**		11.32**		
F for ΔR^2		13.84**		29.49**		10.70**		1.17	
N	73	73	142	142	73	73	73	73	

Note. Coefficients are standardized regression coefficients.
TG = entrepreneurship students. CG = supply-chain management students.
* $p < .05$.
** $p < .01$.

DISCUSSION

Our aim in this study was to test the effectiveness of entrepreneurship education using the TPB. We were motivated to carry out this study because earlier ones have been unable to determine whether entrepreneurship education has an effect on subsequent entrepreneurial behavior. We found that entrepreneurship education has a positive effect on attitudes, perceived behavioral control, and the intention to become an entrepreneur. Attitudes affect people's intentions. The intention to become an entrepreneur affects entrepreneurial behavior 18 months later. In short, entrepreneurship education does have an impact on entrepreneurial behavior.

These findings contribute to existing literature in three ways. First of all, our results indicate that Ajzen's (1991) theory provides a useful framework for explaining the effects of entrepreneurship education on entrepreneurial behavior. Although the theory has previously been applied to entrepreneurship education (Athayde, 2009; Fayolle, 2006; Ferreira et al., 2012; Peterman & Kennedy, 2003), researchers usually assume that intentions are valid proxies of subsequent entrepreneurial behavior. However, the link between intentions and behavior may very well be weak in the area of entrepreneurship (Katz, 1990), because there are a number of situational constraints inhibiting the development of entrepreneurial behavior. For example, studies on the emergence of business ventures discuss a number of factors, such as entry barriers, lack of financial resources, the absence of attractive opportunities, or fear of failure, all of which make it difficult to turn intentions into actual behavior. Accordingly, prior studies have reported that preference levels of entrepreneurship are higher than actual levels of entrepreneurship, which also indicates that intentions do not necessarily result in entrepreneurial behavior (Blanchflower, Oswald, & Stutzer, 2001; Grilo & Irigoyen, 2006). Our results contribute to existing literature by showing that entrepreneurship education does affect people's intentions as well as their subsequent behavior.

Next, our study highlights the mechanisms by which entrepreneurship education affects behavior. It is important to identify such mechanisms because knowledge about them gives us the opportunity to conceptualize entrepreneurship courses in terms of what is relevant to future entrepreneurs (Edelman et al., 2006). We showed that entrepreneurship education affects attitudes. Thus, entrepreneurship education should be designed in a way that helps students to develop a positive evaluation of entrepreneurship. It especially needs to emphasize the positive aspects of entrepreneurship in such a way that the desire to try it themselves is awakened in students. For example, Souitaris et al. (2007) argued that attitudes can be enhanced by emphasizing the emotions and passion associated with entrepreneurship.

Finally, we found that would-be entrepreneurs are taking action 18 months after the first course was completed. Thus, we were able to identify a causal process by which entrepreneurship education affects behavior. It is quite possible that the timing of effects plays a critical role in our evaluation study. For example, Souitaris et al. (2007) measured entrepreneurial behavior right after course completion and reported nonsignificant relationships between education and behavior. Support for long-term effects was reported by Kolvereid and Moen (1997): They found that entrepreneurship education had an effect on subsequent behavior 8 years later. It appears to be important to allow a considerable time lag in studies testing the effectiveness of entrepreneurship education.

We did not find the expected mediator effects of perceived behavioral control, which is not in line with Autio, Keeley, Klofsten, Parker, and Hay (2001), who found that perceived behavioral control has the strongest relationship with intentions. This could be a methodological artifact because attitudes and perceived behavioral control were highly interrelated, both in our study and in other studies, as reported by Schlaegel and Koenig (2011). On the other hand, the participants in our study were in a relatively early stage of the entrepreneurial process. It is possible that the inspirational part of Ajzen's (1991) model is more important at the early stages of a person's entrepreneurial career. Consequently, this part of Ajzen's (1991) model is partially confirmed in its ability to predict entrepreneurial intention reliably, with attitude as the strongest predictor of people's intentions. Experience-based perceptions about the availability of resources may become more important in the later stages of the entrepreneurial process.

