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THE IMPACT OF ENTREPRENEURSHIP EDUCATION ON HUMAN CAPITAL AT UPPER-SECONDARY LEVEL

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Abstract

In this study we evaluate the impact of entrepreneurship education on human capital at the upper-secondary level using a quasi-experimental design. Data were collected from 494 students attending entrepreneurship education programs and 238 in a control group. Our results indicate that some personality traits such as need for autonomy and risk propensity, as well as beliefs, can have a significant positive influence on entrepreneurial intention. Entrepreneurship education has a positive, albeit limited impact on human-capital assets. The programs we assessed had a statistically significant impact on beliefs, on the capacity to exploit an opportunity, and on entrepreneurial knowledge. However, we did not observe any significant impact on entrepreneurial intention.

Introduction

One crucial element for fostering entrepreneurship is motivating individuals to become entrepreneurs and to equip them with the right skills to turn opportunities into successful ventures (Béchar and Grégoire 2005; Pittway and Cope 2007; Solomon, Duffy, and Tarabishy 2002). Encouraging entrepreneurship has become an accepted wisdom in economic management and government decisions. Consequently, many business schools have initiated courses and programs over the past two decades (Katz 2003; Matlay 2005). Today, it is estimated that at least 600,000 college students take a class in entrepreneurship every year in the US (Schramm 2012). Concurrently, several governments and foundations have also set up initiatives to create awareness about ‘entrepreneurship’ and to train potential entrepreneurs. This trend is prevalent in Europe where the European Commission perceives “entrepreneurship education as essential not only to shape the mindsets of young people but also to provide the skills and knowledge that are central to developing an entrepreneurial culture.” (EACEA 2012, p. 5)

A central premise of these approaches is that entrepreneurship is a learned phenomenon. That is, entrepreneurs are not born, but created by their experience as they grow and learn, being influenced by teachers, parents, mentors, and role models during their growth (Kolvereid 1996; Klandt 2004; Dickson, Solomon, and Weaver 2008). At the same time, Katz (2008) suggests that there is a convergence around a set of standards in entrepreneurship education, which reflects an agreement about what should be taught in entrepreneurship and small-business courses.

The problem is that despite the increasing resources devoted to entrepreneurship education and training, we have very little evidence to demonstrate its benefits. Most impact studies on entrepreneurship education support the hypothesis that entrepreneurship education has a positive impact on entrepreneurial behavior and intentions (e.g., Hansemark 1998; Liao and Gartner 2008; Wilson, Kickul, and Marlino 2007). However, Peterman and Kennedy (2003) claim that although authors have highlighted some of the benefits of entrepreneurship education, “there has

been little rigorous research on these effects” (p. 130). Several scholars lament that there is no clear indication of a trend toward increased methodological rigor at this time (Martin, McNally, and Kay 2012; Oosterbeek, van Praag, and Ijsselstein 2010). For example, many studies do not incorporate both pre- and post-intervention measures and control-group comparisons.

In addition, most entrepreneurship education impact studies have been conducted at the tertiary level, ignoring the vast majority of young adults at the secondary-school level. We are only aware of five studies that analyze the impact of entrepreneurship programs offered at secondary-school and vocational-school level (Athayde 2009; Cheung 2008; Kourilsky and Esfandiari 1997; Oosterbeek et al., 2010; Peterman and Kennedy 2003).

In this study we aim to evaluate the impact of entrepreneurship education on human capital at the upper-secondary level. Our work draws on human capital theory to shed some light on entrepreneurship education outcomes. This theory suggests that individuals with more or higher-quality human capital are more adept in discovering and exploiting entrepreneurial opportunities. Formal education also assists in the accumulation of explicit knowledge that may be useful to entrepreneurs (Martin, McNally, and Kay 2012).

Our study addresses two research questions: Do entrepreneurship-specific personality traits, beliefs, knowledge, and competencies influence entrepreneurial intention? And, does entrepreneurship education change entrepreneurship-specific personality traits, beliefs, knowledge, competencies, and intention? We used a pre-, post-, and post-post-test quasi-experimental design. Data were collected from 494 students attending entrepreneurship education programs and 238 in a control group.

Theoretical Framework Supporting Entrepreneurship Education

A wide range of theories have been used as a framework to outline the importance of education for selection into entrepreneurship for both the individual, entrepreneurial success of the business venture and for rates of business creation in a society. One of the most prominent economic theories employed is human capital theory (Becker 1975). The theory of human capital extended microeconomic analysis to a wide range of human behavior and suggested that knowledge and competencies can increase cognitive ability and lead to more effective activity. The literature distinguishes between general human capital, which refers to overall education and practical experience, and specific human capital, which refers to education and experience with a scope of application limited to a particular activity or context (Becker, 1975; Gimeno, Folta, Cooper, and Woo, 1997).

Numerous studies have established that human capital is a key factor in entrepreneurship. For example, Corbett (2007) showed that when identifying opportunities for entrepreneurial ventures, one’s existing knowledge base is crucial to opportunity identification because it serves as a base for interaction with new experiences, which in turn was used in this study as a foundation to interpret and understand new stimuli. Davidsson and Honig (2003) showed that human capital was a key antecedent for nascent entrepreneurship, but that it played a minor role in carrying the start-up process towards successful completion. Other scholars indicated the importance of human capital in the failure, survival, and the possibilities for high growth of new ventures (Brüderl, Preisendorfer, and Ziegler 1992).

