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REGULAR ARTICLE

# Empowering entrepreneurial capacity: training, innovation and business ethics

**Ángel Rodríguez-López**[1] · **Jaime E. Souto**[2]

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## Abstract

Entrepreneurship's training is an issue with many gaps—even with contradictory results—, in which many aspects and the relationships between them are still unknown. This paper addresses the relationships that exist in training process and on their impact on the resultant entrepreneurial capacity. The sample includes 469 individuals interested in starting a new venture. A common method bias was addressed on the questionnaire design including psychological separation of predictor and criterion variables and response anonymity. Furthermore, a principal factor analysis on the questionnaire measurement items was carried out, without a single factor emerging. The statistical analysis was carried out by ordinal logistic regression and multinomial logistic regression. The results obtained are not a trivial issue for entrepreneurship, but rather a key aspect, which must be very present in the training stages of the entrepreneur. In fact, the emerging entrepreneur requires training in areas or capacities that complement and reinforce entrepreneurship capacity, combines different essential ingredients for entrepreneurship, and is adapted to increases in entrepreneurship capacity. Innovation and business ethics contribute to any kind of entrepreneurship and they make a net contribution to the entrepreneurial capacity and in any entrepreneurial process. Finally, innovation and ethical commitment are more critical for obtaining a high level of entrepreneurial capacity, and they are important for entrepreneurship in general, outside social entrepreneurship and innovative entrepreneurship.

**Keywords** Entrepreneurship · Start-ups · Interconnected training · Innovation · Training stages · Business ethics

✉ Ángel Rodríguez-López
arlopez@ccee.ucm.es

Jaime E. Souto
jaimeeds@ucm.es

[1] Department of Accounting and Finance, Complutense University of Madrid, Campus of Somosaguas, Pozuelo de Alarcón, 28223 Madrid, Spain

[2] Department of Business Management, Complutense University of Madrid, Campus of Somosaguas, Pozuelo de Alarcón, 28223 Madrid, Spain

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## 1 Introduction

Several researchers have emphasized the variety of skills and capacities that entrepreneurs use to create and develop a new company (Dunham 2010; Kodithuwakku and Rosa 2002). Entrepreneurial capacity is used together with different capacities and skills that enhance and complement it (Bacigalupo et al. 2016). In line with Frese and Rauch (2000) when we refer to entrepreneurial capacity, we are alluding to the act of carrying out a project or business. More specifically, we are talking about a project that is undertaken through effort and by overcoming various difficulties in order to achieve a particular goal; in other words, entrepreneurial capacity is to know and to be able to carry out the creation of a new venture, confronting the uncertainty and assuming the risks inherent to such activity. Furthermore, Hindle and Yencken (2004) highlighted that entrepreneurial capacity requires inputs such as risk-taking, decision-making in uncertain environments, managing rapid growth in volatile contexts, the creation of extensive networks, and leading new projects.

However, entrepreneurial activity requires other ingredients in addition to entrepreneurial capacity, such as *capacity to innovate* (Bacigalupo et al. 2016; Hindle and Yencken 2004) and *ethical commitment capacity* (Buchholz and Rosenthal 2005; Clarke and Holt 2010). These ingredients are recognized as critical factors for the creation of innovative companies or social enterprises, that is, for social entrepreneurship and innovative entrepreneurship. Despite this, knowledge about their relationships and effects is scarce in the entrepreneurship area in general (RezaeiZadeh et al. 2017). Here we can suppose that they act as complements to entrepreneurial capacity, enabling the creation of a new company and its subsequent development. Entrepreneurial capacity does not imply, *ceteris paribus*, innovation capacity (Lazear 2004) or ethical capacity. Moreover, while ethics may be tied to any business or company, it is an isolated capacity, since entrepreneurial capacity and innovation capacity do not necessary imply the existence of ethical capacity (Marina 2010).

Amoroso et al. (2018) analyze the relationship between an entrepreneur's experience and education and his reliance on alternative sources of knowledge for exploring new business opportunities, finding that the association of these characteristics differs significantly across sources of knowledge, and across European regions. Moreover, tolerance is essential for innovation because it creates an open environment where creativity and knowledge emerges (Audretsch et al. 2018). Nevertheless, academic literature suggests that the relationship between tolerance and freedom is more nuanced towards additional social factors, such as the role of trust and other institutions. In this regard, Audretsch et al. (2018) find that tolerance and trust play an important role in stimulating innovation performance, despite of fact that the exact nature of the relationships is influenced by economic development.

Although the array of capacities that are used along with entrepreneurial capacity is an issue that has generated tremendous interest and much research (Aldrich and Martinez 2001; Hmieleski and Baron 2009), there has been scant research into the

entrepreneurial capacity and many other capacities outside of specific niches, and even a great gap in the literature about the relationship between the training in entrepreneurial capacity and training in other capacities (Driscoll and Tesfayohannes 2009; RezaeiZadeh et al. 2017). In fact, it is completely unknown whether training generates any kind of symbiosis or synergies between capacities that will be used jointly in the entrepreneurship process. The term symbiosis refers to the effects of specific training on a capacity over another capacity.

