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Entrepreneurial intention among engineering students: The role of entrepreneurship education

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ABSTRACT

Partly due to the current crisis and its high unemployment rates, the labor market increasingly requires multidisciplinary engineers with additional skills to their own. Engineering education therefore faces new challenges and these include equipping engineers with greater entrepreneurship. Although entrepreneurship education has consequently been integrated into the new engineering degrees, is this enough to boost entrepreneurship among engineers and on what does their level of entrepreneurship depend?

This research work aims to analyze the impact of entrepreneurial motivations on entrepreneurial intentions among future engineers and identify the role than entrepreneurship education plays in the development of the engineers' entrepreneurship. The results indicate that *the need for independence* is the key factor in the entrepreneurial intent of future engineers and confirm the positive contribution that entrepreneurship education has on their entrepreneurial intentions. Finally, recommendations are offered which could help the various agents involved increase the effectiveness of actions aimed at promoting firm creation in this area.

1. Introduction

The current economic crisis has resulted in alarmingly high unemployment figures in Spain, with a rate exceeding 25% of the general working population and over 20% among graduates (INE, 2014). In this context, one of the measures being considered by both the Spanish Employment Strategy 2012–2014 (BOE, 2011) and the Europe 2020 Strategy for Employment and Growth (European Commission, 2010) is to promote entrepreneurship development, the reason being that the importance for governments of strengthening entrepreneurship mainly lies in the spillover of benefits which generate entrepreneurship activities (Oosterbeek, van Praag, & Ijsselstein, 2010). Gómez-Grass, Mira-Solves, and Martínez-Mateo (2010) pin these benefits on the positive effect that venture creation has on four macroeconomic variables: growth, employment, development and innovation.

One of the missions of the 21st century University is therefore to encourage the social and economic development of its surroundings through venture creation training and entrepreneurship development; published work, however, offers conflicting opinions about whether or not entrepreneurship can be taught. Some researchers highlight the importance of motivation for running a business and therefore question whether teaching can enable this motivation to emerge (Colette, Hill, & Leitch, 2005); others, meanwhile, believe that this entrepreneurial motivation may be developed with specific entrepreneurship education (Souitaris, Zerbinati, & Al-Lahman, 2007).

According to the final report of the European Commission on the study of entrepreneurship in higher, non-university education, especially non-business studies, compiled by the expert group of the Directorate-General for Enterprise and Industry (European Commission, 2008: 67), the first of the final recommendations for action involves: "Creating a task force or steering group (including the Ministry of Education and other departments: Economy; Employment; Science and Research) to determine how entrepreneurship can be integrated into the education system across primary, secondary and higher education".

It has consequently been the European authorities themselves who have prioritized the integration of entrepreneurship education into primary, secondary and higher education. In this respect, Yemini and Haddad (2010) highlight the importance of this

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inclusive process in 21st century universities in order to become important engines of technological development and economic growth. However, the key to the success of this approach lies in developing entrepreneurship, the basis for the creation of new companies, which originates in an individual's personal motivation (Barba-Sánchez & Atienza-Sahuquillo, 2012).

In this context, various questions arise: What entrepreneurial intentions do university students have? Are they prepared to undertake a venture? What are the main motivational factors which attract or drive them in this respect? From this point of view, one of the main aims of this work is to analyze the impact of entrepreneurial motivations on entrepreneurial intentions among future engineers.

The second main aim of the paper is related to identify the role that entrepreneurship education plays in the development of the engineers' entrepreneurship, since this is one of the student profiles which is best suited to the development of new Technology-Based Companies (TBCs) which strengthen the current corporate fabric, mainly in the technological sector and innovation and therefore contribute to the creation of new jobs, thereby reducing the currently high unemployment rates (SCNEERC, 2006).

For this purpose, an empirical study was carried out among 423 engineering students following an optional course in the fields of business management and entrepreneurial skills. The outcomes of this research could be useful to policy makers to understand not only the pattern of relationships among intention antecedents, but also its implications for interventions and developing entrepreneurial intention.

