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Are different entrepreneurship-promotion activities equally effective? an analysis by academic year and gender

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Abstract

Entrepreneurial education (EE) has proliferated in recent years, however, while previous research has extensively analyzed the impact of EE on students' entrepreneurial intentions (EI), studies tend to analyze EE as a monolithic concept without distinguishing between different types of academic activities and hence under examining how EE achieves its goals. To fill this gap in the literature, drawing on Ajzen's (1991) Theory of Planned Behavior and EE theory, we examine the relative effectiveness of different teaching models (supply, demand, and competence models) and specific academic activities in developing entrepreneurial intentions (EI). In particular, we focus on interdisciplinary activities (i.e., activities involving students from varying profiles and career fields), a type of academic activity that has been neglected by previous literature. We also explore potential differences in the effectiveness of these models depending on students' educational stage and gender, factors which have also been overlooked by the literature. Using survey data from 859 business school students, a structural model, and partial least squares technique, we found differences in the impact of teaching models on students' EI depending on activity characteristics, as well as student educational stage and gender. The results have important implications for educational practice and for public and private organizations interested in promoting entrepreneurship: i) the importance of autonomy, experiential learning, and exploratory learning in entrepreneurship-promotion activities, and ii) the convenience of tailoring these activities according to the gender, year of education, and academic field of the students.

Keywords Entrepreneurial intentions · Entrepreneurial education · Gender differences · Interdisciplinarity · Partial least squares · Teaching-model archetypes

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Introduction

The single best predictor of actual entrepreneurship is entrepreneurial intention (Krueger et al., 2000) and it is important to understand the way in which young people form their entrepreneurial intentions (EI) since they are the entrepreneurs and intrapreneurs of the future. Entrepreneurial education (EE) has proliferated in recent years and there is a need to better understand the impact of academic entrepreneurship-promotion activities on students' EI (Liñán et al., 2011; Monllor & Soto-Simeone, 2019; Nabi et al., 2017).

Resources are increasingly being devoted to EE on the grounds that this will lead to a new generation of entrepreneurs (Rauch & Hulsink, 2015) and several original articles, reviews, and meta-analyses have tried to confirm its effectiveness (Bae et al., 2014; Martin et al., 2013; Nabi et al., 2017). Yet there are no conclusive findings regarding the link between EE and EI (Aparicio et al., 2019). There are several scholars who claim that future research should be focused on assessing "whether different teaching methods and learning environments… have different effects on the outcomes [of EE]" (Barba-Sánchez & Atienza-Sahuquillo, 2018, p. 58). In other words, there is plenty of research that provides evidence that EE is effective, yet there is a scarcity of knowledge about which concrete forms are more effective than others.

Regarding the effects of EE on students' EI for example, Pittaway and Cope (2007) found that entrepreneurial learning benefits are linked to experiential and collaborative approaches. Similarly, Pittaway et al. (2015) found that participating in student-led clubs supports entrepreneurial learning. Fayolle and Gailly (2015) found that while the positive effects of EE on EI are triggered when students do not have much pre-existing entrepreneurial exposure, there are significant countereffects for those students with more extensive previous exposure to entrepreneurship. Using correlation and hierarchical regressions analyses, Mueller (2011) found that entrepreneurial programs involving business planning activities, student-oriented teaching, and feedback processes have a positive effect on EI. Likewise, Sansone et al. (2021) found that EE is positively linked to the creation of academic spinoffs, thus providing empirical evidence for the usefulness of EE in providing entrepreneurial skills. In turn, Abbasianchavari and Moritz (2021), in their literature review on the impact of role models on entrepreneurial intentions and behavior, found that role models at universities tend to positively influence students' EI (Fellnhofer & Puumalainen, 2017; Mueller, 2011) as well as their choice of an entrepreneurial career (Muofhe & Du Toit, 2011; Rahman & Day, 2014).

Although there is abundant EE research analyzing entrepreneurship courses, programs and initiatives offered by higher education institutions, there is a scarcity of empirical evidence regarding the fit between pedagogical methods, student specificities, subject content, and institutional constraints (Fayolle, 2013). Thus, there is a need to explore and empirically assess these links in depth. Teaching models are representations of how an educational institution implements its pedagogical approach based on specific goals (Legendre, 1993). In this regard, this paper

aligns with the teaching models in entrepreneurship for higher education framework proposed by Béchard and Grégoire (2005, 2007), which is a fertile method of classifying EE initiatives given its robust pedagogical basis. While several studies endorse its practical utility in designing and assessing educational practices (e.g., Nabi et al., 2017), this paper contributes to the EE literature by attempting to confirm its power to empirically test hypotheses on outcomes from distinct EE initiatives. Specifically, this study contributes to the EE literature by empirically analyzing the relative effectiveness of different EE initiatives, (classified into the three different teaching-model archetypes identified by Béchard and Grégoire (2005) -supply, demand, and competence models)- on the formation of students' EI. This disaggregation of EE into different types of academic activities, rather than analyzing EE as a monolithic concept, helps to explain how EE achieves its goals. We also contribute to the EE literature by analyzing the effectiveness of different EE activities in the same sample/population of students in three different academic fields: management, tourism, and design. In other words, to develop the analysis, we investigate one type of academic activity under-examined by previous literature: interdisciplinary activities, i.e., activities involving students from different profiles and career fields. In addition, we contribute to the EE literature by exploring potential differences in the effectiveness of the different activities depending on students' educational stage and gender.

Structural equation modeling on survey data from 859 students in higher education shows evidence of a positive impact of competence-teaching activities on EI, while demand-teaching activities show mixed results (positive and negative) and supply-teaching activities show a negative impact. Results also suggest that short-duration highly intensive activities with a ludic and fun character, and involving competition among students, should be combined with longer more intensive activities, such as real-life projects with companies, in particular at late educational stages. Results have important implications for academic institutions offering entrepreneurship courses and interested in promoting students' EI. Resources applied to improve EI of higher education students can yield better results if they are dedicated to competence-model activities rather than to demand- or supply-model activities. This is important, because some entrepreneurship activities were found to have negative effects on EI in certain groups of students.

The rest of the paper is organized as follows: the theoretical framework is developed in order to summarize the relevant research on the topic and support the hypotheses; then, the method for hypotheses testing is presented, including the development of the questionnaire, sampling method, and data analysis; results are presented and discussed, and finally, conclusions, limitations, and implications are presented, along with recommendations for future research.