Otherwise, the entrepreneurial ecosystem approach is an emerging theoretical research stream based in two dominant lineages such as the strategy literature and the regional development literature that share common roots in ecological systems thinking, providing novel insights into the interdependence of actors in a particular community to create new value (Acs et al. 2017). Moreover, the entrepreneurial ecosystem is a kind of systemic approach to entrepreneurship that offers a new path for scholars and policy makers to expand the understanding of entrepreneurship (Brown and Mason 2017). In addition, Malecki (2018) outlines that the usage of the concept entrepreneurial ecosystem has overtaken other terms, such as environments for entrepreneurship, which also highlight the mechanisms, institutions, networks, and cultures that support entrepreneurs. Finally, Brown and Mason (2017) argue that entrepreneurial ecosystem is a highly variegated, multi-actor and multi-scalar phenomenon, requiring bespoke policy interventions and its lack of specification and conceptual limitations has hindered the understanding of these complex organisms.

Furthermore, Theodoraki et al. (2018) state that entrepreneurial ecosystem has been studied from the university perspective, but it has not yet been introduced in deep in the entrepreneurial support field. In this regard, training in entrepreneurial capacity in universities has had a remarkable and gradual evolution over time (Audretsch and Link 2017; Hayter et al. 2018; Neck and Greene 2011) because of the growing interest in everything related to courses in and programs on entrepreneurship (Hindle 2007; Truell et al. 1998; Wright et al. 2017). Interest in this field has intensified due to the impact generated by entrepreneurs in the economic sphere, particularly their actions in the business world (Donckels 1991; Kuratko 2005; Wright 2014). Besides, the growing number of university business incubators has led to increasing research interest in the entrepreneurial support field (Rodríguez-López and Souto 2019; Theodoraki et al. 2018).

Despite the above, training in entrepreneurship remains an issue that requires more detailed attention (Mason and Siqueira 2014; Shane and Venkataraman 2000; Solomon et al. 2002). Training programs are designed to foster entrepreneurship and thereby stimulate new venture development (Marzocchi et al. 2018; Tounés et al. 2014). In this regard, Kuratko (2005) and Mueller and Thomas (2001) recognize that studies on the manner in which entrepreneurship training is imparted represents an important gap in the entrepreneurship literature, despite the crucial role of training in entrepreneurship. Lastly, the analysis of the effects of training in different capacities and entrepreneurial capacity is relevant and worth attention, since the academic literature up to now has not been able to establish what essential elements are required to guarantee a significant positive impact of entrepreneurship training.

The aim of this research is to analyze entrepreneurship training, from the perspective of the relationships existing in the training of capacities and their impact

on entrepreneurial capacity. In particular, it seeks to examine the impact of specific training oriented towards achieving certain ethical capacity or innovation capacity on training in entrepreneurial capacity. This paper is organized as follows: after this introduction, in the second section, we review the previous academic literature on training in innovation, business ethics and entrepreneurship and we formulate hypothesis. In the third section, we describe materials and methods; that is, data collection, sample, variables and data analysis. In the fourth section, we outline the results obtained from the empirical analysis by using ordinal logistic and multinomial logistic regressions. The article ends with discussion and final conclusions.

## 2 Theoretical framework and hypothesis

### 2.1 Innovation and entrepreneurship training

*First*, we can define innovation as any change that introduces a novelty or several of them to the business sphere. But, in fact, it is the capacity to create and implement a new idea (for example: about product, service, or business) successfully in the market, and to profit from such idea, due to its successful use (Fagerberg et al. 2005; Meissner et al. 2017). Moreover, we can also say that innovation is configured as a "secondary process" in which the primary process of creativity is applied to the creation of a new procedure, product or service (Carayannis et al. 2017; Farr et al. 2003) while entrepreneurship is a tertiary psychological process, whose ultimate goal is the implementation of a business venture or operating system of the innovation already developed. So, we can argue that training in innovation and entrepreneurship are processes that can be analyzed separately (as well as the capacities resulting therefrom), despite the relationships that may exist between both.

*Second*, training in innovation involves a process based on a transverse or specific curriculum model focused on innovation and entrepreneurship (Thursby et al. 2009). Thus, training in innovation requires strategies and teaching approaches that are based on students' active learning (Bonwell and Eison 1991), the completion of case studies, analysis of the relationship between concepts, promoting dialogue and critical thinking (Smith et al. 2003) and the appropriate use of information technology and communications (European Commission 2005).

*Third*, the academic literature on innovation training (Baumol 2006; Hall et al. 1975) and entrepreneurship (Brockhaus et al. 2001; Greene et al. 2004) is broad and diverse, from authors like Baum et al. (2001), which focus on the analysis of the study of personality factors as an engine of innovation and entrepreneurship, through the study of entrepreneurial optimism by Hmieleski and Baron (2009), or the analysis of the important impact of contextual factors on innovation and entrepreneurship (Aldrich and Martinez 2001; Kodithuwakku and Rosa 2002). Other authors such as Rauch et al. (2009) analyze the strategies of innovation and entrepreneurship, as well as their relationship with the planning of competitive advantages.