In addition, our results indicate that entrepreneurship education directly affects intentions (Noel, 2002) and, thereby, entrepreneurial behavior. This allows for alternative explanations regarding the predictors of intentions. For example, one of the factors that may have blurred the results of our research is that it is relatively difficult to differentiate between enterprising individuals and entrepreneurial agency; specifically, the students as

a cohesive group embedded in a shared setting. In these views, entrepreneurship is conceived as embedded within a social and local context (Bøllingtoft & Ulhøi, 2005; Jack & Anderson, 2002). Translating the concept of entrepreneurial agency to the involvement of students and the specific group dynamics of students in a master's program, we find that social individuals cocreate their reality through joint participation and shared experience in class and in an overall team effort between two or more entrepreneurial actors in all kind of assignments and projects. In this way, agency may have caused intentions and, thereby, entrepreneurial behavior.

Limitations

When we interpret the results of this study, we have to take into account that we studied participants within a single context. For example, the fact that we studied business administration and management students at Erasmus University's business school may have affected the generalizability of our findings. Intention models have been tested in different countries and have been replicated in different contexts (Liñán & Chen, 2009). However, there are regional and cross-country differences in entrepreneurial behavior (Reynolds et al., 2005). Whether the relationship between people's intentions and their subsequent entrepreneurial behavior is context dependent is not clear given the limited number of studies examining this relationship (Kautonen et al., 2013, Souitaris et al., 2007). On the other hand, the existing entrepreneurship programs are all set in locations that are not immediately generalizable. Whether the effectiveness of such programs depend on the context needs to be examined in future studies.

In addition, because we relied on a quasi-experimental design, we could not randomly assign participants to the treatment and comparison conditions. Therefore, we cannot control for initial differences between the two groups. To account for such differences, we introduced control variables. Moreover, self-selection may affect generalizability because it can bias results in favor of entrepreneurship education. We identified only two studies investigating participants whose participation in entrepreneurship courses was mandatory (Oosterbeek et al., 2010; von Graevenitz et al., 2010), which means that these studies did not suffer from self-selection bias. Of interest is that both studies reported zero results of the training interventions. It is important that future research addresses selection effects in the evaluation of entrepreneurship programs, for example, by designing true experiments in which students are randomly assigned to treatment and control groups. At the same time, it is important to note that mandatory programs usually have other goals than do voluntary programs. The former type of program usually does not try to create entrepreneurs per se, but rather to teach participants what entrepreneurship is about. The program that was evaluated in this study focuses on students wanting to become entrepreneurs.

Another limitation inherent in the design of this study is that the comparison group could develop specific behaviors that affect our results. For example, the fact that they may have been aware of taking part in a study about entrepreneurship behavior may have affected their intention to become an entrepreneur (John Henry Effect, compare Cook & Campbell, 1979). However, the attitudes, perceived behavioral control, and intentions within the comparison group did not change during our study, which is why we assume that reactions on the part of the comparison group did not affect our results.

Future Research

There are three obvious areas for future research. First, we have shown that entrepreneurship education affects behavior; however, attitudes and perceived behavioral control do not always predict intentions and intentions are not always translated into behavior. Future research should focus on other sources of intentions and behavior. It is likely, for example, that there are moderators affecting the link between attitude and intention and between intention and behavior. High opportunity costs, to name one, may prevent some students who score high on perceived behavioral control from developing the intention to become entrepreneurs. The availability of resources and institutional forces may affect the relationship between people's intentions and subsequent entrepreneurial behavior. Thus, there are contextual issues that affect the outcomes of entrepreneurship education (Ettl & Welter, 2010), and that have not been addressed in our study. Consequently, it makes sense to evaluate moderator factors that influence the entrepreneurial behavior. There may also be events that trigger the decision to start a business venture (Shapero, 1982). Furthermore, exposing individuals to entrepreneurship education may increase their confidence in their ability to pursue an entrepreneurial career. As a matter of fact, there is evidence that self-efficacy affects people's intention (Wilson,

Kickul, & Marlino, 2007; Zhao, Seibert, & Hills, 2005) and their willingness to start a business venture (Chen, Greene, & Crick, 1998; Rauch & Frese, 2007). Thus, social learning theory (Bandura, 1986), which is conceptually narrower than the TPB, provides an alternative explanation for how education affects intentions. Finally, Gollwitzer (1999) stressed that intentions are not sufficient to predict behavior because people are wrapped up in their daily routines. Rather, he argued that intentions need to be succeeded by *implementation intentions* that are mental representations linking intentions with goal-directed behavior. These arguments suggest that future research should address mediating processes that transmit the effect of entrepreneurship education on behavior.