Formal entrepreneurship education is one component of human capital that may assist in the accumulation of knowledge useful to entrepreneurs (Martin, McNally, and Kay 2012). Empirical research has demonstrated a range of results regarding the relationship between education, entrepreneurship, and success, with education frequently producing nonlinear effects in supporting the probability of becoming an entrepreneur, or in achieving success (Souitaris, Zerbini, and Al-Laham 2007; Reynolds 1997). In a recent meta-analysis, Martin et al. (2012) found a significant relationship between entrepreneurship education and human-capital assets. Overall, previous research in general thus tends to support the existence of a positive relationship between entrepreneurship education and entrepreneurial activity.

In this study, we focus on four types of entrepreneurship-related human-capital assets: (1) entrepreneurship-related personality traits, including need for achievement, entrepreneurial self-efficacy, pursuit of professional autonomy, risk propensity, and innovation propensity; (2) beliefs, including perceived desirability and feasibility; (3) entrepreneurial knowledge, and (4) entrepreneurial competencies. We chose entrepreneurial intention as the outcome variable.

The Impact of Personality Traits, Beliefs, Knowledge, and Competencies on Intention

“Entrepreneurial intentions or the expressed intention to start a venture at some point in the future is the most often studied antecedent of venture creation.” (Dickson, Solomon and Weaver 2008, p. 249) The importance of the intention concept is highlighted by Ajzen (1991), who suggested that action presupposes the conscious intention of carrying out such actions. Intentions have proven to be the best predictor of planned behavior, “particularly when that behavior is rare, hard to observe, or involves unpredictable time lags” (Krueger, Reilly and Carsrud, 2000, p. 411). Since new businesses emerge over time and can involve considerable planning, entrepreneurship is exactly the type of planned behavior for which intention models are ideally suited (Bird 1988).

Past research showed that intentions are one of the best predictors of entrepreneurial behavior (Kolvereid 1996). It is therefore not surprising that Krueger et al. (2000, p. 413) argued that “promoting entrepreneurial intentions by promoting public perceptions of feasibility and desirability is not just desirable; promoting entrepreneurial intentions is also thoroughly feasible.” Because the expressed ‘intent’ to form a venture at some point in time is a widely established predictor of entrepreneurial behavior, we retained entrepreneurial intention as the dependent variable in the study.

Entrepreneurial personality traits

Relationships between personality traits and entrepreneurial behavior have been frequently addressed in the entrepreneurship literature. Yet a deep-rooted skepticism prevails amongst entrepreneurship scholars about the presence and strength of this relationship. For example, Gartner (1989) argued that the diversity among entrepreneurs is much larger than differences between entrepreneurs and non-entrepreneurs. Being innovative and idiosyncratic, entrepreneurs tend to defy stereotyping, and consequently trying to ‘profile’ them is a daunting task. Empirical studies provided mixed results, although most of them identified differences between

entrepreneurs and managers, and correlations between personality and business creation (Chell, Haworth, and Brearley 1991).

However, recent meta-analyses provided evidence for the predictive validity of personality traits in entrepreneurship research (Collins, Hanges, and Locke 2004; Zhao and Seibert 2006). Rauch and Frese's (2006) meta-analysis indicated that a few carefully selected personality traits—including self-efficacy, need for autonomy, innovation propensity, and need for achievement—can predict well entrepreneurial behavior. Overall, these recent studies suggested that the common variance of traits contribute to entrepreneurial behavior. In our study we focus only on entrepreneurship-related personality traits.

Need for achievement. Of all the psychological measures presumed to be associated with the creation of new ventures, the need for achievement has the longest history. Need for achievement—a person's desire either for excellence or to succeed in competitive situations—has been identified as a key personal attribute of successful entrepreneurs (Stewart and Roth 2007). This trait implies that one chooses tasks of moderate difficulty, accepts responsibility for results, and seeks feedback on action outcomes. McClelland (1965) showed that founders of businesses have a higher need for achievement, and the significance of need for achievement as a factor for business growth has been demonstrated (Hansemark, 1998).

Entrepreneurial self-efficacy. Self-efficacy relates to a person's perception of ability to execute a target behavior (Bandura 1997). People with high self-efficacy are likely to persevere when problems arise, and tend to search for challenges and, therefore, challenging opportunities; they also show a higher degree of personal initiative (Speier and Frese 1997). Perceived entrepreneurial self-efficacy is a specific form of self-efficacy, and measures an individual's perceptions of their own entrepreneurial abilities (Forbes 2005). Shapero's (1982) model indicates that self-efficacy is central to intentions toward entrepreneurship and specifically influences the perceived feasibility of starting a business.

Need for autonomy. The need for autonomy measures the desire for independence and freedom. People with high needs for autonomy prefer self-directed work, care less about others' opinions and rules, and prefer to make decisions alone (Cromie 2000). Entrepreneurs prefer to make decisions independent of supervisors, to set their own goals and develop their own actions, and to control goal achievement themselves (Rauch and Frese 2006).

Innovation propensity. The trait of innovativeness helps entrepreneurs to foster innovation in their firms. As innovators, entrepreneurs must adopt and implement competitive strategies such as introducing new products and services, new methods of production, opening new markets or sources of supply, or even reorganizing an entire industry (Bird 1988). However, prior to implementation, the potential entrepreneur must be able to effectively formulate such strategies suggesting the possession of personal characteristics which reflect creativity and innovativeness. Other studies have shown that innovation is a primary motive to start a business. For example, Shane, Kolvereid, and Westhead (1991) reported that the opportunity to innovate and be in the forefront of new technology was frequently given as a reason for starting a business.

Risk taking propensity. The tasks of entrepreneurship include taking risks—for example, making decisions in uncertain situations (Rauch and Frese 2006). Stewart and Roth's (2001) meta-analytic review indicated that the risk propensity of entrepreneurs is greater than that of managers. However, entrepreneurs are not gamblers; they are characterized by a propensity to

take calculated risks and they manage the risk, in part by transferring a portion of the risk to others (investors, partners, customers, employees, and so on).