*Lastly*, Zhao (2005) highlights the relationships between innovation and entrepreneurship capacities, seeking to develop an integrated framework of interaction between entrepreneurship and innovation, and analyzing the factors that enhance

and stimulate such interaction. This research finds that entrepreneurship and innovation are positively correlated and interact to help an organization thrive, since the entrepreneurial spirit and innovation are complementary, with organizational culture and management style being the two crucial factors affecting the development of entrepreneurial behavior and innovation. Similarly, a combination of both is essential to achieve business success and sustainability in a highly dynamic business environment such as the current one. In addition, this work shows that both the entrepreneurial spirit and capacity for innovation should be considered as a continuous and daily practice, forming part of a comprehensive and dynamic process of economic business units.

**Hypothesis 1** *Training in innovation has a positive effect on training in entrepreneurship.*

### 2.2 Business ethics and entrepreneurship training

*First*, there is academic literature focused on analyzing the ethical problems and tensions that can arise during the development of the entrepreneurial process (Dunham 2010; Fisscher et al. 2005; Hannafey 2003) and the importance of ethical commitment capacity on the entrepreneurial practice and initiative (Buchholz and Rosenthal 2005; Clarke and Holt 2010; Morris et al. 2002). Furthermore, Teal and Carroll (1999) focused on empirically analyzing whether entrepreneurs use cognitive reasoning processes that reflect a higher level of moral development than that observed in the general adult population. The results of this work suggest that entrepreneurs may show certain capacities or skills related to moral reasoning, that are slightly higher than that of middle managers or the average general level of the adult population. Similarly, Chau and Siu (2000) attempted to design and build a model of ethical decision-making for corporate business organizations and Cordeiro (2011) explored ethical decision-making by entrepreneurs, analyzing business practices and their context, with the ultimate goal of making recommendations to them about ethical decision-making. Lastly, Bucar et al. (2003) developed an integrative theoretical framework for the study of cultural differences in the ethical attitudes of entrepreneurs, revealing that social, cultural and economic norms can predict the level of ethical attitudes among the different societal groups researched.

*Second*, Von Weltzien (2009) highlights the importance, in the training of business students, of using literature, plays and novels to illustrate the ethical norms and moral values that students will have to manage in their future careers, since, for this author, literary texts provide excellent descriptions of the circumstances and ethical dilemmas that may be encountered by students in the future, when they are professionals within their respective business organizations. Moreover, Pohling et al. (2015) analyze the role and influence of affective empathy and personal ethical values comprising the "ethical commitment" in a sample of 366 German students, with a high positive correlation in the results obtained in that study. Meanwhile, Desplaces et al. (2007) outline how the ethical codes transmitted in college and the perception that students have of them, influence their understanding of the ethical

nature of those institutions and the specific moral development of students, underscoring the importance of this environment for the development of their "business ethics".

*Finally*, Jiménez and Palmero (2007) discuss the importance of ethics training, under the new educational framework established in the European Higher Education Area (EHEA). In addition, they address the crucial role that universities should play in this respect, to ensure that individuals achieve and improve these capacities. Ultimately, Bacigalupo et al. (2016) assess the consequences of ideas that bring value and the effect of entrepreneurial action on the target community, highlighting—as a possible proposition—the positive relationship by ethical thinking´s training on training in entrepreneurship.

**Hypothesis 2** *Training in business ethics has a positive effect on training in entrepreneurship.*

### 2.3 Entrepreneurship: training stages

*First*, the number of textbooks focused on entrepreneurial training has increased in recent decades (Driscoll and Tesfayohannes 2009; Mason and Siqueira 2014). Thus, Rideout and Gray (2013), Souitaris et al. (2007) and Weber (2012) analyzed the influence of courses on entrepreneurship training, particularly in relation to the creation of new companies and business opportunities. Moreover, special mention should be made of the studies on the state of entrepreneurship training in USA, made by Solomon et al. (2002) or those developed by Sobel and King (2008) that analyze the positive influence of entrepreneurship training, teachers' attitudes and the creation of an entrepreneurial school environment on youth entrepreneurship rates in US counties. Similarly, Falck and Woessmann (2013) investigated the effect of training in privately run schools in different countries, on the entrepreneurial intentions of students and the creation of their entrepreneurship spirit. In addition, Edelman et al. (2008) analyzed the correspondence between emerging business practices developed by novice entrepreneurs and the standards, advice and recommendations provided in the manuals and textbooks on entrepreneurship directed towards achieving business success.

