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Research Article

Impacts of entrepreneurial education on brazilian higher education students: An empirical study comparing required and elective disciplines

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Abstract

Objective of the study: This study assesses the impact of entrepreneurial education on students of entrepreneurship courses at the undergraduate level of Brazilian universities. **Methodology:** The methodology adopted was pre/post based on the collection of primary survey data among 398 entrepreneurship students of 10 undergraduate courses from six Brazilian universities, involving twelve professors. Data analysis was performed using confirmatory factor analysis and paired t-tests to compare means. **Main results:** Entrepreneurship elective courses have a greater positive impact (especially for entrepreneurial attitudes, perceived behavioral control and entrepreneurial intention) for undergraduate students, when compared to mandatory courses, which negatively impacted entrepreneurial attitudes, perceived behavioral control and entrepreneurial intention. **Theoretical / methodological contributions:** The development of a framework to analyze the impact of entrepreneurial education based on the recent entrepreneurship literature representing an extended version of the Theory of Planned Behavior that includes entrepreneurial knowledge and competencies. **Relevance / originality:** The application of a rigorous methodology (pre/post intervention) with application of paired t-tests and the comparison between elective and mandatory entrepreneurship courses in large database.

Keywords: Entrepreneurial Education. Teaching Entrepreneurship. Entrepreneurship.

Impactos da educação empreendedora em alunos brasileiros do ensino superior: Um estudo empírico comparando disciplinas obrigatórias e eletivas

Resumo

Objetivo do estudo: O presente estudo tem como objetivo avaliar os impactos da educação empreendedora em alunos de disciplinas de empreendedorismo no nível de graduação de universidades brasileiras**. Metodologia:** A metodologia adotada foi pré/pós a partir da coleta de dados primários por meio de questionários estruturados entre 398 estudantes de empreendedorismo provenientes de 10 disciplinas de graduação de seis universidades brasileiras, envolvendo doze professores**.** As análises de dados foram realizadas por meio de análise fatorial confirmatória e testes pareados de comparação de médias. **Principais resultados:** As disciplinas eletivas de empreendedorismo têm maior impacto positivo (sobretudo para atitude empreendedora, controle percebido do comportamento e intenção empreendedora) para os alunos de graduação no Brasil, se comparado às disciplinas obrigatórias, que, inclusive, impactaram negativamente alguns fatores (ex.: atitude empreendedora, controle percebido do comportamento e intenção empreendedora)**. Contribuições teóricas/metodológicas:** Desenvolvimento de um modelo para analisar o impacto da educação empreendedora fundamentado na recente literatura sobre o tema e que representa uma versão estendida da Teoria do Comportamento Planejado, a qual inclui conhecimentos e competências empreendedoras. **Relevância/originalidade:** Uso diferencial de uma metodologia rigorosa (pré/pós com aplicação de teste-t pareado) e comparação dos efeitos de cursos eletivos e obrigatórios de empreendedorismo em uma ampla base de dados.

Palavras-chave: Educação Empreendedora. Ensino de Empreendedorismo. Empreendedorismo.

INTRODUCTION

Can education promote entrepreneurship? This questioning on the impact of entrepreneurial education has been the object of speculation by academics, public policymakers and educators (Saes & Marcovitch, 2020). Defined "as an activity aimed at transferring knowledge to stimulate the creation of goods and services from the exploitation of opportunities, regardless of how the effort is made, by whom it is offered and with what effects" (Ribeiro & Plonski, 2020, p.30), entrepreneurial education or "for entrepreneurship" proposes to develop skills and knowledge aimed at boosting the development of new businesses and job creation (Nabi et al., 2017). Many studies have examined its effectiveness in order to investigate the results of different pedagogical practices on student behavior (Martin et al., 2013). However, there is no consensus on the answer to this question (Lima et al., 2015b), which constitutes an important dilemma.