Theoretical framework and hypothesis

The best-established intention-based model to study EI is the Theory of Planned Behavior (TPB), extensively used in entrepreneurship research (Kautonen et al., 2015; Kolvereid, 1996; Krueger & Carsrud, 1993; Liñán & Chen, 2009; Liñán et al.,

2011; Rauch & Hulsink, 2015; Vuorio et al., 2018). The TPB states that planned behaviors (such as starting a business) are intentional and thus predicted by intentions toward that particular behavior (Souitaris et al., 2007). According to the TPB, EI (EI) are directly influenced by three antecedents: (1) Entrepreneurial personal attitude (PA), referring to the degree of attraction toward entrepreneurship, and depends on expectations about the outcomes resulting from being an entrepreneur (Krueger et al., 2000); (2) Entrepreneurial perceived behavioral control (PBC), or the perceived ability to become an entrepreneur or how confident one feels when developing the entrepreneurial behavior (Krueger et al., 2000; Moriano, 2005), overlapping with Bandura's (1997) self-efficacy and; (3) Perceived subjective norms (SN), referring to the perceptions of what reference people think about respondents firm-creation decision and captures the influence of society on individual EI (Ajzen, 1991).

According to the TPB, exogenous factors (e.g., age, gender, and role models) also influence EI through the three antecedents listed above (Boyd & Vozikis, 1994; Kautonen et al., 2015; Lee & Wong, 2004; Liñán & Chen, 2009). In this article, we use the TPB and teaching models in EE to examine the impact of different teaching models on students' EI.

Teaching models in entrepreneurship for higher education

Human beings learn and are taught through a combination of external guidance – lecturing, training, coaching, instruction, mentoring, etc.– and their own personal experiences. In this vein, there is a critical distinction between learning and teaching processes. While learning processes shape an intricate and constant process of incorporating new competencies or strengthening the existing ones, the teaching processes comprise a deliberate pursuit of learning by revealing or instructing such competencies through a teacher-learner relationship (Kozlinska, 2016).

One remarkable and well-developed experiential learning model is Kolb's (1984) experiential learning theory (ELT) (Armstrong & Mahmud, 2008). Under this framework, experiential learning is: "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 41). Hence, following Kolb and Kolb (2005), it is critical to integrate what the learner senses and thinks with what he or she actually knows and feels. One of the key features of this learning approach is that "learning results from synergistic transactions between the learner and the environment" (Kolb & Kolb, 2005, p. 194). Thus, learning is a holistic process of adaption to contextual changes, trends, and circumstances that shape individual experience.

Béchard and Grégoire (2005) distinguished between three archetypes –*supply*, *demand* and *competence models*. These models arise from diverse combinations of operational (i.e., teaching objectives, knowledge emphasized, pedagogical methods and means, and assessment method) and ontological dimensions (i.e., philosophical paradigms, theoretical bases, educators' conceptions concerning teaching, themselves, students, and about the contents taught).

The *supply model* comprises the theoretical approach to study entrepreneurship rather than a practical or applied entrepreneurial preparation. This model is completely teaching-oriented and aims to provide students with a theoretical understanding of the entrepreneurship phenomenon, which normally incurs in students' boredom and demotivation (Fiet, 2000).

The *demand model* stresses the importance of students' learning needs. Concretely, just as the supply model focuses on the teaching-side of education, the demand model focuses on answering the learning goals, motives and needs of students (Béchard & Grégoire, 2005, p. 110). Within this approach, professors bring and encourage students to experience some features inherent to the entrepreneurial process both inside and outside the classroom.

Finally, the *competence model* aims to help students develop the entrepreneurial skills required to initiate business ventures. In this model, educators adopt the role of coaches, trainers or mentors who enable the students' self-directed, autonomous, and experiential learning of entrepreneurship (Müller & Diensberg, 2011). Some of the distinctive training methods are the creation of student enterprises, entrepreneurship labs, joint projects with companies, and mentorship programs, among others. Contrasting with the supply model, in the competence model students are encouraged to fail and to celebrate mistakes as an exceptional source of learning (Löbler, 2006).

Table 1 synthesizes the main characteristics of each teaching model in Béchard and Grégoire's (2005) framework. While the supply model adopts a behaviorist standpoint, both the demand and competence models embrace a constructivist approach to EE (Löbler, 2006; Nabi et al., 2017). Behaviorism undertakes learning essentially as the passive transmission of knowledge from educators to students, whilst the constructivist approach postulates that learning encompasses the students' active participation and engagement, becoming co-creators of new knowledge and insight.

Although the robust explicative power of this model may be acknowledged, it remains a simplified representation of reality and it is rather unlikely to find pure supply, demand or competence models in practice (Béchard & Grégoire, 2007). Thus, it is more common to encounter hybrid models (i.e., supply–demand, demand-competence and even supply-competence).

This paper proposes that academic activities involving experiential and explorative learning that give students more autonomy will be more effective in positively influencing students' EI than supply-model activities. Those two aspects are highly present in competence-model activities as well as in demand-model activities, although with less intensity. Experiential theories argue that learning takes place through personal and subjective experiences in an ongoing process (Kolb, 1984). Relatedly, explorative academic activities require students to take an active role in developing their personal entrepreneurial experience. In our context this could mean participating in the creation of a mini-enterprise or in a real-life project with a company. For example, previous research such as Pittaway and Cope (2007) find that new venture planning courses, involving experiential learning, are effective at simulating learning in entrepreneurship.

Table 1 Main features of teaching models in EE

Features	Supply model	Demand model	Competence model
Methodological focus	Spread and reproduction of theoretical knowledge in an attempt to develop critical thinking regarding entrepreneurship among students	Strengthening students' entrepreneurial competence by imparting knowledge, emphasizing self-directed exploration and experimentation (i.e., application of old theories in new ways)	Developing experience-based know-how by promoting a special learning environment and emphasizing the fostering of communication, networking and production competencies
Pedagogical methods	Lectures, seminars, reading course-books, solving exercises and case studies, in-class group work, discussions, business planning, use of audio-visual resources, etc	Lectures, seminars, field trips, simulations, animations, case studies, thematic debates, elevator pitches, business planning, internships, learning diaries, etc	Real-life projects with companies, innovation teams, entrepreneurship labs and competitions, incubation, virtual or real mini-companies, business modeling, mentorship, etc
Assessment method	Exams, tests, objective proofs; summative. Outcomes measurement may not exist	Summative and formative (i.e., through mentoring). Some form of outcomes measurement exists (i.e., course feedback survey)	Performance in authentic situations. Self and peer assessment. Long-term tracking of graduates. EE outcomes measurement system
Environment	Standard classrooms and lecture amphitheaters. Formality and standards prevail. Underdeveloped local EE ecosystem	Interactive classes/training sessions in standard or out-of- classroom settings, living labs, entrepreneurship camps, etc. Authenticity, ease of educator-student communication. EE ecosystem support (cooperation with entrepreneurs and industry, pre-incubators, science parks, design factories, alumni networks, etc.)	
Approach	Theoretical: content-driven	Mixed: content and process-driven	Practical: process-driven
Educator's role	Presenter and instructor, may lack practical experience in the entrepreneurship field	Instructor and trainer; "cheerleader", experienced in pedagogy and entrepreneurship	Facilitator, mentor, consultant, coach, fellow learner, having extensive experience in entrepreneurship
Student's role	Passive, receptive; rather limited	Active, generative; broad	Participative, co-creators of knowledge; independent and responsible