*Second*, Mason and Siqueira (2014) researched 57 textbooks on entrepreneurial training and their conclusion is that the vast majority of textbooks provide important coverage of business issues such the nature of entrepreneurship, business plans, financing, marketing and case studies. However, most textbooks analyzed by the authors provide very little coverage of topics such as sales, family business, women and minorities, and issues related to *ethics* and sustainability in the business environment. Obviously, the problem lies not only in the issues addressed in entrepreneurship manuals, but also in the absence of adequate connection with other disciplines such as *innovation* or *ethics*. Furthermore, Driscoll and Tesfayohannes (2009) analyzed 16 manuals for training in business ethics, seeking to assess to what extent the SME principles, ethics and entrepreneurship appear in these texts. This study suggests that the analyzed texts have little or no coverage of *ethical issues* that are

relevant to small businesses and their relationship with entrepreneurship. This corroborates that the textbooks analyzed do not cover certain topics, especially in cross-disciplinary areas.

*Third*, to the degree that a student receives more training in a specific subject, it seems reasonable that their knowledge and skills would improve as they advance in their training process (Ronstadt 1987), so it is possible to deduce that, at the different stages of training pursued by individuals seeking to enhance their capacities, the content varies and even the relationships or links between the knowledge and skills encompassed in the training may be different (OECD 2013; RezaeiZadeh et al. 2017).

In this regard, Bacigalupo et al. (2016, p. 14) set up an entrepreneurship training progression model that "provides a reference for the development of proficiency starting from value creation achieved through external support, up to transformative value creation. It consists of four main levels: Foundation, Intermediate, Advanced and Expert. Each level is in turn split into two sub-levels. At Foundation level, entrepreneurial value is created with external support. At Intermediate level, entrepreneurial value is created with increasing autonomy. At Advanced level, responsibility to transform ideas into action is developed. At Expert level, the value created has considerable impact in its reference domain. The model aims to be comprehensive and to offer a tool that can be adapted to different needs". Additionally, Bacigalupo et al. (2016) argue that entrepreneurship training progression model does not lay down a linear sequence of steps that individuals must take to become proficiently entrepreneurial or to successfully start a venture. This research shows that the boundaries of individual and collective entrepreneurship capacities can be pushed forward in the different stages or levels that integrate entrepreneurship training in order to achieve greater and greater impact through value creating endeavors.

*Finally*, according to RezaeiZadeh et al. (2017), there has been a lack of consensus in regard to the perceived relative importance of entrepreneurship capacities and their interrelationships among students, academic and entrepreneurs. In fact, relationships (between knowledge and capacities) are not the same throughout each training stage—as for example: basic, medium or advanced—, because the requirements, contents, implications and effects required for this will be different depending on the training level attained (Novak and Gowin 1984; Ros 2005). Thereby, the training is not the same as more advanced students receive higher levels of training, because the coursework is more complex as they progress in a particular field (OECD 2013). In this respect, as the process of training in entrepreneurship is configured as progressive, complex and diverse (Bacigalupo et al. 2016; Gorman, et al. 1997; Kuratko 2005; Ronstadt 1987), the third hypothesis seeks to extend the previous results of the first two hypotheses, referring to the evolution in the effects of training in ethics and innovation on entrepreneurship at every level of training; that is, a deeper analysis that reveals differences as the training undertaken seeks to impart a greater capacity in the areas examined.

**Hypothesis 3** *The effect of training in innovation and business ethics on training in entrepreneurship is different throughout the various training stages and is incremental.*

## 3 Materials and methods

### 3.1 Sample

Data was collected at the end of 2016 in different Spanish universities. The sample includes 469 individuals interested in starting a new venture: all of them have an original and/or innovative business idea and are involved in the entrepreneurship process in the stage of creating the business plan or in the stage immediately after the creation of the business plan. The respondents participated voluntarily and anonymously. A common method bias was addressed following the recommendations of Podsakoff et al. (2003) on the questionnaire design including psychological separation of predictor and criterion variables and response anonymity. Furthermore, taking the lead from Podsakoff and Organ (1986), a principal factor analysis on the questionnaire measurement items was carried out, without a single factor emerging. Therefore, common method bias is not a serious problem. In addition, the content of the questionnaire was explained to the participants. The characteristics of the sample are summarized in the Table 1.

### 3.2 Variables measurement

Entrepreneurial capacity is to have the knowledge to be able to create a new venture, confronting uncertainties and assuming the risks inherent to such activity. Entrepreneurial capacity is the result of specific training in entrepreneurship (Hindle and Yencken 2004; Katz 2008; Martin et al. 2013); in our research, as the respondents do not have previous experience in the creation of a company in any way, entrepreneurial capacity is derived completely from the specific training received in entrepreneurship. Thus, training in entrepreneurship is measured by the entrepreneurial capacity resulting from training—as a measure of training outcomes; that is, the respondents detailed their entrepreneurial capacity in relation to the training

**Table 1** Sample characteristics

| | |
|---|---|
| Age | |
| Mean (S.D.) | 23.47 (1.42) |
| Minimum | 22 |
| Maximum | 31 |
| Gender | |
| Female | 236 (50.3%) |
| Male | 233 (49.7%) |
| Studies | |
| Economics and business management | 147 (31.3%) |
| Social sciences (except economics and business management) | 62 (13.2%) |
| Engineering | 123 (26.2%) |
| Sciences (except health sciences) | 106 (22.6%) |
| Health sciences | 31 (6.6%) |

received that relates exclusively entrepreneurship—, using a Likert scale of 5 points, from very low (1) to very high (5).