Therefore, personality traits should be related to entrepreneurial behavior. It is anticipated that the need for achievement, entrepreneurial self-efficacy, the need for autonomy, risk propensity, and innovation propensity will be positively related to the intent to form a venture at some point in time. Thus, we hypothesize that:

H1 There is a positive relationship between entrepreneurship-related personality traits (need for achievement, entrepreneurial self-efficacy, need for autonomy, innovation propensity, and risk taking propensity) and entrepreneurial intention.

Beliefs

Represented in most general terms, individual intention and action involve a configuration of beliefs and desires (Ajzen 1997). Similarly, scholars have suggested that the three main factors affecting entrepreneurial intentions are perceived desirability, perceived feasibility, and perceived benefit of a career in entrepreneurship (Krueger, Reilly, and Carsrud 2000).

Perceived desirability. Shapero (1982) defined perceived desirability as the personal attractiveness of starting a business, including both intra-personal and extra-personal impacts. In other words, perceived desirability pertains to “the extent to which entrepreneurship is a valid career option for the individual.” (Dimov 2007, p. 567)

Perceived feasibility. Perceived feasibility is the degree to which one feels personally capable of starting a business. The success of the venturing effort hinges on several critical milestones, such as attracting customers, implementing competitive strategies to fend off rivals, and acquiring financial, physical, and human resources. “To the extent that these are not deemed achievable, nascent entrepreneurs will be more likely to abandon their efforts as signs of trouble accumulate.” (Dimov 2010, p. 1127)

Perceived personal benefits. The perceived personal benefits significantly influence the intention to pursue a career as an entrepreneur, as well as the desirability and feasibility of such a career (Peterman and Kennedy 2003). Such benefits include the general advantages of this career option in comparison with other alternatives, the perceived career rewards, and the personal satisfaction derived from being an entrepreneur. Thus, we hypothesize:

H2: There is a positive relationship between beliefs and entrepreneurial intention.

Knowledge

Knowledge transfer, i.e. the accumulation of factual information, is another key human-capital asset which is part of most entrepreneurship programs. Discovering, evaluating, and exploiting business opportunities requires a variety of knowledge related to the technical, financial, organizational, legal, and market dimensions of the project (Kuratko 2005). Thus, we hypothesize that someone who has a greater repertoire of relevant entrepreneurship knowledge may have an increased entrepreneurial intent:

H3: There is a positive relationship between knowledge and entrepreneurial intention.

Competencies

While factual knowledge is important, entrepreneurship is an action-oriented endeavor. Entrepreneurs need to be able to act and implement their ideas in order to produce the intended results. Typically, the primary goal of an entrepreneurship curriculum seeks to develop the recognition and the evaluation of market opportunities as core competencies, and to encourage students to initiate ventures of their own.

Opportunity recognition. The first step of the entrepreneurship process is to recognize an opportunity. This is an art and a science—blending observation, market insight, and adaptation—from which both the identification of need in the marketplace and the idea for a service or product that meets that need at an acceptable price emerge. Entrepreneurs have a knack for looking at the usual and seeing the unusual, for observing the ordinary and perceiving the extraordinary (Baron 2004). Consequently, they can spot opportunities that turn the commonplace into the unique and unexpected. This combination of intuitive skills and applied knowledge can be taught and refined.

Opportunity exploitation. Having distilled an opportunity, the would-be entrepreneur must be willing to and capable of finding out whether an idea can really deliver its original promise. In order to achieve this, would-be entrepreneurs need to shape the opportunity by taking action: seeking feedback, continually incorporating new information, and adapting their initial idea (Dimov 2007). The belief that one is capable of taking action suggests, therefore, that the initial idea is being transformed into an opportunity. Indeed, as Kirzner (1979, p. 169) argued: “Only ideas that are acted upon are deemed to have been perceived as profit opportunities.” This range of abilities can also be greatly enhanced through effective education.

We posit that individuals who possess the competencies to recognize and evaluate opportunities show higher entrepreneurial intention. Thus, we derive the following hypothesis:

H4: There is a positive relationship between competencies and entrepreneurial intention.

Previous Reviews of Entrepreneurship Education Impact Studies

A series of reviews have systematically explored the evidence base in entrepreneurship education and training. Dainow (1986) conducted a pioneer survey of entrepreneurship education studies within the ten-year period up to 1984 with the aim of providing an overview of the then-current state of the art. He concluded that there was a need for more systematic data collection, more empirical research, and more varied methodologies. Ten years later, Gorman, Hanlow, and King (1997) conducted a similar review in which they analyzed 63 articles published between 1985 and 1994. They noticed a significant increase in the number of empirical studies and concluded that “Entrepreneurial attributes can be positively influenced by educational programs...” (p.15). They further remarked that research was still in an exploratory stage and that basic standards in impact, such as ex-ante and ex-post measurements, were not widely used. More recently, Pittaway and Cope (2007) explored different themes within entrepreneurship education via the use of a systematic literature review. Their findings support the conclusion that entrepreneurship education has had an impact on student propensity and intentionality. What is unclear is the extent to which such education has an impact on the level of graduate entrepreneurship, or whether it enables graduates to become more effective entrepreneurs.

In addition to these general reviews, we identified three comprehensive studies assessing the impact of entrepreneurship education and training programs (Dickson, Solomon, and

Weaver, 2008; Mwasalwiba 2010; Martin, McNally, and Kay 2012). First, Dickson et al. (2008) analyzed the impact of entrepreneurship education on a range of entrepreneurial activities. In this context, they reviewed 21 peer-reviewed studies published between 1995 and 2006, of which 6 studies examine the impact of entrepreneurship education on venture creation and 15 studies focus on other entrepreneurship human-capital outcomes, such as attitudes and intentions. They found that “there was a significant and positive correlation between participation in the [entrepreneurship] educational programs and selection into entrepreneurship” (Dickson et al., 2008, p.245). They also identified critical methodological weaknesses, such as an over-reliance on measurements conducted solely after the intervention, a focus on specific, unique, and sometimes non-transferable education programs, and a tendency towards cross-section surveys with few experimental controls.