Source: adapted from Béchard and Grégoire (2005)

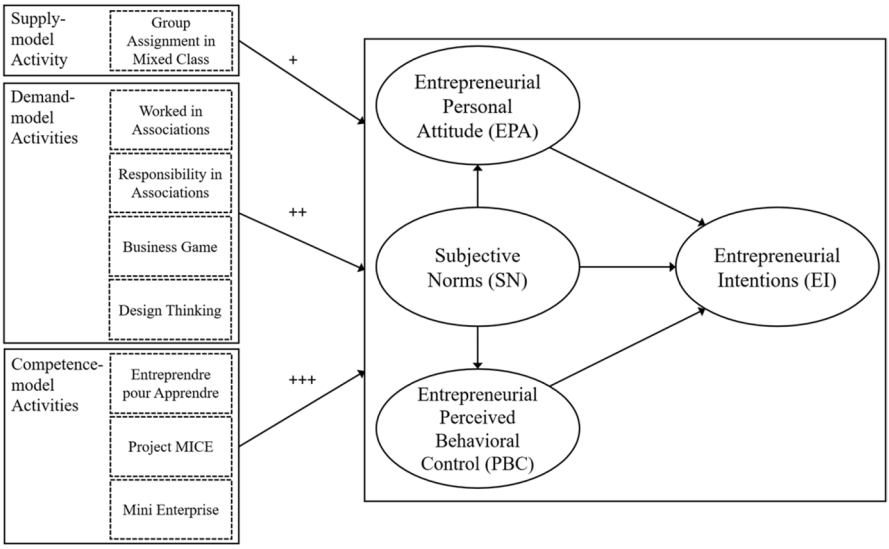

Fig. 1 Research model (the higher the number of + the higher the expected positive effects)

In line with the above arguments, previous research has found that supply-model activities such as traditional entrepreneurship lectures given by course instructors and experienced teachers do not improve students' EI (Chen et al., 2015). Also, in a correlation and hierarchical regression analysis using the TPB, Mueller (2011) found that courses involving business planning activities, student-oriented teaching, and explorative elements positively influence students' EI. Similarly, in a regression analysis, Piperopoulos and Dimov (2015) found that higher self-efficacy is associated with lower EI in the theory-oriented courses while it is associated with higher EI in the more practice-oriented courses.

Based on the above arguments, we hypothesize that the more experiential, exploratory and autonomous the learning activity, the greater its positive effect on students' EI. Hence, in terms of the three different teaching models by Béchard and Grégoire (2005), we posit the following hypothesis:

Ho. Competence-model activities will have a higher positive effect on students' EI than demand-model activities, and demand-model activities will have a higher positive effect on students' EI than supply-model activities.

This hypothesis is represented graphically in Fig. 1. Activities are grouped according to the teaching model to which they belong: supply, demand, or competence. The arrows represent expected effects of the activities on the variables in the TPB model. The relative effects of the different teaching-model activities are expressed by using +, + +, and + + +, to indicate a progressively higher positive impact.

Method

Research design

This study is based on a quasi-experimental cross-sectional design in which all the variables in the hypothetical model are measured using Likert-type scales through a survey instrument. A quasi-experimental design is useful in analyzing cause–effect relations between variables when experimentation is not possible (Campbell & Stanley, 1963). Survey data were analyzed using Partial Least Squares (PLS) – Structural Equation Modeling (SEM) techniques, using MS Excel XLSTAT software. PLS-SEM is a causal modeling approach widely used in behavioral sciences (Shook et al., 2004) aimed at maximizing the explained variance of the dependent latent constructs (e.g., entrepreneurial intentions) in empirical studies; particularly, PLS-SEM is appropriate for prediction purposes (Hair et al., 2011). We therefore consider this approach to be suitable for our research.

Data

We examine a sample of students from a French Ecole de Commerce highly focused on entrepreneurship. Samples of students have been extensively examined in the entrepreneurship literature to analyze the formation of EI (Fayolle et al., 2006; Kolvereid, 1996; Krueger et al., 2000; Santos & Liguori, 2019; Tkachev & Kolvereid, 1999; Veciana et al., 2005).

To promote students' entrepreneurial spirit, the institution uses many different entrepreneurial academic activities, such as business-game competitions or business plan contests and cooperates with a local business incubator in a variety of activities. All the activities we analyze are included in some courses and are compulsory for the students attending them. Then, self-selection is not an issue. Additionally, students at the school can engage in numerous associations ranging from sports, cultural, professional to humanitarian, among others. Students are encouraged to join associations or create their own from their first year. Associations are considered an integral part of the pedagogical program since students obtain academic credits when participating in them. We analyze these activities as student associations provide opportunities to gain certain entrepreneurial experience. However, in contrast with professional student associations (where, in general, the explicit objective is to develop entrepreneurial abilities), students engaging in sport, humanitarian or cultural associations are essentially motivated by their tastes and hobbies and not because they are 'entrepreneurship-minded'. Consequently, there is no self-selection problems in relation to students' participation in associations.

The sample includes students from three schools in different fields. The Management and Business School offers, among others, a Bachelor's in International Management (INBA) and the Grande École Program (PGE, a generalist program in management organized in two parts: a bachelor's degree in Management during the first year, and a Master's Degree in Management the following two years). The School of

Table 2 Students per program and year (total sample)

Program	Year 1	Year 2	Year 3	Year 4	Year 5	Men	Women	Total
Design	42	44	48	2	19	47	108	155 (18.0%)
Tourism Bachelor	46	32	40	0	0	20	98	118 (13.7%)
Tourism Master	38	9	0	0	0	3	44	47 (5.5%)
Grande École	116	120	153	0	0	226	163	389 (45.3%)
International Management	61	35	15	39	0	56	94	150 (17.5%)
Total	303 (35.3%)	240 (27.9%)	256 (29.8%)	41 (4.8%)	19 (2.2%)	352 (41%)	507 (59%)	859 (100%)

Tourism and Leisure Management offers a Bachelor (EMVOL) and a Master (MBA-Tour) in Tourism, Leisure and Travel Management. Finally, the Design School offers a Bachelor's in Graphic Arts and Design.

> We electronically administered a questionnaire to students at the end of the second semester (June 2015) and, to maximize participation, responding to the questionnaire was made compulsory for students to be able to access their students account in the school intranet for about two months. Students access their accounts to check for all relevant academic information, including grades and lecture timetables. Compared to voluntary responses, this method has the advantage of avoiding self-selection problems or non-response bias.