On the one hand, the literature recognizes several positive effects of entrepreneurial education for the individual, including improvements in their entrepreneurial attitudes, intention, self-efficacy, skills and action, as well as for society, such as in the establishment of companies and in the performance of new businesses(Duval-Couetil, 2013; Lorz et al., 2013; Mwasalwiba, 2010; Pittaway & Cope, 2007; Ribeiro & Plonski, 2020). For example, the study by Byabashaija and Katono (2011) suggests that entrepreneurial education is effective, as it positively impacts perceptions of desire and the viability of entrepreneurship as a career option for students. On the other hand, the literature emphasizes the limits of entrepreneurial education, revealing neutral and even negative impacts (Dickson et al., 2008; Fayolle & Gailly, 2015; Lima et al., 2015a, Walter & Dohse, 2012). Studies such as Karimi et al. (2016) found no significant effects of participating in entrepreneurship courses, while those of Oosterbeek et al. (2010) and Von Graevenitz et al. (2010) found negative effects. As for the studies carried out with students in Brazil, in addition to being scarce, they also show incompatible results. Lima et al. (2015a) concluded that the intentional founders, who took entrepreneurship courses in Brazilian higher education, did not increase their entrepreneurial intentions and self-efficacies. Rocha and Freitas (2014) and Barbosa et al. (2020) found significant changes in the entrepreneurial profile of students who participated in entrepreneurship training, while Lima et al. (2015b) reported negative effects for entrepreneurial intention and self-efficacy.

The lack of consistency shows a dubiousness in the literature about the impact of entrepreneurial education on entrepreneurship development. The apparently conflicting empirical results have led researchers to question methodological aspects, as less rigorous research overestimates positive effects (Martin et al., 2013). Another reason for the contradictory results is the difference between pedagogical methods. Few papers, such as Curtis et al. (2021), directly connect the impacts of entrepreneurship education to pedagogical methods (Nabi et al., 2017; Pittaway & Cope, 2007), which makes a reliable comparative analysis difficult. Despite several empirical studies on the subject, isolating entrepreneurial behavior is uncertain. Most studies adopt methodologies that are viewed as limited, as they do not use comparable treatment and control groups of participants, do not control for self-selection bias (Storey, 2017), do not collect longitudinal data and do not compare the effectiveness of different pedagogies (Nabi et al., 2017; Rideout & Gray, 2013). In effect, there is consensus among researchers that the investigation of the impacts of entrepreneurial education is an area still lacking attention, especially in Brazil (Ribeiro & Plonski, 2020).

The present study aims to answer the following research question: *what are the impacts of entrepreneurial education on students in entrepreneurship courses at the undergraduate level of Brazilian universities?* Taking the Theory of Planned Behavior (TPB) as a theoretical framework and using an empirical study with 398 Brazilian university students, the present article addresses some theoretical and methodological gaps in studies on the evaluation of the impacts of entrepreneurial education in Brazilian higher education. Among its contributions are the development of a model to analyze the impact of entrepreneurship education, which incorporates entrepreneurial knowledge and skills into the original TPB model, the use of a rigorous methodology (pre/post with paired t-test), and the comparison of the effects of elective and required entrepreneurship courses.

Investigating the impact of entrepreneurial education is relevant, especially in the context of the economic crisis caused by the COVID-19 pandemic, as entrepreneurship is recognized as an engine of economic growth and job creation (Kuratko, 2005; Schumpeter, 1934). In 2020, the increase in unemployment in Brazil led to the growth of entrepreneurship out of necessity (lack of income alternatives), from 37.5% to 50.4%. In addition, the contingent of initial entrepreneurs reached the highest level of the historical series since 2002, with a rate that represents 23.4% of the adult population or 32.6 million Brazilians (GEM, 2020). In the face of growing social demand (Saes & Marcovitch, 2020), formal training mechanisms through entrepreneurial education have been widely discussed as a strategy for developing more and better entrepreneurs.