Second, Mwasalwiba (2010) analyzed 108 entrepreneurship education papers devoted to five main themes, one of which focused on “evaluation and impact indicators” and covered 17 studies. While taking into account a wide range of factors, Mwasalwiba (2010) concluded, while considering all groups of outcome indicators, that "Although most studies vary in terms of approach and theoretical orientations [...] their results seem to conclude that entrepreneurship education has some positive impact on students." (p. 35)

More recently, Martin et al. (2012) conducted the first meta-analysis of entrepreneurship education and training outcomes. Based on 42 independent samples ($n = 16,657$), they found a significant relationship between entrepreneurship education and entrepreneurship skills, intentions, and outcomes. In addition, their results related to study rigor helped to quantify the concern that the entrepreneurship education and training literature suffers from low standard of rigor. The authors noted that a large number of studies were not viable for inclusion in their meta-analysis because of methodological and/or reporting issues, and there was no clear indication of a trend toward increased methodological rigor.

To sum up, all reviews indicate a positive impact to some extent of entrepreneurship education on entrepreneurial outcome measures. At the same time, they also recognize potential pitfalls in methodologies. Thus, we hypothesize the following:

H5: Entrepreneurship education will be positively associated with entrepreneurship-related human-capital assets.

Method

We adopted a pre-, post-, and post-post-test control group design (Souitaris et al. 2007) to measure the change in human-capital assets caused by participating in an entrepreneurship program. Most of the programs ran over a period of 6 to 12 months. The pre-test was conducted at the beginning of the respective entrepreneurship program (t_1), the post-test was conducted at the end of the program (t_2), and the post-post test was conducted four to five months after completion of the program (t_3) in order to demonstrate additional stability in the measurement. Such post-intervention measurements at several points in time are recommended by Martin et al. (2012) in order to capture the stability of the intervention's effect.

While significant effects are often observed directly upon completion of an intervention, these effects are likely to decline over time. A third point of measurement provides therefore an indication of the effects' stability. With regard to entrepreneurship-related personality traits,

beliefs, and competences, we can expect that an effect that is measureable after four or five months can be regarded as stable (Collins, 1991). The effect on knowledge might decline further after that period, depending on whether or not the knowledge is applied.

Sample

This study draws on a sample of 494 students who took entrepreneurship as a compulsory or elective course in 27 Swiss vocational, commercial, and technical schools. More specifically, the students were attending the following entrepreneurship programs: (1) an intervention program in entrepreneurship initiated by the Swiss Federal Office for Professional Education and Technology (107 participants in 5 schools); (2) the “Company Program” of Young Enterprise Switzerland—a member of Junior Achievement Worldwide (181 participants in 12 schools); and (3) the “Learn to undertake” program (206 participants in 10 schools). In addition, the study included a control group of 238 students from comparable schools. Therefore, the total initial sample size comprised of 732 students.

Since all major programs in entrepreneurship at the upper-secondary level in Switzerland were considered, this study provides a representative and comprehensive picture of entrepreneurship education in vocational, technical, and commercial schools. While we cannot exclude that other small, sporadic courses in entrepreneurship were offered by other schools, we nevertheless estimate that the sample in this study covered 80% to 90% of the overall targeted population (students who were attending an entrepreneurship course at upper secondary level). The age of the students (19.3 years old) and the sex (54% of male and 46% of female) was documented during the pre-test.

Sample size decreased in the second and third rounds of measurement. The number of matching questionnaires from pre- (t1) and post-measurement (t2) was $n = 345$ (control group = 133). The number of matching questionnaires from all three measurement rounds was $n = 291$ (control group = 102). The reasons for the decreasing number of returned questionnaires are two-fold. First, some students left the programs during the term. This was especially prevalent for students who took the course as an elective. Second, some of the students who participated in the program were in their final year and since they received the third questionnaire (post-post) via mail at home, their response rate was expectedly lower.

In addition to addressing a similar audience, the entrepreneurship programs shared three common content and pedagogical features. First, the programs covered knowledge aspects with regard to product development, marketing, strategy, finance, and business planning, all of which focused on the specific context of creating a new venture. Second, since business entry is fundamentally a different activity than managing a business, the entrepreneurship programs addressed the equivocal nature of business entry (Solomon, Duffy, and Tarabishy 2002). To this end, they included soft-skill modules in creative thinking, new product development, and social responsibility. Third, all three programs followed experiential, action-learning precepts (Neck and Greene 2011). The types of learning tools included the development of a business idea, consultation with practicing entrepreneurs, and field trips. The incorporation of real-world practice and “learning by doing” aimed to develop capabilities to manage knowledge assets in a dynamic manner. (Honig 2004)

Measurement

The variables were measured by drawing from a variety of established instruments from the entrepreneurship literature (for example, Krueger, Reilly, and Carsrud 2000; Dimov 2007; Shapero 1982). With the exception of entrepreneurial knowledge, all variables were captured by multiple self-reported items measured on a five-point Likert scale. As shown by Miner and Raju (2004), there is substantial evidence that an average positive relationship between implicit (measured by projective techniques) and self-attributed measure (measured by self-report tests) appears to exist. Table 1 provides a description of the items and their original source together with measures of reliability (Cronbach α).

— Insert Table 1 here —

We considered the following control variables:

Gender (dummy variable: 0 = female; 1 = male). The majority of past studies found that gender plays a role when it comes to launching a venture. The consensus is that men show higher entrepreneurial intention (Kolvereid 1996) and that they are more likely to set up a venture (Reynolds 1997).