The remainder of the paper contains five sections: a literature review section presenting a conceptual framework and reflecting on previous research to underpin the model and hypotheses; subsequently, we describe the purpose and hypothesis; a methodology section to explain the sample and measures used; after, the results are presented and discussed; Section 5 explains the conclusions and implications; and a final section to discuss limitations and future research.

2. Review of literature

The Global Entrepreneurship Monitor (GEM) study, meanwhile, demonstrates the importance that entrepreneurship has acquired, having become a basic tool, in the current context, for job creation and the generation of wealth, and highlighting the fact that growth and economic development are linked to entrepreneurship (Acs, Arenius, Hay, & Minniti, 2005; Gómez-Grass et al., 2010; Nabi, Holden, & Walmsley, 2010; Oosterbeek et al., 2010). In this respect, Thurik, Carree, van Stel, and Audretsch (2008) confirm the close relationship between self-employment and the reduction of unemployment rates, in general, and Rasmussen, Mosey, and Wright (2011) establish it more specifically for TBCs in times of economic recession.

There is, however, the important question of whether entrepreneurship can be encouraged through education. Moreover, the results of previous studies are inconsistent. Some of these studies reported a positive impact from entrepreneurship education (e.g., Block, Hoogerheide, & Thurik, 2013; Souitaris et al., 2007; Walter & Dohse, 2012), whereas others found evidence that the effects are statistically insignificant or even negative (e.g., Oosterbeek et al., 2010; von Graevenitz, Harhoff, & Weber, 2010).

Different researchers emphasize the difficulties of evaluating the benefits or importance of teaching entrepreneurship. Colette et al. (2005) point out that much of the entrepreneurial research to date has provided no empirical support for the affirmation that completion of formal entrepreneurial initiative and SME (Small and Medium Enterprises) management courses increases an individual's probability of starting a business. In accordance with this line of thought, Matlay (2005) adds that the real contribution that these courses have on entrepreneurial activity remains unclear. Various authors such as Barringer, Jones, and Neubaum (2005), Fayolle, Gailly, and Lassas-Clerc (2006), Mueller (2011) or Packham, Jones, Miller, Pickernell, and Thomas (2010) have corroborated the positive contribution that entrepreneurship education can have on its participants in terms of skills, knowhow and better entrepreneurial attitude. There is no agreement on what would constitute a suitable conceptual model for assessing the effects of entrepreneurial education. According to Martin, McNally, and Kay (2013), understanding entrepreneurial intentions will enable the definition of this conceptual model.

Entrepreneurial action can be understood as any innovative action that, through an organized system of human relationships and the combination of resources, is directed towards the achievement of a specific goal (Liao & Gartner, 2006). According to Rekha, Ramesh, and Jaya-Bharathi (2015), coupled with innovative action is creativity, since the entrepreneurial mindset cannot exist without it; the entrepreneur draws conclusions from reality, identifies a problem and creates, innovates and invents. It is not simply a matter of doing things well: it is necessary to add something new (Townsend, Busenitz, & Arthurs, 2010).

According to Haynie, Shepherd, Mosakowski, and Earley (2010), entrepreneurial activity has its cognitive origin in individual motivation, and is understood to be the detonating factor which sparks behavior and obtains energy to support and steer it towards its objective. In this regard, the decision to create a business involves two levels (Barba-Sánchez & Atienza-Sahuquillo, 2017): the rational level and the motivational level. The first level revolves around the objective reasons for this conduct, which are to be found in the environmental conditions which reinforce or hinder this behavior (Ajzen, 1991; Bandura, 1977). The second level refers to subjective reasons arising from decision-maker expectations, i.e. motivations.