We obtained 859 questionnaires. The respondents were 59% female, 41% male, between 17 and 35 years old. Table 2 shows the composition of the total sample by program, year, and gender. On average, students were 22 years old, 72.9% of the sample knew at least one entrepreneur and 87.78% had had some work experience at the moment of the survey. Table 3 shows the number of students per activity and program.

Measures

This research uses an adapted version of the *Entrepreneurial Intention Questionnaire (EIQ)* (Liñán et al., 2011). The Appendix shows the twenty items used to measure the variables in the entrepreneurial intention model. The questionnaire, originally in English, was translated into French by teachers at the school who were French native speakers and had extensive experience in giving lectures in English. The questionnaire uses Likert-type scale items (from 1 to 7) to measure the four central constructs of the Theory of Planned Behavior (entrepreneurial intention, entrepreneurial personal attraction, entrepreneurial subjective norms and entrepreneurial perceived behavioral control). To deal with problems of response-set bias and the halo effect, items were intermingled and randomly

Table 3 Students per entrepreneurship academic activity and program

	Design	EMVOL	MBATourism	PGE	INBA	Total per activity
Worked in associations	67	90	21	284	111	573
Responsibility in Associations	45	52	9	122	77	305
Group Assignment in Mixed Class	99	74	5	189	75	442
Entreprendre pour Apprendre	18	8	0	37	8	71
Project MICE	14	4	2	38	11	69
Mini Enterprise	8	5	1	32	4	50
Business Game	63	82	21	122	87	375
Design Thinking	41	2	0	10	31	84
Students per program (n = 859)	155	118	47	389	150	

The sum of students in each activity does not match the number of students per program because each student might participate in several activities

ordered in the questionnaire (Liñán et al., 2011). In the same spirit, six items were reversed (items EI9, EI19, PA2, PA12, PBC5, and PBC16). We applied these measures as an *ex ante* approach implemented in the research design to reduce the possibility of common method variance derived from the fact that all data were collected through the same survey instrument, according to Chang et al. (2010).

The variables related to learning activities are dummies equal to one if the respondent had participated in them and zero otherwise. Pedagogical methods in EE in higher education still tend to predominantly embrace a behaviorist approach, mainly based on lectures, assignments, tests, etc., which ultimately emphasize knowledge acquisition, instead of deeper experience-based approaches characteristic of the constructivist perspective (Nabi et al., 2017). However, higher education institutions are gradually grasping the necessity of implementing experience-based learning initiatives and have begun to include experiential pedagogic methods within their courses that complement the traditional learning approach, eminently characterized for being lecture-based (Leal-Rodríguez & Albort-Morant, 2019; Peris-Ortiz et al., 2016).

The next section describes the academic activities assessed, classified by teaching-model archetype. These activities correspond to the different entrepreneurial academic activities that a French business school implements to promote students' entrepreneurial vocation. Apart from the *interdisciplinary group assignment* academic activity, which fits with the supply model (Béchard & Grégoire, 2007), the other academic activities correspond to the demand model-*Business Game*, *Design Thinking* and *Participation in student association with responsibility*—and to the competence model – *Entreprendre pour Apprendre, Mini-enterprise* and *Project MICE*.

Description of the entrepreneurship activities by teaching-model archetype

1) *Supply model*

Interdisciplinary group assignment. This activity consists of a group assignment that aims to analyze in depth a particular company and its business strategies in courses where students from different programs at the school are mixed during one semester. The assignment requires students to work in groups of 3, 4 or 5. The assignment involves the choice of group members, in-class and outside-class group work, the writing of a report, and an oral presentation.

2) *Demand model*

Participation in a student association. This activity consists of participating for one year or more in a student association with no particular responsibility. The types of associations include sports, cultural, professional, and humanitarian, among others. Associations organize events (e.g., workshops, competitions of different sorts, concerts, cultural visits, exchanges and meetings), search for sponsors and raise money for events, competitions or humanitarian projects, manage funds and do networking. Students are encouraged to join associations of their choice or to create their own from the start of their tenure at the school. Students obtain academic credits (i.e., European Credit Transfer and Accumulation System, ECTS credits) when participating in an association.

Participation in a student association with responsibility. This involves participation in a student association with some responsibility (president, vice president, treasurer…), usually for one year.

Business game. For a whole week, students working in teams of 6 people are asked to manage and implement an innovative project within challenging scenarios. In particular, students run their own virtual businesses and the teams compete against each other in order to gain market share in a simulated market and make profits. The game integrates diverse functional areas such as production, finance, marketing and logistics. The objective is to help participants plan their strategies and practice decision making while taking into account interactions across all the typical functions within the firm. Students are free to ask for advice from instructors during competition. Participation involves team formation, defining strategies, analyzing competitors and understanding consumer behavior. At the end of the week, there is a debriefing from the winning team, which is publicly awarded in the final prize-giving ceremony.

Design thinking. For two and a half days, management and design students work in teams to reflect on a problem proposed by an organization (for example the accommodation of people without shelter proposed by the Amis de Médecins du Monde Foundation). Students are free at the reflection and design of solutions level. Students proceed in steps of half a day, structured around the major phase of the design thinking process: 1. Empathize (observe and understand), 2. Define (Re-frame and define the problem), 3. Ideate (propose concepts), 4. Prototype (adopt a hands-on approach in prototyping) and 5. Test (develop a prototype/solution to the problem). At the end of every half a day, they are asked to prepare an original report (based for instance on media support or a two-minute pitch), evaluated by four school teachers.

3) *Competence model*

Mini enterprise. Students, in groups of 6 to 8, accompanied by a teacher, collectively create and manage one enterprise during the whole academic year. Teachers accompany and motivate students to take the project to term. Students build the start-up funds, assimilated to capital as part of the pedagogical exercise, and start the activity. At the end of the academic year they close the company and review the project collectively.

Entreprendre pour Apprendre. Students, teachers and entrepreneurs collectively create and manage one enterprise. Students learn the procedure to create an enterprise by preparing a business plan and initiating the activity in the form of a mini enterprise. Students run the mini enterprise during the whole academic year. Teachers accompany and motivate students to finalize the project. Entrepreneurs participate in examination juries and validate all the steps of the project. Entrepreneurs can also sponsor and accompany students during the project. To promote excellence, a championship round bringing together all the teams participating in the project is organized at the national level. The winning team competes at the European championship. The project includes 5 steps: 1. The birth of the project -the idea (find the idea, go from the idea to the project, and prepare the project planning step); 2. Project planning (market research to check for business opportunities before starting; strategic study to identify the customer, position the company in the marketplace and define the marketing strategy; analysis of resources required for the project; legal study to choose the legal status of the company); 3. The firm in operation (build the start-up funds, assimilated to capital as part of the pedagogical exercise, and start the activity); 4. The championships (prepare for the national and European championships); 5. Project closure (close the company and review the project collectively).