Age. Entrepreneurial activity involves a minority of the population, and there is no general theory indicating the stage of life that is best for launching a business venture. However, in the specific case of entrepreneurship education, empirical evidence suggests that older students have more human-capital assets, which in turn lead to increased entrepreneurial intention (Kolvereid 1996).

Parents' education attainment. (scale: 1 = obligatory school to 8 = university degree; average of both parents). This variable was included because of the increasing evidence suggesting that parents' education attainment influences their children's career choice (Jodl et al. 2001).

Migration background (dummy variable: 0 = no; 1 = yes). Ethnic affiliation has historically played an important role in entrepreneurship (Aldrich and Waldinger 1990). The main explanation is that migrants set up a venture as a response to the lack of opportunities in the dominant culture. However, entrepreneurship can also be a first choice between different career alternatives, and this might result from different pull factors such as the presence in the family of entrepreneurs who act as role models.

High school (dummy variable: 0 = no; 1 = yes). This variable was intended to identify students who studied full-time in high schools. Other students were serving an apprenticeship and attending vocational schools mostly on a part-time basis.

Previous entrepreneurial exposure (index 0 = no exposure; 9 = multiple exposure). From a social-learning perspective (Bandura, 1986), previous experience is an important environmental factor in the development of an individual's self-efficacy and career-selection process. Prior exposure to entrepreneurial experience was measured applying a series of 9 items used in Kruger's (1993) study. Participants were asked whether they had been exposed to each of nine possible types of entrepreneurial experience. We derived a 'prior entrepreneurship exposure' index by computing the sum of these 9 yes-no questions (coded 1 for yes, 0 for no).

Results

Table 2 shows the descriptive statistics and the correlations for the total initial sample ($n = 732$) at the first point of measurement ($t1$). The correlations were mainly in the low to medium range, suggesting that multicollinearity is not an issue.

— Insert Table 2 here —

To test whether the participants in the program differed from control group members at $t1$, we employed a t-test for independent samples. The results are presented in Table 3. With the exception of perceived feasibility (Belief) and opportunity exploitation (Competencies), the values for the program group are significantly higher than the values for the control group. We believe this to be partly due to self-selection of students (most of the courses were electives) and partly due to the teachers, who might have selected courses with students who are generally motivated.

— Insert Table 3 here —

Antecedents of entrepreneurial intentions: Hypothesis 1 to 4

We used a stepwise, hierarchical regression analysis to test H1 to H4. As shown in Table 4, two models were tested in the regression analysis. Model 1 included only the control variables (age, gender, parents' educational attainment, migration background, previous entrepreneurial exposure, migration background, and high school attendance). At $t1$ the model shows a significant influence on the control variables age, gender, previous entrepreneurial exposure, migration background, and on the dummy variable "Gymnasium". Previous entrepreneurial exposure had the largest influence, i.e., the more entrepreneurial experiences someone had had before $t1$, the higher the entrepreneurial intention. However, in model 2 we find that the influence of the control variables, with the exception of age, disappears under the influence of the measures of the antecedents.

— Insert Table 4 here —

Unexpectedly, we only find a significant influence on entrepreneurial intention for four out of eleven variables: need for autonomy ($\beta = .119$; $p < .001$), perceived desirability ($\beta = .092$; $p < .01$), perceived feasibility ($\beta = .241$; $p < .001$), and personal benefit ($\beta = .463$; $p < .001$). In model 2 there is an additional, significant influence of risk propensity ($\beta = .171$; $p < .001$) and knowledge ($\beta = .097$; $p < .005$), with the influence of knowledge being negative. The influence of the pursuit of professional autonomy is not significant at $t2$ any longer. The fit of the model (R^2) was .531 ($t1$) and .519 ($t2$), respectively.

Hypothesis 1: We found a positive relationship between risk propensity and entrepreneurial intention. However, this was only the case for the regression analysis of $t2$. There was no significant, positive relationship between the other four personality traits. Thus, H1 was partly rejected.

Hypothesis 2: The regression analysis showed that all three belief measures (perceived desirability, perceived feasibility, and personal benefits) had a positive influence on entrepreneurial intention. Thus, H2 was accepted.

Hypothesis 3: There was no significant, positive relation between knowledge and entrepreneurial intention. To the contrary, we even found a significant negative relation between knowledge and entrepreneurial intention at t2, i.e. the less knowledge participants had about entrepreneurship, the higher their entrepreneurial intention. Thus, H3 was rejected.

Hypothesis 4: Regarding the two entrepreneurial competencies (opportunity recognition and opportunity exploitation), we did not find a significant relationship and rejected H4.

The influence of the entrepreneurship course: Hypothesis 5

In H5 we posited that participating in an entrepreneurship education program has a positive influence on the entrepreneurship-related human capital assets (e.g., entrepreneurial personality traits, beliefs, knowledge, competencies) and entrepreneurial intention. The hypothesis was tested using a univariate, single-factor covariance analysis (ANCOVA) with repeated measurement. The covariance analysis was run separately for each scale with the dependent variables at t1, t2 and t3 as inner-subject factors and the between-subject factor program participation (program vs. control group). To reduce the impact of the control variables, we used them as covariates. We were interested in the interaction terms between program participation and time to see whether attending one of the three programs had an influence on the dependent variables over time. We found significant results for four dependent variables, namely perceived desirability ($F 5.74; p < .05$), perceived feasibility ($F 19.73; p < .001$), entrepreneurial knowledge ($F 6.74; p < .01$), and opportunity exploitation ($F 9.73, p < .001$). However, the influence on perceived desirability was negative and only significant for t2. The effect sizes of the changes were small. We did not find a significant effect with regard to the intention to start an own company within the next five years.