In brief, the dominant models of entrepreneurial intentions are: Shapero and Sokol's Entrepreneurial Event model (SEE) (1982), the Psychological-Economic model (MEP), whose precursors were Bird (1988) and Davidsson (1995), and Ajzen's Theory of Planned Behavior model (TPB) (1991); although this last one is not actually a model of entrepreneurial intent it has gained a place among these models since it is the conceptual

Although an important part of literature on entrepreneurial intention has opted for SEE (Fitzsimmons & Douglas, 2011), for TPB (Izquierdo & Buelens, 2011) or for a combination of both models (Krueger, Reilly, & Carsrud, 2000), the empirical results obtained have highlighted the gap between these theoretical models and the entrepreneurship reality in many current contexts. Authors such as Autio, Keelyey, Klofsten, and Ulfstedt (1997), Athayde (2009) or Lee, Wong, Foo, and Leung (2011) have proposed economic-psychological methods, providing alternative explanations for the entrepreneurial phenomenon and for the key variables which stimulate entrepreneurial intention. Our work is therefore in keeping with the sphere of these by considering both personal factors specific to entrepreneurial potential and situational factors related to our socio-economic surroundings.

This study therefore aims to contribute to the current debate by examining the effectiveness of entrepreneurship education in Spain.

3. Purpose and hypothesis

Additionally, following UNESCO recommendations (2010), Spanish universities are showing a growing interest in job placement and the promotion of entrepreneurial culture, since these matters are increasingly becoming a more important criterion

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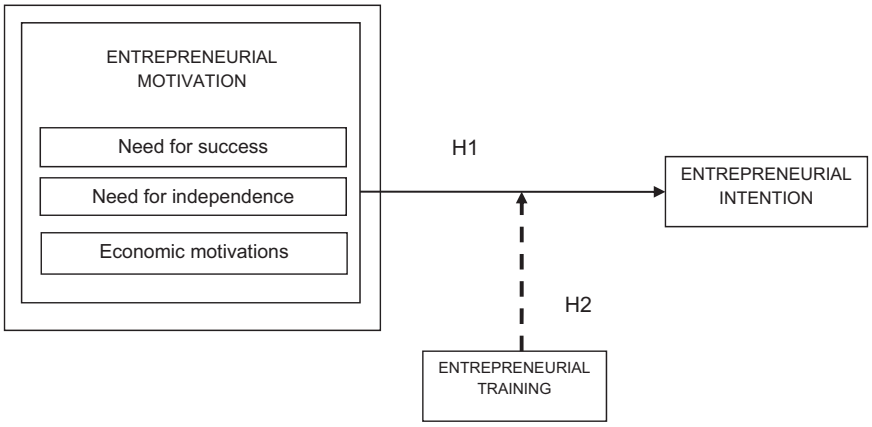

Fig. 1. Research model to explore.

Source: Adapted from Atienza-Sahuquillo and Barba-Sánchez (2012).

when a student chooses their university and studies and is also a demand of society in general.

Regarding the promotion of entrepreneurial culture and self-employment, this interest has resulted in various actions (Directorate-General for Small & Medium-sized Enterprises, 2010), such as the inclusion of a specific subject on venture creation in various study programs (Sardeshmukh & Smith-Nelson, 2011), the creation of self-employment support units (Crum & Chen, 2015) or the development of specific actions to encourage enterprise creation (Colette et al., 2005), such as business idea competitions, business incubators, encouragement and support for start-ups, etc. The problem is that these actions do not always have the intended result (Kuratko, 2005).

In this context, the aim of our research study is twofold: firstly, to analyze the entrepreneurial profile of university students, and more specifically engineering students, in order to identify the key motivations for "sparking" their entrepreneurial intent and searching for the possible relation between entrepreneurial motivation and their entrepreneurial intention; secondly, to establish the effect that the contribution of entrepreneurship education has on promoting entrepreneurship.

Fig. 1 presents the research model proposed in this paper, and summarizes the following objectives and hypotheses which are to be explored:

Hypothesis 1. The entrepreneurial motivations of engineering students directly affect their entrepreneurial intention.

Hypothesis 2. The entrepreneurship training of engineering students moderate the relationship between their entrepreneurial motivations and their entrepreneurial intention.