Project MICE. Students with management, engineering or design background are engaged in a real-life project with a company or entrepreneurs for seven months. They must identify and evaluate a business opportunity (in an existing or new project company), prototype the offer and implement the solution. The project may be fulfilled in a company or dedicated to the creation of a company (start-up). They collaborate in interdisciplinary teams, always composed by an engineer, a manager, and a designer.

With regard to demographic variables, age is measured in years, and the other three demographic variables are dummies taking the value of one if the questionnaire respondent is female (Gender variable), knows personally at least one entrepreneur (Role Model variable) and has some work experience (Work Experience variable). Zero means the opposite. The year of the program in which the respondent was registered is also considered.

As a first step, we did a confirmatory factor analysis of the adapted EIQ items. Using Partial Least Squares (PLS) MS Excel XLSTAT software, four factors were extracted according to the TPB model. Table 4 presents factor loadings for the twenty items in the questionnaire, as well as a composite reliability indicator for each factor. Control variables (age, gender, role model and work experience) were

Table 4 Reliability and convergent validity analysis for the full sample (N = 859)

Construct	Items	Loadings	Composite Reliability	Average Variance Extracted (AVE)
Entrepreneurial Intentions	EI4	0.841	0.912	0.634
	EI17	0.881		
	EI6	0.792		
	EI13	0.890		
	EI9-rev-	0.663		
	EI19-rev-	0.678		
Entrepreneurial Personal Attitude	PA18	0.796	0.880	0.594
	PA2-rev-	0.654		
	PA10	0.856		
	PA15	0.862		
	PA12-rev-	0.657		
Subjective Norms	SN3	0.863	0.906	0.763
	SN11	0.882		
	SN8	0.875		
Entrepreneurial Perceived Behavioral Control	PBC1	0.796	0.831	0.461
	PBC5-rev-	0.470		
	PBC20	0.625		
	PBC16-rev-	0.400		
	PBC14	0.842		
	PBC7	0.809		

introduced in the measurement model as dummy variables in order to reduce possible spurious relations.

Table 5 gives evidence of convergent and discriminant validity. Bivariate Pearson correlations are smaller than the square root of average variance extracted (AVE) values in all cases but two. The correlation between EI and entrepreneurial personal attitude is higher than the corresponding AVE values, and the correlation between EI and entrepreneurial behavioral control is slightly higher than one of the corresponding AVE values. These findings suggest that EI, entrepreneurial personal attitude, and entrepreneurial perceived behavioral control might not be completely

Table 5 Square root of AVE and bivariate Pearson correlations

Construct	Mean	Standard Deviation	1	2	3	4
1. Entrepreneurial Intentions	4.33	1.44	**0.796**			
2. Entrepreneurial Personal Attitude	4.77	1.34	0.854	**0.771**		
3. Entrepreneurial Perceived Behavioral Control	4.26	1.00	0.684	0.602	**0.679**	
4. Perceived Subjective Norms	5.14	1.36	0.410	0.478	0.491	**0.873**

square root of AVE in bold face

AVE Average Variance Extracted

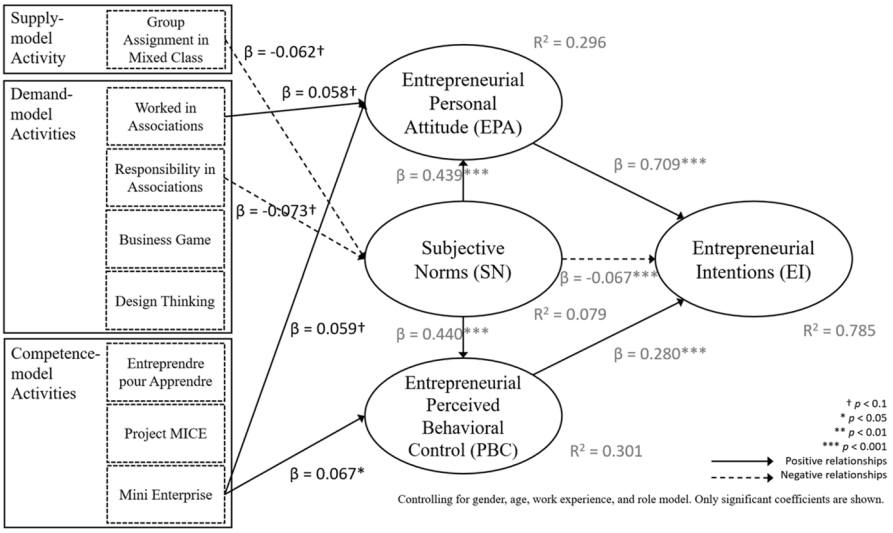

Fig. 2 Research model with non-standardized coefficients (Years 1 to 3, n = 799)

orthogonal. However, since the EIQ has been used in several studies, we decided to continue with the analyses without modifying the structure of the scales.

Data analysis

We performed Partial Least Squares (PLS) modeling to test the hypotheses, by using MS Excel XLSTAT software, after confirming the validity and reliability of the measurement model, as recommended by Anderson and Gerbing (1988) and Hatcher (1994). The full structural model included the control variables and the relations assumed in the TPB model. The TPB variables are regressed on the learning activities to test hypothesis Ho.

We decided to discard questionnaires from 4 and 5th year students for the rest of the analysis because all the students but 2 in 4th year were INBA students and all the students in 5th year were design students (see Table 3). Consequently, a sample of 799 was used from here on in the analysis.

Results

Figure 2 shows the TPB model with non-standardized coefficient estimates for the 1st to 3rd year students, controlling for gender, age, work experience, and role model. Table 6 presents the path coefficients. The analysis supports the core TPB intentional model, and only the relationship between SN and EI is, unexpectedly, in the opposite direction.[1]

[1] Note that the total effect of SN on EI is still positive and significant, thanks to the indirect positive effects through EPA and PBC.