— Insert Table 5 here —

Discussion

This study provides an analysis of human-capital development related to entrepreneurship education. We had posed two research questions: Do personality traits, beliefs, and entrepreneurial knowledge and competencies influence entrepreneurial intention? And, does entrepreneurship education affect personality traits and raise beliefs, entrepreneurial knowledge and intention?

To address the first research question, we developed a series of five hypotheses grounded for the most part in Ajzen's Theory of Planned Behaviour (1991). Because the expressed intent to form a venture at some point in time is a widely established predictor of entrepreneurial behavior, we retained entrepreneurial intention as the dependent variable in the study. The results showed that selected personality traits (need for autonomy [t1] and risk propensity [t2]) and beliefs (perceived desirability, feasibility, and benefits), have a significant positive relationship with entrepreneurial intention. Entrepreneurial knowledge had no impact at t1 and a significant negative influence on entrepreneurial intention at t2. In addition, the results suggest that older individuals and individuals with previous entrepreneurial exposure show a higher entrepreneurial intention.

Similar to prior research that investigated entrepreneurial intentions (Athayde 2009; Krueger et al. 2000), our findings support the positive associations between attitudes towards self-employment and entrepreneurial intention (Hansemark 1998). In addition, this study provides further support for use of Ajzen's Theory of Planned Behaviour (1991) and Bandura's Social Cognitive Theory (1997) to test the antecedents of entrepreneurial intentions. However, our results suggest that knowledge does not have a significant influence on intention (t1) and even a slightly negative effect (t2). A possible explanation is that knowledge allows making a better and more informed decision for or against an entrepreneurial career. Thus, it appears participants of an entrepreneurship course have more realistic perceptions about what it means to become an entrepreneur. Consequently some students will recognize that a career as an entrepreneur is not the most suitable option for them. Another explanation is that knowledge does not have a direct affect on entrepreneurial intention but that it rather affects antecedents such as feasibility perception, as suggested by Liñán, Rodríguez-Cohard, and Rueda-Cantuche (2005).

To address the second research question, we employed a pre-, post-, and post-post-test design. The results showed that entrepreneurship programs had a statistically significant effect on beliefs (perceived feasibility and desirability), on the capacity to exploit an opportunity, and on entrepreneurial knowledge. We found no effect on entrepreneurial personality traits and entrepreneurial intention. Our results contradict previous studies which found a positive effect of entrepreneurship education on intention (Krueger et al. 2000; Peterman and Kennedy 2003; Souitaris et al. 2007). However, our results are in line with von Graevenitz, Harhoff and Weber's (2010) impact study which showed that entrepreneurial intention declined somewhat after attending an entrepreneurship course, although the course had significant positive effects on entrepreneurial skills.

The absence of impact of entrepreneurship education on entrepreneurial intention suggests that the programs lead to a "demystification" of entrepreneurship and self-employment. While the students updated their beliefs about their entrepreneurial aptitude and improved their entrepreneurial knowledge, many of them came to realize how difficult it is to get a project off the ground, and that failure is a prevalent feature in entrepreneurship. Indeed, the programs followed an experiential learning approach which encompassed a combination of lectures, a business idea development, field trips, and testimonies from entrepreneurs'. This pedagogy probably increased a failure anxiety and diminished students' intentions to become entrepreneurs. This could be a concern for educators who believe that "the primary purpose of entrepreneurship courses is to encourage students to pursue entrepreneurial careers, provide them the tools necessary for success, and to avoid failure." (Shepherd, 2004, p. 282)

However, the fact that upon completion of an entrepreneurship course students do not show a stronger intent to form a venture in the near future is not necessarily a disappointing outcome per se. Some participants might want to gather experience in the work place first and become entrepreneurs later. Also, educators, policy makers, and practitioners alike have to move beyond purely quantitative measures in impact studies. A significant change of entrepreneurial intention or a burst in venture creation after the completion of an entrepreneurship program could be misleading. Quality and sustainability also matter. Do intentions ultimately turn into a concrete action? Are the ventures sustainable? Do they create value?

This study reminds us that educators should not only be interested in raising entrepreneurial intentions and increasing the number of start-ups. Providing students with a learning

environment that helps them to make a more profound decision for or against an entrepreneurial career provides an important function as well. This sorting effect can be socially positive (von Graevenitz et al., 2010), even if that means that the overall level of entrepreneurial intention decreases. In addition, educating students about potential failure can improve their emotional intelligence and help them in coping with grief, even if this is achieved at the expense of entrepreneurial intention. (Shepherd, 2004)

The absence of any impact on personality by participating in an entrepreneurship program is perhaps less surprising. Recently, the literature in entrepreneurship has made great strides in defining the essential behaviors and roles of entrepreneurs, and contemporary meta-analytic reviews provide evidence of the validity of personality traits for predicting entrepreneurial behavior (Zhao and Seibert 2006; Rauch and Frese 2006). However, we focused on specific entrepreneurial traits, rather than on broad traits (such as the big five traits), and we applied a treatment to a population of students, not of entrepreneurs. Another possible explanation is that traits are relatively stable over time, and thus hard to influence in an intervention.

Conclusion

The primary purpose of this study was to evaluate the impact of entrepreneurship education on the human capital of students in vocational, technical or commercial schools at the upper-secondary level. Our objective was to get a deeper insight into an individual's entrepreneurial intentions, thereby developing a model that linked entrepreneurship education to the formation of such behavioral intentions. Given the potential to explain entrepreneurial behavior through intention models, understanding the impact of entrepreneurship education through changes in students' personality traits, beliefs, knowledge, and competencies is of importance to vocational educators and public policy makers.