4. Methodology

4.1. Participants

The research was carried out at the University of Castilla-La Mancha's Degree Courses in Industrial Engineering and Computer Engineering in the Spain. There were two main reasons for the selection of engineering students (UNESCO, 2010): firstly, because there is an important shortfall of engineers around the world, and secondly, because the study of their attitudes and behavior is particularly important in the knowledge-based economy, and, as a result, in TBCs.

In addition, some authors such as Liñán and Chen (2009) defend the use of student samples in research into entrepreneurial intentions since they make it possible to work with individuals currently involved in real career-choice processes, and facilitate examination of the psychological processes prior to new venture creation as an alternative to working for somebody else.

Concretely, participants in this study were 423 engineering students (219 industrial engineering students and 204 computer engineering students) who are at the end of their Degree trajectory. All enrolled students were invited to participate, and none refused to take part in the survey. Among the students who participated, 64.7% followed an optional course in the fields of business management and entrepreneurial skills as part of their professional development, and 35.3% had not received any entrepreneurship education at all prior to the study.

The demographical characteristics of this sample are summarized in Annex 1: mostly young males, with no professional experience or dependents, although with some family entrepreneurial background.

4.2. Instruments

As with any empirical work, it is important to consider how the proposed variables should be measured. Because of their nature, it has been necessary to adapt existing measurement scales, gathering the suggestions proposed by George (2011). The scale for measuring entrepreneurial motivation was adapted from Amabile's Work Preference Inventory (WPI) (Amabile, Hill, Hennessey, & Tighe, 1994), which was validated by Barba-Sánchez and Atienza-Sahuquillo (2012). The items were measured using a 5-point Likert-scale, ranging from 1 (strongly disagree) to 5 (strongly agree), were 3 is interpreted as a point of indifference. The reliability of the scale as indicated by Cronbach's Alpha should be higher than 0.6 (Table 1). Additionally, a principal component factor analysis has been conducted on this construct in order to reduce its size, and regression analysis to contrast the proposed hypotheses.

According to Jones and English (2004), we have proposed a mix of action-oriented teaching that encourages project-based learning. The methods most often employed are readings, class discussion, business plans, using cases of prestigious entrepreneurs, and inviting local entrepreneurs to give lectures. The entrepreneurial training has comprised of various independent modules directed to engineering undergraduates. They aim to increase university graduates' knowledge about entrepreneurship and encourage them to be job creators rather than job seekers. Thus, the entrepreneurial training was measured with a single item similar to the one used by Izquierdo and Buelens (2011). The item "number of active learning modules passed from our entrepreneurship-related course" was

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Table 1
Overview of the dependent and independent variables.

Variables/construct	# items	Scale	Cronbach's alpha
Entrepreneurial motivation	16	Adapted from Amabile et al. (1994) and validated by Barba-Sánchez and Atienza-Sahuquillo (2012)	0.847
Entrepreneurial training	1	Izquierdo and Buelens (2011)	–
Entrepreneurial intention	1	Block et al. (2013)	–

measured ranging from 1 representing "none of the modules" to 5 representing "all of the modules".

The entrepreneurial intention was measured with a single item, similar to the one used by Block et al. (2013). The item "respondents intend to become founders" was measured using a 5-point Likert-scale (coded as 1 = strongly disagree and 5 = strongly agree).

4.3. Data-gathering process

The necessary empirical evidence was obtained during the academic year 2013/14 by means of online student questionnaire. With this aim, a web page was designed that only these students could access by means of a password Thus, these students completed this online questionnaire, both at the start of the study to identify the starting situation in terms of their entrepreneurial motivation and intention, and also at the end of academic year in order to analyze and assess the incidence of this experience on entrepreneurial orientation and motivation. The entrepreneurial intentions is studied in two time periods as the students were asked about their future career choices before the entrepreneurial training begins and after it.

The questionnaire has been divided into three groups of questions: demographical characteristics (5 questions), entrepreneurial motivation (one question with 16 items), and entrepreneurial training and intention (2 questions). In total, 423 questionnaires were collected, of which 414 were suitable for analysis: 216 questionnaires from industrial engineering students and 198 from computer engineering students. The nine questionnaires that were left out were incomplete with regard to our target dependent variable.