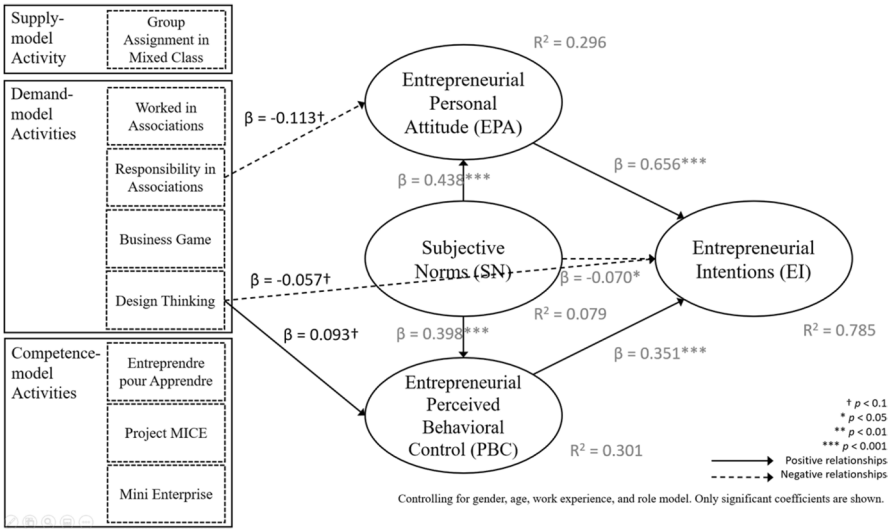

Fig. 3 Research model with non-standardized coefficients (Year 1, n = 303)

Previous research found a non-significant relationship between SN and EI (Autio et al., 2001; Krueger et al., 2000; Liñán & Chen, 2009).

Few significant impacts were found for the whole sample. Moreover, some impacts have negative signs: in particular, having responsibility in an association and group assignment in mixed class impacted negatively on subjective norm ($p < 0.1$). The only activities with a positive and significant impact were: having worked in associations, with a positive and significant impact on personal attitude ($p < 0.1$), and Mini Enterprise, with a positive and significant impact on both entrepreneurial personal attitude ($p < 0.1$) and perceived behavioral control ($p < 0.05$). However, a deeper analysis by year and gender revealed some interesting patterns: responsibility in associations and group assignment always has negative impacts while other activities yield both positive and negative impacts depending on the year and gender of students (Figs. 3, 4, 5, 6, 7).

Table 7 summarizes these findings; the hypothesis is not rejected. The supply-model activity (Group Assignment in Mixed Class) shows negative effects on PBC, SN and (for the PGE) on EPA. The demand-model activities show mixed results: Worked in Associations shows only positive effects, while Responsibility in Associations yielded only negative effects; Business Game gave a positive outcome with PGE students; and Design Thinking produced positive effects on some groups while negative effects on others. Finally, as hypothesized, competence-model activities (Entreprendre pour Apprendre, Project MICE, and Mini Enterprise) show mostly positive effects on several groups. That is, the more autonomous, exploratory, and experiential the academic activity, the greater its positive effect on the EI of students.

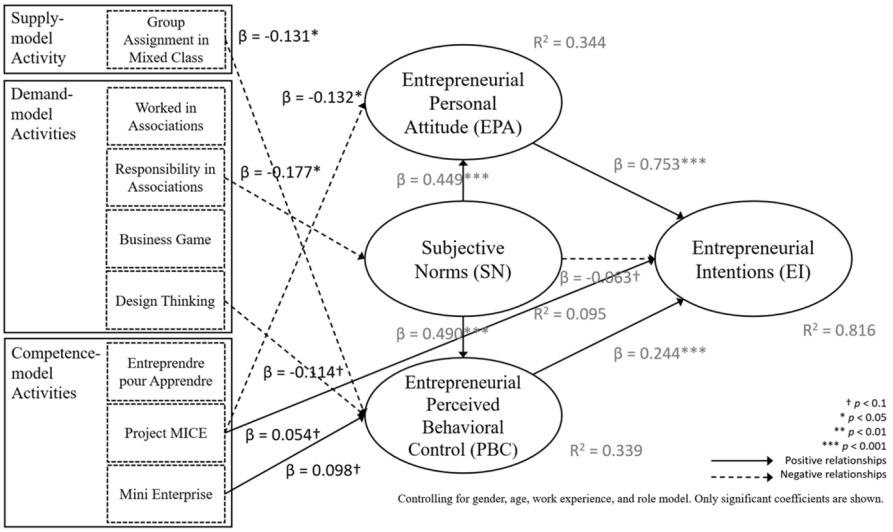

Fig. 4 Research model with non-standardized coefficients (Year 2, n = 240)

Discussion

The presence of EE in higher education institutions has significantly increased worldwide (Fretschner & Weber, 2013) and, therefore, assessing the effectiveness of different types of academic practices in encouraging entrepreneurship is essential (Liñán et al., 2011; Nabi et al., 2018). The prevalent assumption is that pedagogical endeavors in entrepreneurship will lead to enhanced socio-economic developments

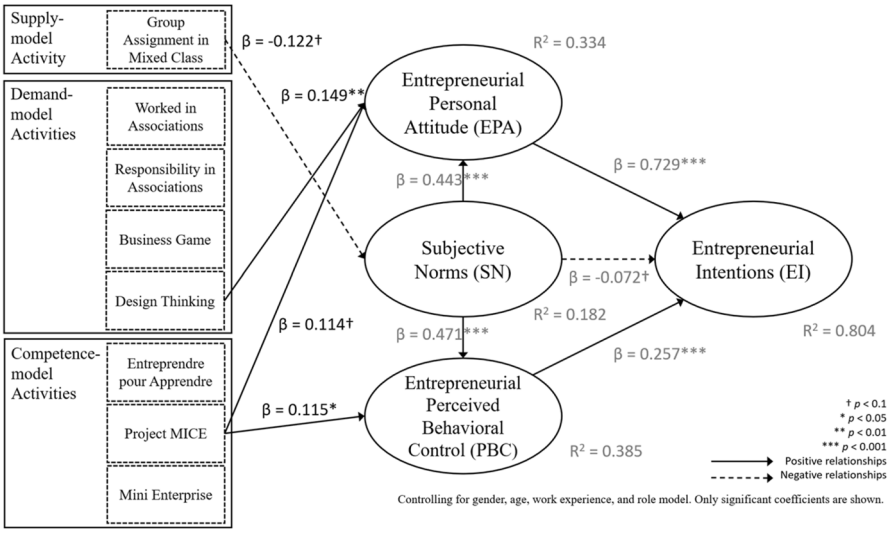

Fig. 5 Research model with non-standardized coefficients (Year 3, n = 256)