This study contributed to the growing field of entrepreneurship education and training by focusing on three research aspects neglected in past literature. First, we considered students in vocational, technical and commercial schools at the upper-secondary level, a population which has received limited attention in previous studies, despite the fact that this population represents the bulk of young adults pursuing an education program in Europe. Second, we integrated personality traits into our models. Third, we adopted a rigorous method, relying on a pre-, post-, and post-post-test quasi-experimental design. The use of three survey points provided extra validity to the models tested.

Our results indicate that some personality traits such as need for autonomy and risk propensity, as well as beliefs, can have a significant positive influence on entrepreneurial intention. Entrepreneurship education has a positive, albeit limited impact on such human-capital assets. The programs we assessed only had a statistically significant impact on beliefs (perceived feasibility and desirability), on the capacity to exploit an opportunity, and on entrepreneurial knowledge. Therefore, it is felt that some components of entrepreneurship can be taught and that these can positively influence some human-capital assets. As such, our results could provide a basis for the development of standards to improve educational outcomes in entrepreneurship. By using these standards as a guide, or so-called opportunities to learn (McDonnell 1995), educators as well as students can measure whether they have a realistic shot at acquiring entrepreneurial knowledge and developing an entrepreneurial mindset.

A number of limitations should also be formulated. First, we relied on a sample from a single country. Therefore, caution is needed when generalizing the results in other contexts. Second, while the entrepreneurship programs shared some common content and pedagogical features, there were nevertheless a number of factors which are likely to create some 'noise' in the data. This might explain why some of the hypotheses were not validated. For example, there were a large number of instructors involved in the program delivery and the formats (eg, compulsory vs. elective course; intensive one-week vs. semester course) varied to some extent. Third, we started the treatment with significant differences in most variables between program and control group. The program group showed statistically significantly higher levels of entrepreneurial personality traits, knowledge and entrepreneurial intention from the outset. This was partly due to self-selection in the programs. It is, therefore, more difficult to effect a change in individuals who are already sold on entrepreneurship.

However, as shown in this study, it is wrong to assume that dedicated entrepreneurship programs will systematically lead to higher entrepreneurial intention or start-up rates. A more likely outcome is that, in addition to a heightened entrepreneurial mindset and enhanced entrepreneurial knowledge, students will be able to make an informed choice about a career in entrepreneurship. This is, after all, the role of schools and educators as learning catalysts. If we consider entrepreneurship as a 'method', our role as educators is to encourage students to better understand their own learning process by drawing from a repertoire of "feeling, playing, creating and thinking" (Neck and Greene 2011, p. 68). Setting aside the hype about entrepreneurship and the need to 'produce entrepreneurs' entrepreneurship educators can play a more important role by asking questions, engaging students at many different levels (not only deconstructing their worldview but also helping them to reconstruct it), and relating the daily tasks, and roles, and of entrepreneurs to the grand questions facing humanity.

This study offers a number of avenues for further research. First, given the absence of impact on entrepreneurial intention, entrepreneurship education should explore other outcomes. For example, there is a need to formulate and evaluate the competencies that students should acquire in an entrepreneurship course. While attending a program, students might also learn more about themselves (self-realization) than just about entrepreneurship. Entrepreneurship is a journey where the opportunity is intertwined with the person of the entrepreneur. Subjective feelings such as emotions can play an important role in this context and they should be integrated in future studies.

One of the most pressing challenges for entrepreneurship educators consists perhaps in conducting an in-depth reflection about what and how we teach. We need to further consider and explore the implications of changes in curricula and teaching format on the antecedents of entrepreneurial intentions. For example, what effect do approaches using different theoretical anchors such causation, effectuation or bricolage produce? What do courses which follow a learner-centered approach (involving students in the knowledge creation and using a dialogue) achieve in comparison with courses following a teacher-centered approach (courses where the instructor takes center stage and based on a monologue)? This is truly an area where research and teaching can occupy a virtuous circle of improvement.

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Table 1 Measures for personality traits, beliefs, knowledge, competencies, and intention

Personality traits
1. Need for achievement: six items adapted from McClelland (1965) to capture situations characterized by individual responsibility, moderate risk-taking, knowledge of results of decisions, novel instrumental activity, and anticipation of future possibilities (Cronbach α : t1= .792, t2 = .792, t3 = .821)
2. Entrepreneurial self-efficacy: five items adapted from Forbes (2005) to measure entrepreneurial roles and tasks across five distinct dimensions: marketing, innovation, management, risk taking, and financial control (Cronbach α : t1= .719, t2 = .716, t3 = .705)
3. Need for autonomy: five items from the Manifest Needs Questionnaire (MNQ) used in Baum et al. (1993) to capture the desire for independence and freedom (Cronbach α : t1= .628, t2 = .621, t3 = .620)
4. Risk propensity: four items adapted from Sitkin and Weingart (1995) to measure the individual's willingness to take risks (Cronbach α : t1= .698, t2 = .683, t3 = .732)
5. Innovation propensity: five items adapted from Mueller and Thomas (2001) measuring creativity, innovation, and initiative (Cronbach α : t1= .553, t2 = .555, t3 = .532)
Beliefs
1. Perceived desirability: four items adapted from Shapero (1982) and Krueger, Reilly and Carsrud (2000) (Cronbach α : t1= .638, t2 = .646, t3 = .676)
2. Perceived feasibility: five items adapted from Shapero (1982) and Krueger, Reilly and Carsrud (2000) (Cronbach α : t1= .725, t2 = .732, t3 = .811)
3. Personal benefit: three items adapted from Shapero (1982) capturing the general advantages, career rewards, and personal satisfaction of being an entrepreneur (Cronbach α : t1= .759, t2 = .756, t3 = .776)
Competencies
1. Opportunity recognition : five items adapted from the opportunity recognition scale used by McCline. Bhat and Baj (2000)(Cronbach α : t1= .715, t2 = .673, t3 = .762)
2. Opportunity exploitation : three items derived from Dimov's (2007) action likelihood to fine tune the initial idea; discuss the opportunity with friends and advisors; and find potential investor (Cronbach α : t1= .693, t2 = .643, t3 = .707)
Knowledge
Entrepreneurial knowledge: index computed from 13 multiple-choice items about the key concepts of entrepreneurship, such market positioning, financing, business model, legal issues, and business plan; adapted from Kourilsky and Esfandiari (1997)
Entrepreneurial intention
Entrepreneurial intention : three items adapted from Krueger, Reilly and Carsrud (2000) capturing the intention to start a business in the next five years (Cronbach α : t1= .781, t2 = .810, t3 = .764)