5. Results analysis

The study results are presented and analyzed in two sections: the first section details the results of the descriptive comparison between future engineers gathered in the sample in terms of profile and entrepreneurial intention; the second section sets out the results relating to contrasting the proposed research model and the hypotheses on which it is based.

5.1. Entrepreneurial motivation and intention of industrial engineers versus computing engineers

In terms of entrepreneurial motivation, we can see that "Job satisfaction" is ranked first and "Achieve political and social power" last. Both groups are extremely similar in terms of how they rank the different items although there are certain small differences: for example, computer engineers consider it more important to "Develop professionally and personally" rather than "Cover my personal needs". In a similar way to what happened in job prospects, in motivation there is a higher level of agreement in terms of average values among industrial engineering students.

In terms of the question: Am I willing to create my own business when I finish studying? (Table 2), both the percentage and average score obtained by both groups is very similar although it is possible to observe a significant increase in entrepreneurial intent once they have received specific training on business creation and management, in keeping with the results obtained in previous studies, such as those by Izquierdo and Buelens (2011), Karimi, Biemans, Lans, Chizari, and Mulder (2016), Lans, Popov, Oganisjana, and Täks (2013), and Peterman and Kennedy (2003).

5.2. Effects of entrepreneurial motivation on intention to create a business

From the answers given by the engineering students comprising the sample, we have examined the latent dimensions summarizing the information contained in 16 items relating to business creation motivation using the principal components analysis (PCA) method. PCA explores underlying patterns of relationships between the entrepreneurial motivations, which generates new variables (factors) that are uncorrelated with one another and that avoid the multicolinearity problem in our regressions. The estimation of the multiple regression models requires the absence of multicollinearity between the variables. A descriptive analysis of the data and the correlation matrix are presented in Annex 1. Linear regression closely on a measure of linear association, as a Pearson's r and their associated p-values. Note also that all correlation coefficients are below 0.7. Thus, the absence of multicollinearity is concluded.

To apply the PCA method the correlation matrix of the variables involved was submitted to various tests to highlight data adequacy for this, as shown in Table 3. The KMO statistic is 0.739, a value higher than the recommended 0.50, and Bartlett's test is statistically significant at the $p < 0.001$ level.[1] These results show that the sample can be subjected to PCA in order to uncover the underlying patterns of the entrepreneurial motivations variables.

As Table 4 shows, from the factor analysis we obtain three factors with eigenvalues greater than or equal to the unit for the 16 items in total comprising the constructor on reasons for venture creation. These factors, which were extracted using the PCA method, together account for 61.792% of total variance. Additionally, the commonalities between variables and factors are also high (all of their values are greater than 0.5), which indicates that these explain a high percentage of their variability.

In Table 5, we show rotated factor matrix using the varimax normalization, which gathers the factor scores on which we establish the interpretation of factors resulting from the analysis.

- The first factor is highly saturated with the items "Be independent", "Feel satisfied with my job" and "Be my own boss" presenting saturations of over 0.7, highlighting the need for independence which is innate to any entrepreneur. This factor also presents high saturations in "Cover my personal needs", "Be successful professionally", "Gain social prestige" and "Have good work relations", which may be connected with the need to maintain both this personal and profession independence over time. In this regard, this factor may be called **Need for Independence**.
- The second factor focuses on the items "Have job stability" and "Be financially secure", with saturations of 0.812 and 0.791, respectively, thereby indicating that this represents the primary motivation of any human being: survival. High values are also

[1] According to Harper, Kim, and Mueller (1980) the KMO value should be higher than 0.50 and the chi-square value of Bartlett's test must be significant at the 0.5 level.

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Table 2
Entrepreneurial intention of engineering students.

	Ex-ant: before training			Ex-post: after training		
	Yes (%)	No (%)	Mean (σ)	Yes (%)	No (%)	Mean (σ)
Industrial (n = 216)	35.4	64.6	3.02 (0.933)	67.2	32.8	3.81 (0.893)
Computer (n = 198)	41.5	58.5	3.29 (0.845)	70.5	29.5	3.77 (0.868)

Table 3
KMO and Bartlett's test.