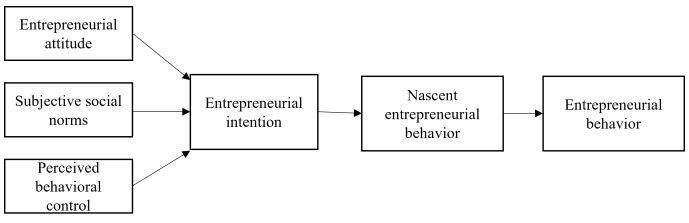
THEORETICAL BASIS AND HYPOTHESES

Theory of planned behavior

Entrepreneurship is an intentional process in which individuals cognitively plan to perform activities related to recognition of opportunities, creation and development of ventures (Lortie & Castogiovanni, 2015). Based on this observation, most studies on the effects of entrepreneurial education are based on the principle that becoming an entrepreneur is something planned (Nabi et al., 2017), that is, it is a process of rational choice. This draws on the TPB in the field of psychology, which emphasizes the controllable aspects of information processing and decision-making (Ajzen, 2011). According to this theory, the intention to undertake - that is, the goal that a person aims to achieve - precedes the act of undertaking and is the main predictor of entrepreneurial behavior (Vasconcelos et al., 2020). Personal intention is considered the basic element of the entrepreneurial process, as it refers to the mental decision to create a business and determines the personal engagement of the Nascent entrepreneurial during this process (Liñán, 2007). Three variables precede the formation of the intention to undertake: attitude, subjective social norms and perceived behavioral control (Ajzen, 1991), as illustrated in Figure 1. Several empirical studies corroborate the validity of TPB in the context of entrepreneurship (Lima et al., 2015b; Lortie & Castogiovanni, 2015) and particularly in the choice of students for an entrepreneurial career (Gorgievski et al., 2018; Valencia-Arias & Restrepo, 2020).

Figure 1

Illustration of the general model of the TPB



Note: Elaborated by the authors from Ajzen (1991).

Attitude refers to the degree to which behavior is perceived positively or negatively (Ajzen, 1991). It depends, therefore, on beliefs related to the consequences of a given behavior (Bosnjak et al., 2020), whether real or guided by irrational assumptions and emotional biases linked to fear and anger (Ajzen, 2011). Unlike

other types of behavior, entrepreneurship represents a challenging behavior in the context of work as it is characterized by risk, uncertainty, and complexity (Obschonka et al., 2015). Relevant entrepreneurial attitudes are related to job security, workload, belonging to a social group, the need for challenges, autonomy to make decisions, the desire to engage in creative projects and financial opportunity (Kolvereid, 1996).

Subjective social norms consist of the perception of favorable or unfavorable social pressure exerted by important or relevant people in the individual's circle of relationships (Ajzen, 1991), so that they may or may not go forward with the idea of entrepreneurship. Such social norms are fed by so-called normative beliefs (Bosnjak et al., 2020), that is, social influences that lead to certain behavior, such as the expectations of the would-be entrepreneur's family (Lima et al., 2015a). Subjective social norms are considered favorable to entrepreneurship when a person's peers (friends, family, and colleagues) value and create positive expectations about entrepreneurial behavior (Obschonka et al., 2015). The perceived behavioral control is defined as the perception of difficulty or ease to develop that behavior, taking into account past experiences, shortcomings, and obstacles (Ajzen, 1991). It results from beliefs about factors that can facilitate or prevent the performance of a behavior, also known as control beliefs (Bosnjak et al., 2020). Therefore, it concerns not only entrepreneurial self-efficacy, which refers to the individual's belief in their ability to perform certain tasks successfully, but also to the degree of control of the individual over their own behavior (locus of control) (Lima et al., 2014).

As a rule, the TPB prescribes that the more favorable an attitude and subjective social norms are and the greater the perceived behavioral control, the stronger a person's intention to perform the behavior in question (Bosnjak et al., 2020). This means that people's attitudes toward entrepreneurship, subjective social norms and the perceived behavioral control over entrepreneurial behavior have an additive effect, influencing their entrepreneurial intentions (Fayolle et al., 2006). The intention to undertake, in turn, is a good indicator to predict entrepreneurial behavior, as it is configured, according to the TPB, as an immediate antecedent (Bosnjak et al., 2020). By capturing motivational factors, entrepreneurial intention indicates how much effort an individual is willing to put into establishing a new business (Lortie & Castogiovanni, 2015). Thus, an important group of researchers, such as Vasconcelos et al. (2020), evaluates the effectiveness of entrepreneurial education through the analysis of variance of these three variables (attitudes, subjective social norms and perceived behavioral control), comparing the before and after of an educational intervention. If positive changes are perceived, entrepreneurial education is considered to have been successful.

The limitation of the TPB is that it does not measure the relationship between entrepreneurial intention and behavior. There is often a significant time lag between intention and action. As the development of new businesses by undergraduate students at the end of their entrepreneurial education courses is rare[1], an option adopted by some researchers includes the assessment of activities carried out by students that characterize "nascent entrepreneur" behavior (Souitaris et al., 2007). Another approach is to investigate entrepreneurial behavior years after the educational intervention. In this case, real entrepreneurial behavior is studied as it is manifested, or not, in practice (Nabi et al., 2017). However, the long-term investigation of real entrepreneurial behavior is complicated by the difficulty of isolating empirical evidence that it was the entrepreneurial education that caused such behavior.