The training related to innovation is key for achieving innovation capacity (Audretsch and Lehmann 2005; Hjalager 2002; Santamaría et al. 2009). Hence, training in innovation is outlined through the innovation capacity resulting from training—as a measure of training outcomes—, measured by the respondent's assessment of his/her innovation capacity in relation to the training received in innovation, using a Likert-5 points scale, from very low (1) to very high (5).

Brady and Hart (2007) highlight that responsibilities and commitments with ethical background show the ethical capacity of individuals. In other words, ethical commitment and ethical responsibility are descriptors of morally ethical behavior. Ethically correct actions and decisions require both good ethical judgment and ethical responsibilities that cannot be evaded (Nyberg 2008). Also, training is essential for the development of ethical capacity (Brady and Hart 2007). Thereby, training in business ethics is measured using a Likert-5 points scale, from very low (1) to very high (5), as the ethical capacity of each respondent in relation to the responsibility and commitment to ethics in the business and economic sphere, fruit of the training received—as a measure of training outcomes.

Training in entrepreneurship is the dependent variable, and training in innovation and training in business ethics are independent variables (Table 2).

The control variables are age, gender (Forbes 2005; Greve and Salaff 2003; Mueller and Thomas 2001; Sobel and King 2008), and studies (Rideout and Gray 2013). The age is measured by the respondents' age in years. Gender is a dichotomous variable with "1" representing male and "0" representing female. The studies is measured as "1" for social sciences (except economics and business management), "2" for economics and business management, "3" for engineering, "4" for sciences (except health sciences), and "5" for health sciences.

### 3.3 Data analysis

The data was analyzed using a logit model, since the dependent variable is categorical. The first and second hypotheses were tested using ordinal logistic regression, and according to Martínez-Román and Romero (2013), a multinomial logistic regression was used to confirm the results for the first two hypotheses. In addition, the multinomial regression was used to test the third hypothesis, allowing discrimination by categories. This enables a disaggregated analysis of training in entrepreneurship; i.e., a more detailed analysis of the effects of each of the stages of training in entrepreneurship. Thus, multinomial logistic regression extends the analysis, as it

**Table 2** Variables features

| | Mean | S.D. |
|---|---|---|
| Training in entrepreneurship | 3.73 | 1.062 |
| Training in innovation | 3.69 | 1.057 |
| Training in business ethics | 3.66 | 1.056 |

**Table 3** Variance inflation factor of independent variables

| | VIF |
|---|---|
| Training in innovation | 1.134 |
| Training in business ethics | 1.095 |
| Age | 1.117 |
| Gender | 1.035 |
| Studies | 1.041 |

**Table 4** Spearman correlation matrix

| | (1) | (2) | (3) |
|---|---|---|---|
| (1) Training in entrepreneurship | 1 | | |
| (2) Training in innovation | 0.56*** | 1 | |
| (3) Training in business ethics | 0.39*** | 0.23*** | 1 |

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

breaks the regression up into a series of binary regressions comparing each category to a baseline—the referent category is very low (1).

Because multicollinearity affects the estimation of coefficients, the reliability of the model requires the absence of multicollinearity problems. The variance inflation factor (VIF) is calculated to detect multi-collinearity among independent variables. Field (2009) and Kremelberg (2011) recommended a threshold of VIF of 10. The Table 3 shows that the model's VIFs values are below 1.15, considerably far from 10. Consequently, multicollinearity is not a concern. The statistical software used was SPSS 15.0 (Table 4).

## 4 Findings

Two ordinal logistic regression models were estimated; the first one without control variables and the second with control variables (Table 5). The model is a good fit because the Chi-square of likelihood test is 227.15 in model 1 and 333.83 in model 2, both significant at $p < 0.001$. This means that the final model explains a significant amount of the original variability. Pearson and Deviance statistics are not significant ($p > 0.1$), meaning that the predicted values are not significantly different from the observed values—well-fitting models $R^2$ of Nagelkerke is 0.42 and 0.55 in each model; the second model is 0.13 higher than the first model. Therefore, both models have a good overall fit, although the second model has a better fit.