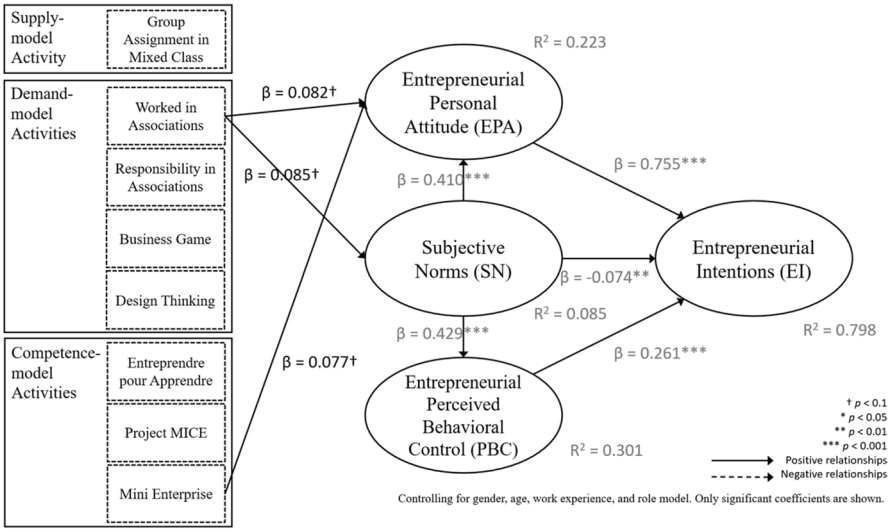

Fig. 6 Research model with non-standardized coefficients (Women, n = 507)

through an improved entrepreneurial competence (Kozlinska, 2016). Nevertheless, the extensive literature addressing the influence of EE (Bae et al., 2014; Fayolle & Gailly, (2015); Martin et al., 2013; Nabi et al., 2017) has not shed sufficient light on the ties shaping the above-mentioned logical sequence, nor on the fundamental drivers of effective interventions (Rideout & Gray, 2013). This study has hopefully contributed to fill this gap by distinguishing which interventions, teaching-model

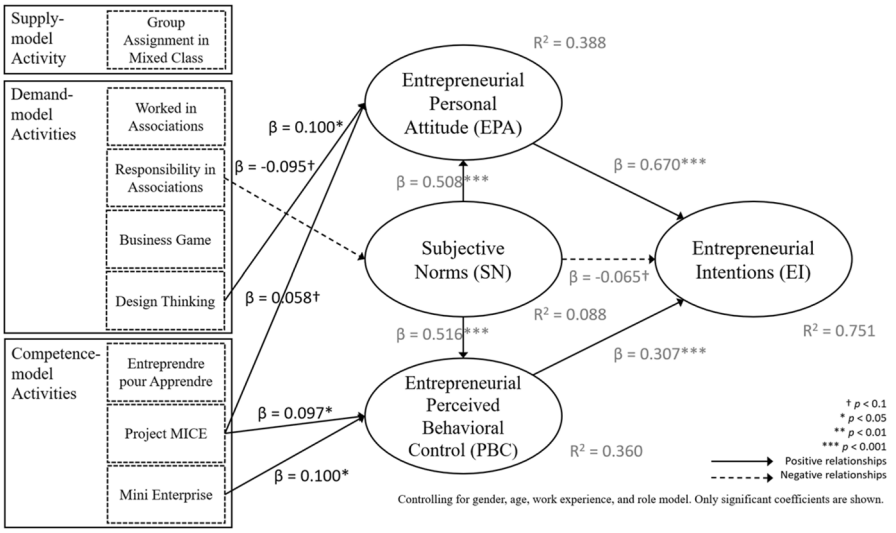

Fig. 7 Research model with non-standardized coefficients (Men, n = 352)

Table 6 Path coefficients of the structural model (Years 1 to 3, N = 799)

Independent Variable(s)	Dependent Variable	Non-standardized coefficient	t	Two-tailed significance ($p <$)	R^2
Personal Attitude	Entrepreneurial Intentions	0.709	32.121	0.001	0.785
Perceived Behavioral Control		0.280	12.639	0.001	
Subjective Norms		-0.067	-3.334	0.001	
Subjective Norms	Personal Attitude	0.439	14.084	0.001	0.296
Subjective Norms	Perceived Behavioral Control	0.440	14.170	0.001	0.301

Controlling for gender, age, work experience, and role model

archetypes, and academic activities, exert a higher positive impact on the students' entrepreneurial intention.

The main contribution of this research is providing empirical evidence for the higher effectiveness of the competence-model activities relative to the demand- and supply-model activities in positively influencing students' EI. In the competence teaching model, educators adopt the role of coaches, trainers or mentors who enable the students' self-directed, autonomous and experiential learning of entrepreneurship (Müller & Diensberg, 2011). These activities include the creation of student enterprises, entrepreneurship labs, joint projects with companies, and mentorship programs. Our findings are in line with those obtained by a recent study by Sansone et al. (2021), showing that entrepreneurial education has proven to be of utmost usefulness while creating academic spin-offs. Furthermore, these authors' findings reveal that practice-oriented –rather than theory-oriented– entrepreneurship courses enable and contribute more greatly to the development of academic spin-offs.

Additionally, the effect of each activity seems to be different depending on gender, degree and field of study, and what year the student is doing. A careful review of these results could offer relevant implications for the design and implementation of EE academic activities. It may be possible to increase their effectiveness by reorganizing them regarding their target student population (considering year and program, for instance).

In the first year, few effects are apparent. In the second year, several effects are significant, but most of them are negative. Finally, in the third year, the results are mostly positive. Although we have not specifically investigated the reasons for these differences, the results seem to suggest that students' receptivity to EE changes as they advance through the degree. In the first year, students seem to be less receptive, since the impact observed from EE activities is minimal (Nabi et al., 2018). Only Design Thinking (positive effect on PBC) and responsibility in an association (negative effect on EPA) have an impact on some TBP model components.

Regarding second year students, we obtained several negative effects, which might cause demotivation toward entrepreneurship and a decreasing entrepreneurial intention. At this stage, students are probably more focused on academic aspects,

Table 7 Direct impacts on the TPB-model constructs (standardized coefficients) by teaching-model archetype and academic activity

	Entrepreneurial Intentions	Entrepreneurial Personal Attitude	Entrepreneurial Perceived Behavioral Control	Subjective Norms
SUPPLY MODEL				
Group Assignment in Mixed Class		PGE (β = -0.089**)	2nd Year (β = -0.131**) PGE (β = -0.070*)	3rd Year (β = -0.122*)
DEMAND MODEL				
Worked in associations		Women (β = 0.082*) Tourism (β = 0.244***)		Women (β = 0.085*)
Responsibility in Associations		1st Year (β = -0.113*) Tourism (β = -0.139*)		2nd Year (β = -0.177**) Men (β = -0.095*) PGE (β = -0.087*)
Business Game				PGE (β = 0.092*)
Design Thinking	1st Year (β = -0.057*) INBA (β = -0.070*)	3rd Year (β = 0.114*) Men (β = 0.100**) PGE (β = 0.086*)	1st Year (β = 0.093*) 2nd Year (β = -0.114*)	
COMPETENCE MODEL				
Entreprendre pour Apprendre				INBA (β = 0.234***)
Project MICE	2nd Year (β = 0.054*)	3rd Year (β = 0.149***) Men (β = 0.058*) PGE (β = 0.093**) 2nd Year (β = -0.132**) Design (β = -0.132*)	3rd Year (β = 0.115**) Men (β = 0.097**)	
Mini Enterprise		Women (β = 0.077*)	2nd Year (β = 0.098*) Men (β = 0.100**) PGE (β = 0.092**)	

Positive relationships in boldface; negative relationships in italics

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

and less concerned about their professional career path and employability, and hence are less receptive to these initiatives. The only activity with a positive impact on PBC is Mini-Enterprise. Meanwhile, third year students benefit from participation in both the longest activity (project MICE, involving a real-life project with a company for 7 months) and the highly intensive and ludic Design Thinking activity. A plausible explanation is that these students are close to their entry into the labor market and therefore more likely to be receptive to these activities (Reynolds et al., 2002; Veciana et al., 2005).