In addition, the TPB is not sufficient in itself, that is, the constructs originally contained in the theory do not fully explain the intentions and actions of people in certain contexts (Ajzen, 1991). The systematic review carried out by Lortie and Castogiovanni (2015) reveals a large number of additions to this theory, in the literature on entrepreneurship, to expand the TPB in terms of new constructs with antecedent, moderating and mediating effects. For example, recent contributions include entrepreneurial identity (Obschonka et al., 2015) and social values (Gorgievski et al., 2018) not only as guiding elements of entrepreneurial behavior but also in synergy with attitudes, subjective social norms and perceived behavioral control. Other studies have proposed a TPB extended with self-efficacy to emphasize feasibility issues, on the grounds that self-efficacy differs significantly from perceived behavioral control, even though they are similar concepts (Liñán, 2007). Perceived behavioral control is the general belief in a person's power over the results of their actions, while self-efficacy is a deep self-confidence in performing specific tasks in a field of work (Pihie & Akmaliah, 2009). Research in this field shows a mediating role of entrepreneurial self-efficacy perceived by students in the relationship between entrepreneurial education and entrepreneurial intention (Lima et al., 2015b; Zhao et al., 2005).

In the field of entrepreneurship education, a significant limitation of the TPB refers to the non-incorporation of entrepreneurial competencies, which refer to the set of skills linked to the exploitation of new opportunities developed by aspiring entrepreneurs (Gorgievski et al., 2018). As highlighted by Lackéus (2015), entrepreneurial education is also perceived as a means of empowering people and organizations to create social value aimed at the public good. In contrast to the narrow definition, which thinks of entrepreneurship as the establishment of a new business, the broad definition goes further and states that entrepreneurial education involves the fostering of competencies, abilities and soft skills. The goal is to make students more creative, opportunity-oriented, proactive and innovative in various circumstances of their lives (Lackéus, 2015). In Liñán's (2007), view, the broad approach should include content aimed at "entrepreneurial awareness" in order to foster a greater number of potential entrepreneurs, regardless of whether they set up their business immediately after graduating. In the context of the TPB, this type of education is likely to have more effects on antecedents (i.e., subjective social norms) and an indirect influence on entrepreneurial intention.

Research hypotheses

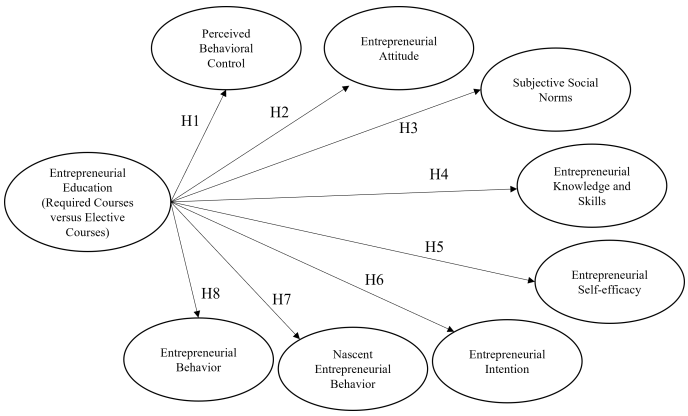
Based on the TPB, the effects of two types of entrepreneurial education (elective and required courses) are evaluated in this study from the perspective of entrepreneurial intention and entrepreneurial behavior. The distinction between courses was adopted to minimize the self-selection bias, which prevents ruling out the possibility that people who were already entrepreneurs had been attracted to entrepreneurial education, leading naturally to higher levels of entrepreneurial behaviors (Bager, 2011). This bias can be eliminated by using samples with students from required disciplines. Only two studies reviewed by Martin et al. (2013) investigated students from required entrepreneurship courses. These studies (Oosterbeek et al., 2010; Von Graevenitz et al., 2010) reported negative impacts on entrepreneurial intention, self-efficacy and/or attitude. Karimi et al. (2016) also revealed different results for students of elective and required courses regarding intentions to undertake.

Required subjects are taught to all students enrolled in a given degree program; therefore, they include both those interested and those not interested in entrepreneurship education. Participants in elective courses chose entrepreneurial education among other course options. They seek more knowledge and skill in this subject. In addition, because they are more motivated, they tend to participate more actively in learning activities than students forced to participate in the course. Therefore, following the logic of Martin et al. (2013), electives are expected to have a greater impact than required courses.

Figure 2 illustrates the general model and research hypotheses of the present study. As the theoretical arguments and conceptual mechanisms are similar for both types of course, a single hypothesis is formulated. The impact of each construct is then empirically tested for both types of course.