Kaiser–Meyer–Olkin measure of sampling adequacy	.739
Bartlett's test of sphericity	
Approx. Chi-square	410.877
Df	36
Sig.	.000

presented by the item "Earn a lot of money", and so this factor also reflects the classic motivation of money as a synonym for physical well-being. In our society, financial security is seen as a symbol of safety and a guarantee for an individual's good standard of living. In this regard, the variables "Achieve political and social power" and "Be socially accepted" also present values of over 0.5. Since this factor is identified with economic aspects, it can therefore be referred to as **Financial Motivation**.

- The third and final factor is related to the items "Be the best at everything I do and develop professionally and personally". "Be the best at everything I do and develop professionally and personally", both directly related with the need for success, are understood to be the individual's need to test their ability by setting themselves challenges and carrying out their daily activities even better. The components "Be able to change my environment and contribute to social well-being" also present high saturations, above 0.6, in relation to this factor, which highlights the previously mentioned need for achievement, since both suppose potential challenges to attain. This factor is therefore called **Need for Achievement**.

In order to see the causal link between the motivation factors and entrepreneurial intention of engineering students, a linear regression model has been performed (model 1), and the results are shown in Table 5. We can therefore see that both Financial motivation and the Need for independence directly and positively affect entrepreneurial intention, while Need for achievement is not significant. The results serve as our benchmark model. The average variance inflation factor (VIF) is below 10; in fact none of the variables exhibits a variance inflation factor larger than 2.46; thus, multicollinearity does not appear to be a problem, according to Burns and Burns (2008). The Durbin-Watson statistic (DW) from the regression characterizes the extent of first-order autocorrelation in the forecast errors. Still, the forecast errors from these models are not autocorrelated, with the DW between 1.5 and 2.5, suggesting that we are including the main explanatory variables. Finally, the F-value statistics test the overall significance of the regression model. This tests the full model against a model with no variables and with the estimate of the dependent variable being the mean of the values of the dependent variable. In this case, the p-value attained for F-value test was below 0.001. Thus, the regression models provide a consistent estimate for our sample (Hayes, 2013).

In order to analyze the moderator effect of entrepreneurial training and according to Hayes (2013), the previous regression analysis was repeated and this variable was added (model 2). It can be seen that the new variable is not significant; however, when we include it in the model, there is an improvement in the significance of the "Need for achievement" improves its significance.

Table 4
Rotated component matrix of motivation factors.[a,b]

	Component		
	Factor 1. Need independence	Factor 2. Financial motivation	Factor 3. Need achievement
Be the best at everything I do			.764
Develop professionally and personally			.633
Feel satisfied with my work	.753		
Cover my personal needs	.617		
Have good work relations	.525		
Be able to change my environment			.693
Achieve political and social power		.597	
Be professionally successful	.584		
Contribute to social well-being			.651
Gain social prestige	.546		
Earn a lot of money		.689	
Be independent	.756		
Be socially accepted		.564	
Be "the boss"	.721		
Have job stability		.812	
Be financially secure		.791	

R^2-adjusted = 61.792%. Extraction method: principal component analysis. Rotation method: Varimax with Kaiser normalization.

[a] Rotation converged in 6 iterations.

[b] Values are collected which are less than or equal to −0.5 and greater than or equal to 0.5.

6. Conclusions and implications

European socio-economic agents have reached the consensus that the development of entrepreneurship is key to escaping from the current economic recession (European Commission, 2008). In this context, the University must play an important role as a higher education institution which has the necessary infrastructure and knowhow for this. The results of this study therefore indicate the entrepreneurial profile of engineering students and confirm the positive effect that entrepreneurship education has on their intention to create a business, while at the same time helping the various public authorities to establish measures and strategies to maximize resource employment in this eagerness to promote entrepreneurship.