Training in innovation and training in business ethics have a significant ($p < 0.001$) positive effect on training in entrepreneurship in the two models, supporting hypothesis 1 and 2. Nonetheless, the logit coefficients of these variables are around 0.1 lower in the second model than in the first model; that is, the changes are really small. The differences between the models are due to the fact that age and studies have a significant effect on entrepreneurial capacity resulting from entrepreneurship

**Table 5** Ordinal logistic regression

| Independent variables | Model 1 Coefficient | Model 2 Coefficient |
|---|---|---|
| Dependent variable: training in entrepreneurship | | |
| Training in innovation | 1.15*** | 1.05*** |
| Training in business ethics | 0.63*** | 0.52*** |
| Age | | 0.38*** |
| Gender | | 0.08 |
| Studies | | |
| Social Sciences (except economics and business management) | | − 1.62*** |
| Economics and business management | | 0.6 |
| Engineering | | 1.31** |
| Sciences (except health sciences) | | 0.59 |
| Health sciences | | 0 (a) |
| Model statistics | | |
| Model Chi-square | 227.15*** | 333.83*** |
| − 2 log likelihood | 244.41 | 797.38 |
| $R^2$ of Nagelkerke | 0.42 | 0.55 |

*(a)* reference category

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

training. Gender is not significant at $p > 0.1$. The reference category in the discipline variable is health sciences; so engineering—compared to health sciences—has a significant positive effect on entrepreneurship training ($p < 0.01$), and studies in social sciences (except economics and business management)—compared to health sciences—has a significant negative effect on entrepreneurship training ($p < 0.001$).

The Brant test or test of parallel lines (with $p < 0.01$) details that parallel lines assumption has been violated, suggesting that the explanatory variables seem to influence in a different way when comparing the categories of the dependent variable. Two multinomial logistic regression models were estimated, one without control variables and the other one with control variables, in order to confirm the results about the first two hypotheses and to test hypothesis 3. Table 6 shows the results for the two multinomial logistic regression models. $\chi^2$-based likelihood ratio (LR) test is much better in model 2, although in both models the Chi-square test is significant at $p < 0.001$. $R^2$ of Nagelkerke is also considerably better in the second model, 0.42 in model 1 and 0.61 in model 2. Hence, the two models fit well, although the second model is a much better fit; the control variables improve the model without changing the sign and the significance of other coefficients.

The first model improves slightly with the multinomial logistic regression and the second model undergoes a significant improvement with multinomial logistic regression.

The predictors of training in innovation and training in business ethics are very similar between Model 1 and Model 2. In both models, training in innovation and in business ethics are not significant only in the entrepreneurship training stage

**Table 6** Multinomial logistic regression

| Independent variables | Model 1<br>Coefficient | Model 2<br>Coefficient |
|---|---|---|
| Dependent variable: training in entrepreneurship | | |
| *Very low vs low* | | |
| Constant | − 1.45 | − 22.38* |
| Training in innovation | 0.36 | 0.35 |
| Training in business ethics | 0.59 | 0.59 |
| Age | | 0.09 |
| Gender | | 0.99 |
| Studies | | |
| Social sciences (except economics and business management) | | 18.22*** |
| Economics and business management | | 18.76*** |
| Engineering | | 17.57 (b) |
| Sciences (except health sciences) | | 18.82 (b) |
| Health sciences | | 0 (a) |
| *Very low vs medium* | | |
| Constant | − 4.52** | − 26.85* |
| Training in innovation | 1.25** | 1.11** |
| Training in business ethics | 1.13*** | 1.17** |
| Age | | 0.94* |
| Gender | | 1.05 |
| Studies | | |
| Social sciences (except economics and business management) | | − 0.23 |
| Economics and business management | | 1.19 |
| Engineering | | 16.36*** |
| Sciences (except health sciences) | | 0.83 |
| Health sciences | | 0 (a) |
| *Very low vs high* | | |
| Constant | − 7.44*** | − 32.03** |
| Training in innovation | 1.78*** | 1.73*** |
| Training in business ethics | 1.44*** | 1.39*** |
| Age | | 1.04* |
| Gender | | 0.74 |
| Studies | | |
| Social sciences (except economics and business management) | | − 3.02* |
| Economics and business management | | 1.57 |
| Engineering | | 17.8*** |
| Sciences (except health sciences) | | 0.83 |
| Health sciences | | 0 (a) |
| *Very low vs very high* | | |
| Constant | − 13.23*** | − 47.02*** |
| Training in innovation | 2.73*** | 2.63*** |
| Training in business ethics | 1.89*** | 1.77*** |

**Table 6** (continued)

| Independent variables | Model 1 Coefficient | Model 2 Coefficient |
|---|---|---|
| Age | | 1.4** |
| Gender | | 0.96 |
| Studies | | |
| Social sciences (except economics and business management) | | − 2.76 |
| Economics and business management | | 2.5 |
| Engineering | | 18.76 (b) |
| Sciences (except health sciences) | | 2.37 |
| Health sciences | | 0 (a) |
| *Model statistics* | | |
| Model Chi-square | 232.08*** | 386.35*** |
| − 2 log likelihood | 239.49 | 744.86 |
| $R^2$ of Nagelkerke | 0.42 | 0.61 |
| Correct classification % | 48.6 | 58.2 |

*(a)* reference category, *(b)* lost value for the system

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

related to a low entrepreneurial capacity—versus very low entrepreneurial capacity. In other words, training in business ethics and in innovation has a significant positive effect throughout all stages of entrepreneurship training, with the exception of the initial stage in which low entrepreneurial capacity requires specific training exclusively in entrepreneurship. This confirms that hypothesis 1 and hypothesis 2 are not rejected, although with the introduction of an exception in the initial training in entrepreneurship.