Overall, our results suggest that activities should concentrate on students in their first and especially third academic years, i.e., when they appear to have more effect on students' EI and perceptions. Short duration high-intensive activities, ludic, fun and involving competition among students, should be combined with longer, more intensive ones (Project MICE and Mini Enterprise), in particular at late educational stages.

A remarkable result is that there are very few direct effects on entrepreneurial intention. Only Project MICE had a positive effect for 2nd year students, while Design Thinking had a negative effect for 1st year and INBA students. All other significant relationships relate to TPB antecedents. This confirms the validity and applicability of the TPB model, as it predicts that external variables (such as EE) will affect intention indirectly through their motivational antecedents (Fayolle & Liñán, 2014; Krueger & Carsrud, 1993; Krueger et al., 2000; Liñán & Fayolle, 2015).

The results also indicate there are gender differences that influence the impact of entrepreneurship activities on students' EI: in particular, there are more activities that positively impact men (4) than women (3), and there are some differences in the activities that show a positive impact. The results suggest that participation in associations is particularly effective in increasing women's EPA and SN, and not those of men. Mini Enterprise and project MICE are effective in increasing men's but not women's PBC. Project MICE seems to fit males very well, since it also helps increase their entrepreneurial attitude. These differences point to the need for some tailoring of programs to the specific predominant characteristics of women and men. We would not, of course, recommend women-only or men-only EE courses, but some special attention could be paid to each sex, based on their response to the EE initiatives analyzed in this study. In this sense, some authors recommend the use of female entrepreneurial role-models (Santos et al., 2016; Shinnar et al., 2014) or to avoid masculine stereotypes about entrepreneurs (Gupta et al., 2009, 2014).

When exploring the impact of activities by program, results indicate that activities are particularly effective for PGE students (Table 7), while the impact is minor for the rest of the programs. Four activities (Project MICE, Mini Enterprise, Business Game and Design Thinking) have a positive indirect impact on PGE students' EI through different TPB antecedents. This is probably due to the profile of students enrolled in this program, and the higher entrepreneurial orientation of the PGE program.

Conclusions

One of the major challenges of any economy is the promotion of entrepreneurial activity, and education can play a vital role in encouraging entrepreneurship among the young. EE has been shown to have a positive impact on the intentions of young people toward entrepreneurship, their employability, and their role in society (Bae et al., 2014; Martin et al., 2013; Nabi et al., 2017).

By using Ajzen's (1991) well-established Theory of Planned Behavior and analyzing a questionnaire administered to first, second and third-year undergraduate students, we provide empirical evidence of the differences in the effectiveness of different teaching-model archetypes (supply-, demand-, and competence-teaching models) and activities to promote entrepreneurship among students. In general, the greater the autonomy of students in the activity, and the more experiential and exploratory the learning activity, the greater its positive effect on students' EI. Also, we show that entrepreneurship activities have a different impact on students' EI depending on gender, educational stage and the degree and field of study.

The results have important implications for academic institutions providing EE to promote EI among students. In particular, the results suggest that activities should concentrate on the first and third academic years, i.e., when they appear to have more effect on students' EI, and that short duration high-intensive activities, ludic and fun and involving competition among students should be combined with longer but intensive ones, especially at late educational stages.

In sum, our findings expand the teaching models framework by empirically testing the outcomes of supply vs. demand and competence models and specific EE activities. These insights may be useful for educators and policymakers in charge of designing EE strategies, since they shed light upon the interactions between didactic, pedagogical and contextual combinations of EE, hence contributing to covering a gap that has remained scarcely explored. Thus, this study suggests that EE strategies in general and particularly autonomous, experiential, and exploratory EE activities may be successful while a proper combination of EE design and implementation meets the particular socio-demographic and contextual factors accompanying it.

As with any other project, our research is not without limitations. However, if properly addressed, these limitations could help develop future research. First, the context of our analysis, which is limited to a single business school and to a single geographical location. Future research could compare our results to those from other academic institutions and geographical locations. Second, cross-sectional data cannot prove causality, but the results point to clearly differential effects of EE activities depending on the program, academic year, and gender. Future studies, especially using longitudinal research designs, could explore the reasons why some activities negatively affected the EI of some students. What were their expectations regarding these activities? What did they seek that is different from what they obtained? Third, the lack of evidence for discriminant validity between EI and entrepreneurial personal attitudes and, possibly, between EI and entrepreneurial perceived behavioral control. We used the *Entrepreneurial Intention Questionnaire (EIQ),* validated by Liñán et al. (2011), which has been tested in different settings, but translation to

the French language may have been the source of cross-loading factors. Finally, our analysis is done from a predominantly business education perspective, and it might not fully reflect other disciplines' perspectives. Future research could try to integrate them in the analysis. Future research could also explore differences across countries using data available through Global Entrepreneurship Monitor or other sources.

Appendix

Items in the Entrepreneurial Intention Questionnaire (in this research, the items were translated into the French language)

	Item
PBC1	Starting a firm and keeping it viable would be easy for me
PA2	A career as an entrepreneur is totally *unattractive* to me
SN3	My friends would approve of my decision to start a business
EI4	I am ready to do anything to be an entrepreneur
PBC5	I believe I would be completely *unable* to start a business
EI6	I will make every effort to start and run my own business
PBC7	I am able to control the creation process of a new business
SN8	My immediate family would approve of my decision to start a business
EI9	I have *serious doubts* about ever starting my own business
PA10	If I had the opportunity and resources, I would love to start a business
SN11	My colleagues would approve of my decision to start a business
PA12	Among various options, I would rather be *anything but* an entrepreneur
EI13	I am determined to create a business venture in the future
PBC14	If I tried to start a business, I would have a high chance of being successful
PA15	Being an entrepreneur would give me great satisfaction
PBC16	It would be *very difficult* for me to develop a business idea
EI17	My professional goal is to become an entrepreneur
PA18	Being an entrepreneur implies more advantages than disadvantages to me
EI19	I have a *very low* intention of ever starting a business
PBC20	I know all about the practical details needed to start a business

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