Table 2 Descriptive statistics and Pearson correlation for total sample (n = 732) at t1

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Need for achievement	2.63	.658	-	.					.	.				
2. Entrepreneurial self-efficacy	2.87	.554	.587**	-										
3 Need for autonomy	2.68	.535	.570**	.607**	-									
4. Risk propensity	2.67	.631	.596**	.668*	.638**	-			.					
5. Innovation propensity	2.63	.532	.434*	.487**	.490**	.549*	-							
6. Perceived desirability	2.36	.675	.457**	.436*	.499**	.383**	.271**	-						
7. Perceived feasibility	2.12	.602	.365**	.485**	.409**	.402**	.300**	.376**	-					
8. Personal benefit	2.26	.797	.337**	.321*	.392**	.369**	.324*	.432*	.332**	-				
9. Opportunity recognition	2.62	.540	.491*	.540**	.472**	.486**	.482*	.430**	.522*	.351**	-			
10. Opportunity exploitation	2.41	.683	.353**	.488**	.350*	.369**	.259*	.271**	.566*	.204**	.492**	-		
11. Entrepreneurial intention	1.6947	.70416	.370**	.386*	.449**	.390**	.272**	.448**	.489*	.642**	.351**	.331**	-	
12. Entrepreneurial knowledge	7.87	1.48	.156*	.193**	.165**	.198**	.098**	.024	.157**	-.064	.191*	.167*	.042	-

* $p < 0.05$; ** $p < 0.01$

SD = standard deviation

Table 3 Mean and t-values of program and control groups

Variable	Group	Mean	t-value
Personality traits			
Need for achievement	PG (n = 487)	2.70	4.61***
	CG (n = 235)	2.47	
Entrepreneurial self-efficacy	PG (n = 486)	2.93	4.21***
	CG (n = 236)	2.74	
Need for autonomy	PG (n =485)	2.72	3.28**
	CG (n = 234)	2.59	
Risk propensity	PG (n = 489)	2.73	3.55***
	CG (n = 238)	2.55	
Innovation propensity	PG (n = 487)	2.70	5.00***
	CG (n = 237)	2.49	
Beliefs			
Perceived desirability	PG (n = 484)	2.42	3.56***
	CG (n = 233)	2.23	
Perceived feasibility	PG (n = 486)	2.14	1.13
	CG (n = 238)	2.08	
Personal benefit	PG (n = 489)	2.32	2.96**
	CG (n = 238)	2.14	
Knowledge			
Entrepreneurial knowledge	PG (n = 493)	0.93	2.31*
	CG (n = 238)	0.88	
Competencies			
Opportunity recognition	PG (n = 482)	2.70	5.08***
	CG (n = 233)	2.46	
Opportunity exploitation	PG (n = 490)	2.42	0.77
	CG (n = 236)	2.38	
Entrepreneurial intention	PG (n = 487)	1.75	2.94**
	CG (n = 238)	1.59	

PG = program group; CG = control group

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 4 Antecedents of entrepreneurial intention

	t1		t2	
	Model 1	Model 2	Model 1	Model 2
Age	.113**	.092**	.147***	.123***
Gender	.168***	.037	.139**	.023
Previous exposure	.268***	.032	.206***	.080*
Parents' education attainment	-.042	-.021	-.048	-.009
Migration background	.092*	.021	.089 *	.042
High school	-.103**	.002	-.024	.058
Need for achievement		.009		-.095
Entrepreneurial self-efficacy		.016		-.031
Need for autonomy		.119**		.052
Risk propensity		.018		.171**
Innovation propensity		-.034		.059
Perceived desirability		.092**		.133**
Perceived feasibility		.241***		.249***
Personal benefit		.463***		.462***
Opportunity recognition		-.070		-.088
Opportunity exploitation		.025		-.082
Entrepreneurial knowledge		-.006		-.097*
R^2	.140	.531	.100	.519
Adjusted R^2	.132	.519	.088	.500
F	18.332***	44.341***	8.503***	28.379***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 5 The effect of the program and time on personality traits, beliefs, knowledge, competencies, and entrepreneurial intention: ANCOVA measures

	F	P	η^2
Personality traits			
Need for achievement	.40	.673	.001
Entrepreneurial self-efficacy	.79	.453	.003
Pursuit of professional autonomy	.75	.471	.002
Risk propensity	.05	.948	.000
Innovation propensity	.20	.819	.001
Beliefs			
Perceived desirability (two measurement points)	5.74	.0107*	.012
Perceived feasibility	19.73	.000***	.061
Personal benefit	.02	.0979	.000
Knowledge			
Entrepreneurship knowledge	6.74	.001**	.021
Competencies			
Opportunity recognition	.15	.860	.001
Opportunity exploitation	9.73	.000***	.0031
Entrepreneurial intention	.076	.468	.002

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Time = 3 measurement points unless specified otherwise