Another issue is the substantial increase in the impact of training in innovation and training in business ethics along the different stages of training in entrepreneurship, especially training in innovation. It is notable that the impact of training in innovation and training in business ethics is greater, as the entrepreneurial capacity—the outcome of training—increases. Thus, the predictors of training in innovation and training in business ethics are different along the different entrepreneurship training stages, in other words, the effects of independent variables are not the same for different categories of the dependent variable. Specifically, in the low level of training category, the effects are not significant while in the others categories the effects are significant. This supports hypothesis 3.

Age also has a significant positive effect on training in entrepreneurship, at all stages of training excepting the initial (low level of training, versus very low level of training), with a predictor which increases with the level of training in entrepreneurship.

In addition, in the stage of low training, social sciences studies (except economics and business management)—compared to health sciences—and economics and business management studies—compared to health sciences—are significant with a very high effect, especially in economics and business management studies.

Engineering studies—compared to health sciences—has a significant positive effect on medium level and high level—versus very low level—of training in entrepreneurship, with a very high effect social sciences studies (except economics and business management)—compared to health sciences—has a significant negative effect on high level—versus very low level—of training in entrepreneurship.

Gender is not significant in the two multinomial logistic regression models, just as in the two ordinal logistic regression models.

## 5 Discussion and conclusions

*First*, we noted divergences in academic literature regarding the magnitude and effect of entrepreneurship training on entrepreneurial capacity. In this regard, Oosterbeek et al. (2010) and Von Graevenitz et al. (2010) focus on analyzing the positive impact of entrepreneurship training programs on the generation of entrepreneurial capacity among Dutch and German university students, respectively. Thus, these works conclude that the correlations analyzed did not have the expected positive results, which were virtually non-existent. In addition, Karlan and Valdivia (2011) found similar evidences for the Latin American case, limiting the importance and effects of entrepreneurial training in the field analyzed.

In contrast, other authors such as Rideout and Gray (2013), Souitaris et al. (2007) and Weber (2012) reveal that programs and business training courses significantly increase the probability that participants start a business or even expand, where appropriate, existing businesses. Thereby, one possible cause for these divergences in literature may be the results obtained in this work. This makes the effects identified in this research a critical factor in the training of entrepreneurs. Furthermore, the absence of these effects may be a possible cause for training's inability to increase the entrepreneurial capacity of individuals. This underscores that the results obtained in our research are not a trivial issue for entrepreneurship, but rather a key aspect, which must be very present in the training of the entrepreneur, because otherwise, the training may fail in its attempt to provide entrepreneurial capacity, especially at the highest training levels.

*Second*, unlike with our findings, several authors state that a researcher or technologist (without entrepreneurship training and experience) that is able to develop a new technology or innovation, is often not well-suited to drive forward a new company (Hindle and Yencken 2004; Samsom and Gurdon 1993). Likewise, Stuart and Abetti (1990) and Lazear (2004) disagree with the premise that training in innovation fosters entrepreneurial capacity, since they argue that most entrepreneurs are not technical people—and have no particular expertise—, and they create their business in areas that do not require excessive technical knowledge.

Despite the above, in line with Hindle and Yencken (2004) and Katz (2008), our research highlights that the entrepreneur needs to have the necessary training to innovate and create new knowledge and new technologies. This knowledge background is the result of the entrepreneur's training in a discipline, which in turn has to have links with the target market. Additionally, these authors also stand out the value of management training. Therefore, the results obtained in this research with

respect to individuals' studies, highlight the need to teach all the subjects with a focus on their implementation, emphasizing possible links with the market. In regard to entrepreneurship, the increasing complexity of markets requires a combination of knowledge and capacities, and puts even more pressure on the entrepreneurial team to assemble specialists with knowledge from different disciplines. This is a task that rarely occurs in the context of training. Nevertheless, in universities all the necessary ingredients are in play, although they all tend to be isolated from each other. In this respect, we note that it would be highly enriching to bring together individuals from different fields to work together, for example on the Final Year Project. In our view, a more multi-disciplinary orientation involving individuals from different fields, who can provide complementary capacities when embarking on an entrepreneurial activity, would probably give a major boost to the new venture.

In this regard, our results highlight the need to bring individuals closer to innovation in order to train them as innovators. Also, innovation should not be a hub just for teaching engineering, but for all students from all disciplines, because innovation is not only a task for engineers, nor should it be sequestered in a single discipline or area. As Chesbrough (2003) noted, all members of an organization should be involved in achieving innovations. Lastly, in line with our result, Spithoven et al. (2011) and Zhao (2005) emphasize the importance of training in innovation to stimulate entrepreneurship capacity. In addition, Hindle and Yencken (2004) also highlight the value of postgraduate and undergraduate training in entrepreneurship and/or technology management. Both are important, but it is worth underscoring that economics and management students do not receive technology or innovation management training.