One first conclusion focuses on the entrepreneurial motivation of these students (Hypothesis 1). In this respect, both industrial engineers and computer engineers have a high need for achievement (with average values of over 4 points out of 5) and independence (with average values of around 4 points) which, according to specialist literature (e.g. Camuffo, Gerli, & Gubitta, 2012; Goethner, Obschonka, Silbereisen, & Cantner, 2012; Haynie et al., 2010), are key identifying features of successful entrepreneurs; when combined with the high percentage of students with entrepreneurial intention this seems to indicate that both variables were connected with this. However, regression analysis indicates that while the need for independence has a significant Beta which is higher than 0.5, the need for achievement has a

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Table 5
Regression analysis of the Entrepreneurial Intention Model.[a,b]

	Model 1		Model 2	
	B	T	B	T
Need for independence	0.564***	9.571	0.471***	4.992
Financial motivation	0.434***	6.189	.376**	3.685
Need for achievement	−0.012	−0.206	0.241*	2.010
Entrepreneurial training			−.067	−.573
R^2-adjusted	0.954		0.961	
D-W	1.790		1.932	
F-value	2012.132***		435.317***	

[a] Dependent variable: I am open to creating my own business when I finish studying.
[b] Standardized coefficients.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

non-significant, very low Beta. Together with the importance of economic motivations in the analysis, this may well indicate that the option of creating a business is seen as a way to gain independence and not rely financially on the family economy in view of the difficulty of finding a job in the current situation, in accordance with the results obtained by Lüthje and Franke (2003) or by von Graevenitz et al. (2010). Thus, the results obtained seen to validate our Hypothesis 1.

Secondly, a separate analysis of the two groups of students reveals that despite having a slightly less favorable motivational configuration, computer engineering students have greater entrepreneurial intentions than industrial engineering students. This may be explained by the moderator effects that entrepreneurial training on this relation. However, when this variable is included in the regression model, there is no significant improvement in the R^2.

The third conclusion focuses on the positive effect of entrepreneurship education (Hypothesis 2), thereby confirming the results obtained by Küttima, Kallastea, Venesaara, and Kiisb (2014), by Levie, Hart, and Anyadike-Danes (2009) or by Wu and Wu (2008). In this regard, it is apparent that there is an improvement in entrepreneurial intentions among engineering students, rising from 35.4% to 67.2% among industrial engineering students, and from 41.5% to 70.5% in the case of computer engineering students, thanks to this training. However, our study indicated that these programs of entrepreneurial training did not have significant impacts on students' intention towards entrepreneurship, in accordance with the results obtained by Karimi et al. (2016). Surprisingly, entrepreneurial training do not add to the explanatory power of the model; thus, Hypothesis 2 is not supported. Following Zhao, Seibert, and Hills (2005), one possible explanation is that formal learning from entrepreneurship-related courses has the strongest positive relationship with intentions through the mediation of entrepreneurial self-efficacy. Future research might assess whether different teaching methods and learning environments would have different effects on the outcomes and whether course educator differences such as skills or academic background would influence the outcomes. In conclusion, this research provides evidence that entrepreneurial training is effective, but the current form needs improvement.

Given these results and in order to foster entrepreneurship among engineering students, we propose the following training activities so that entrepreneurship may be incorporated as a further cross-sectional skill to be developed in the subjects of business management and entrepreneurial skills in engineering degrees:

- Motivate students in entrepreneurship through start-up exhibitions of successful entrepreneurs in the world of engineering. These role models represent a way of showing students an example of the validity of their project, so that they can envisage it realistically and believe that it can be carried out.
- Idea generation workshops, through workgroups, brainstorming, etc., for the development of innovative projects, so that they may be subsequently analyzed and the results discussed.
- Business plan creation workshop so that the plans may be presented in the classroom and academically assessed.
- Organization of inter-university business plan competitions, searching for financing from collaborating bodies, with the establishment of awards.

Finally, the message to transmit throughout entrepreneurial training might very well be: don't study, learn; don't work, create; don't sell, solve; don't wait, do it.