Second, our study cannot make any suggestions as to which type of entrepreneurship education is most suitable for stimulating entrepreneurial behavior. For example, there are interventions focusing on opportunity identification (DeTienne & Chandler, 2004), entrepreneurial action (Neck & Greene, 2011), and biographic assignments (Verduyn & Jansen, 2005), to name but a few. Different types of entrepreneurship education can be compared in true experiments, for example, by randomly assigning students to them. Alternatively, different programs offering different types of entrepreneurship education could be evaluated relying on quasi-experimental design. Future research would have to compare different types of entrepreneurship education and their effects on intentions and entrepreneurial behavior.

Third, it would be interesting to develop more theory about the correct timing of outcomes of entrepreneurship education. While entrepreneurs can start their business ventures at any time during their lives, representative studies indicate that most new business ventures are established by persons who are between the ages of 25 and 35 years (Xavier et al., 2012). Thus, many people start their business venture years after they complete their education. For example, some students might decide to work for an entrepreneur to accumulate more experience before starting their own business ventures. It would be interesting to see whether entrepreneurship education affects this age distribution and, if so, to what extent. Moreover, it would also be interesting to compare students who start early with those who start their businesses later in life. This would require following graduates over time and modeling time to event data. Such information may be available from schools that have had entrepreneurship programs in place for a longer period of time (Bhidé, 1996; Roberts & Eesley, 2011).

Practical Implications

In practice, entrepreneurship education should have a positive impact on people's attitudes toward entrepreneurship and increase their willingness to engage in entrepreneurial behavior. In other words, teaching people how to write a business plan is not enough. Instead, the aim should be to show people that entrepreneurship is a promising and valuable career option that may lead to exciting outcomes. Thus, entrepreneurship education needs to move beyond knowing and understanding and begin to apply otherwise theoretical concepts to the real world (Neck & Greene, 2011) and enable its students to actively exploit opportunities that are imagined, shaped, and created in an entrepreneurial process (Sarasvathy, 2001). To summarize, our work here shows that providing entrepreneurship education in a business school environment is a valuable element of university policy. Also of interest, the firms created by graduates from a single university (Massachusetts Institute of Technology) generated an estimated number of about a million jobs and sales of about $USD 164 billion worldwide (Roberts & Eesley, 2011). This shows that making entrepreneurship education more effective may have a profound impact on the economic development of states and governments.

APPENDIX

Measures Used for Assessing Entrepreneurship Behavior

1. Are you, alone or with others, currently trying to start a new business, including any self-employment or selling any goods or services to others?
2. Even though you currently may not be starting a venture, it would be interesting to see whether you have engaged in any steps toward venture creation in the last year. Please indicate this by answering yes or no to the following questions:

Have you

- 2.1 Spent a lot of time thinking about starting a business?
- 2.2 Organized a start-up team?
- 2.3 Defined market opportunities?
- 2.4 Prepared a business plan?
- 2.5 Selected a business name?
- 2.6 Created a legal entity?
- 2.7 Registered with the tax authorities?
- 2.8 Saved money to invest in a business?
- 2.9 Invested your own money in a business?

2.10 Required and received financial support?
2.11 Searched for facilities and equipment?
2.12 Purchased or leased major items, like equipment, facilities, or property?
2.13 Purchased raw materials, inventory, or supply?
2.14 Developed models or procedures for a product/service?
2.15 Started marketing or promotional activities?
2.16 Devoted full-time to the business?
2.17 Applied for licenses or patents?
2.18 Hired employees?

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