Furthermore, in line with Beltramini et al. (1984), Kuratko and Goldsby (2004) and Morris et al. (2002), our research highlight the importance of a proper ethical training, which integrates and provides reasonable and mandatory guidelines and moral values, in the context of entrepreneurship training programs. However, Weaver et al. (1999) showed that there is a significant training gap in this area -on the training and corporate level in the business environment-, although such training in business ethics can be effective for the recipients (Driscoll et al. 1998; Weber 1990). Therefore, in line with Bacigalupo et al. (2016), Buchholz and Rosenthal (2005) and Clarke and Holt (2010), our findings show the importance of ethical commitment capacity on the entrepreneurial practice and initiative, which would suggest that including training in business ethics in entrepreneurial training programs would help connect such training with entrepreneurship.

*Third*, in line with our results, several works have found that an entrepreneur's age may have a positive influence on entrepreneurial capacity (Cooper et al. 1994; Westhead et al. 2001), though other studies did not find a significant relationship between these two factors (Stuart and Abetti 1990; Tulgan 1999). These latter studies show that these results are the outcome of the accumulation of experience and training relating to entrepreneurship and the knowledge of new ventures' markets and customers; that is, not all the experience and training accumulated over the years is important to increase the entrepreneurial capacity. Otherwise, unlike with our findings, authors such us Carter and Rosa (1998) note that female entrepreneurs generally have fewer opportunities to develop adequate business experience,

have fewer business contacts and networks, and have greater difficulty in accessing financial resources such as bank loans. Furthermore, Cooper et al. (1994) argue that even though women-owned firms are as likely to survive as those run by men, they are less prone to the growth and internationalization than those run by men. Additionally, there is empirical evidence that the number of male entrepreneurs is higher than female entrepreneurs, despite the growth in female entrepreneurship in the last decade (Bosma and Levie 2010). However, according to our results, gender does not play a significant role in terms of entrepreneurial capacity. In our view, this is because entrepreneurial training is the same for both genders and therefore entrepreneurial capacity resulting from such training is the same for both men and women. A separate issue is the fact that there may be differences between genders when undertaking the entrepreneurship activity (De Bruin et al. 2007; Westhead et al. 2001) but not in terms of the resulting entrepreneurial capacity resulting from training in entrepreneurship.

*Fourthly*, Stuart and Abetti (1990) argue that the best way to learn about topics of entrepreneurship is to work in a new company or participate in its creation. For these authors, the time spent in start-ups is much more valuable than time spent in college or in large and established companies. Despite this fact, other authors such as Cooper et al. (1994) suggest that entrepreneurial education enhances the knowledge, skills, problem solving ability, discipline, motivation and self-confidence of those embarking on entrepreneurial ventures. Therefore, in general, companies which are owned by founders who have obtained a university degree are more likely to survive and attain greater business success, since entrepreneurs with higher levels of education have better problem-solving skills than those without such educational backgrounds. In this regard, our findings appear to indicate educational differences in each of the disciplines analyzed. On the one hand, Engineering students stand out positively in terms of their capacity for entrepreneurship. This is because, probably, throughout their training, the focus on improving their analysis and problem solving skills is more intense than in other disciplines. Furthermore, the technical knowledge imparted by the discipline itself, may also be an important factors in this respect. Meanwhile, Social Sciences students (excluding economics and business management) stand out negatively in terms of their entrepreneurial capacity, which may indicate a lack of attention to the connection between the knowledge imparted and entrepreneurship. In addition, they may lack the capacity to analyze and trouble shoot and the knowledge techniques of the discipline itself may be less impactful. Third, studying Business Management or Economics has a moderate impact on boosting the entrepreneurial capacity of students. In line with our results, this seems to suggest that specific training in entrepreneurship is enhanced by training in innovation and in business ethics.

*Finally*, this research also reveals that entrepreneurial capacity requires specific training that addresses issues about entrepreneurship, but also that individuals must be trained in other areas that reinforce their specific training in entrepreneurship, while properly relating to actual on-the-ground entrepreneurship, in order to generate effects between training in business ethics and innovation with entrepreneurship training. Likewise, despite of the fact that not all businesses are innovative or of a social nature, the existence of an impact or effect on the training of entrepreneurial

capacity indicates that the resulting entrepreneurial capacity is increased by the impact on the identification, development and exploitation of opportunity. Lastly, regarding the niches of social entrepreneurship and innovative entrepreneurship, the effects on training would be more symbiotic or synergistic, in which the training of capacities would reinforce each other, i.e., in the first case, entrepreneurial capacity and business ethics, and in the second case, entrepreneurial capacity and innovation capacity.

## Compliance with ethical standards

**Conflict of interest** The authors declared that they have no conflicts of interest.

**Ethical approval** This article does not contain any studies with human participants or animals performed by any of the authors.

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