7. Limitations and future lines of research

Despite its contributions, this study is not without limitations which future research should bear in mind. Firstly, the use of a closed, structured questionnaire makes it impossible to explore in greater depth the nature of causal relations; something which is accentuated in cross-sectional studies. In addition, the sample only consists of engineering students from one university in Spain, so that the conclusions obtained cannot be generalized to other groups of students, particularly those who have opted for a degree in Business Administration and Management. Future research should use new and more diverse samples. We therefore call for further primary studies to contribute to these research areas so that more accurate conclusions can be drawn.

Furthermore, the methodology used, i.e. linear regression analysis, could be supplemented with other more suitable methodologies in order to highlight moderator effects. In this regard, future research can further explore moderator effects (both of students' professional expectations and their context perception) on the relationship between entrepreneurial motivation and business creation intent among different groups of students and possibly widening the diversity of the analyzed groups.

Finally, in terms of the entrepreneurial intention analysis, it might be possible to improve how this is measured by adding more items; using, for example, the Liñán and Chen scale (2009) which comprises six items, which would enable us to value the entire dimension of this entrepreneurial intention.

In brief, further and ongoing research is required to investigate the immediate and longitudinal impact of the entrepreneurial training, using new, larger and more diverse samples. Future work with larger samples would provide useful information on the impact of social variables such as gender and age on the entrepreneurship education–entrepreneurial intentions relationship, especially at early ages. In this sense, it is hoped that

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this paper provides some insights regarding the determinants of entrepreneurial intention among the young generation.

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Annex 1. Demographical characteristics of participants

Dependents		Gender		Labor market experience		Family entrepreneurial background	
Yes	6.3%	Male	83.7%	Yes	30.8%	Yes	52.5%
No	93.7%	Female	16.3%	No	69.2%	No	47.5%

Age					
17–18	27.1%	21–22	12.7%	25–26	4.1%
19–20	45.2%	23–24	6.3%	27–42	4.6%

Annex 2. Descriptive statistics and correlation matrix

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Be the best at everything I do	3.44	1.174															
Develop professionally and personally	3.91	0.899	0.227**														
Feel satisfied with my work	4.32	0.800	0.314***	0.477***													
Cover my personal needs	3.82	0.931	0.202**	0.232**	0.441***												
Have good work relations	3.56	0.867	0.104	0.331***	0.369***	0.401***											
Be able to change my environment	3.55	1.026	0.036	0.367***	0.326***	0.251***	0.333***										
Achieve political and social power	2.36	1.063	0.162**	0.050	−0.079	0.202**	0.091	0.106									
Be professionally successful	4.27	0.846	0.250***	0.276***	0.435***	0.372***	0.246**	0.134*	0.240**								
Contribute to social well-being	3.98	1.059	0.103	0.384***	0.333***	0.327***	0.483***	0.477***	0.173*	0.196**							
Gain social prestige	3.28	1.131	0.228**	0.007	0.020	0.248**	0.197**	−0.023	0.452***	0.325***	0.192*						
Earn a lot of money	3.64	1.031	0.161**	−0.052	0.042	0.208***	0.086	−0.048	0.269***	0.457***	0.099	0.451***					
Be independent	4.05	0.999	0.139**	0.331***	0.296***	0.360***	0.213**	0.247**	0.093	0.283***	0.229**	0.307***	0.156*				
Be socially accepted	2.82	1.147	0.159**	0.109*	0.106	0.264***	0.250***	−0.103	0.353***	0.147*	0.260***	0.500***	0.210**	0.168*			
Be “the boss”	3.14	1.210	0.116*	−0.095	−0.066	0.136*	0.031	−0.087	0.369***	0.217**	0.076	0.518***	0.351***	0.045	0.444***		
Have job stability	3.89	1.101	0.058	0.182*	0.271***	0.379***	0.278***	0.059	0.272***	0.382***	0.173*	0.358***	0.348***	0.357***	0.394***	0.225**	
Be financially secure	3.27	1.041	0.131*	0.195**	0.125*	0.281***	0.193**	−0.018	0.201**	0.287***	0.091	0.281***	0.352***	0.236**	0.296***	0.068	0.560***

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

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