Figure 2

Hypothesis illustration model



Note: Elaborated by the authors.

Entrepreneurial education offers knowledge and often a practical approach on how to bring business ideas to market efficiently and quickly (Davidsson & Honig, 2003; Shinnar et al., 2014; Zhao et al., 2005). Methods for generating ideas (for example, creativity techniques) and for confirming that a given idea is new and valuable (for example, market analysis) are among the many activities conducted in entrepreneurship courses. These activities are expected to make it easier for students to own their own businesses and thus exercise greater perceived behavioral control (Krueger et al., 2000; Rauch & Hulsink, 2015; Shinnar et al., 2014; Zhao et al., 2005). Therefore:

H1: Entrepreneurial education has a positive impact on students' perceived behavioral control.

Both entrepreneurship courses and extracurricular activities focused on this theme play a critical role in the socialization of individuals in entrepreneurial careers (Krueger & Brazeal, 1994; Robinson et al., 1991). They may indicate that the institution considers this career as a legitimate and learnable alternative, creating a favorable environment for entrepreneurship. In addition, positive attitudes toward entrepreneurship can be enhanced by minimizing spurious beliefs about the negative side of entrepreneurship and failure, with the teaching of risk reduction strategies and inspiration through rewards (Rauch & Hulsink, 2015). Therefore:

H2: Entrepreneurial education has a positive impact on students' entrepreneurial attitudes.

Often, entrepreneurship courses present and discuss real cases of successful entrepreneurs, often close to teachers and students (Curtis et al., 2021). These factors support the argument that entrepreneurial education contributes to an increase in subjective social norms regarding student entrepreneurship (Shinnar et al., 2014). Therefore:

H3: Entrepreneurial education has a positive impact on students' subjective social norms.

In its broad sense, entrepreneurship education aims to provide students with different types of knowledge and skills in areas such as marketing, innovation, management, risk-taking and finance (Chen et al., 1998). As for the skills taught in entrepreneurship courses, Mwasalwiba's review (2010) highlights finance and resource ordering; marketing; idea generation/opportunity identification; business plan; growth management; organization and team building; new business creation and SME management. For example, the course studied by Barbosa et al. (2020) provides students with practical experience in business, in the organization and operation of a company based on market, trading and production concepts offered by volunteer professionals. In this way, students from entrepreneurship courses are expected to increase their knowledge and competencies in these areas. Therefore:

H4: Entrepreneurial education has a positive impact on students' entrepreneurial knowledge and skills.

In addition, entrepreneurial education seeks to strengthen entrepreneurial self-efficacy in several ways. Entrepreneurship courses often offer an opportunity for repetitive engagement in a task and the development of students' confidence in their abilities to perform these types of tasks in the future. For example, by conducting a market analysis, pitching an idea, developing a business model, or writing a business plan in these courses, students can gain confidence in their abilities to perform such tasks as entrepreneurs. Cox et al. (2002) highlight 11 tasks from three different phases of the development cycle of a new business - planning (ex: having an idea for an innovative business), ordering (ex: raising capital to start a business) and implementation (ex: managing a small business) – that can be worked on in the courses. Thus, entrepreneurial education is expected to increase students' entrepreneurial self-efficacy as it provides mastery experience, role models, social persuasion and support, and involves them in running simulated or real small businesses (Pihie & Akmaliah, 2009). As Barbosa et al. (2020), suggest, hands-on learning opportunities provide a realistic view of the business world that ensures not only the applicability of the knowledge acquired in the classroom but also greater self-confidence in the career. Students' entrepreneurial self-efficacy also tends to increase when they are exposed to the following experiences that may be present in entrepreneurship courses: lectures or case studies on successful real entrepreneurs, receiving positive feedback from others (teachers and peers), and achieving good performance on course assignments (Shinnar et al., 2014). Therefore:

H5: Entrepreneurial education has a positive impact on students' entrepreneurial self-efficacy.

Based on the TPB, it is expected that by influencing positively entrepreneurial attitudes, perceived behavioral control, and subjective social norms, entrepreneurial education also contributes to increased entrepreneurial intentions. According to this theory, intentions function as a "portal" between the motivation phase and the action phase in entrepreneurship (Obschonka et al., 2015). The TPB has been tested empirically by several researchers to assess the impact of entrepreneurial education on students' entrepreneurial intentions, and its value has been demonstrated consistently (Byabashaija & Katono, 2011; Fayolle et al., 2006; Gielnik et al., 2015; Heuer & Kolvereid, 2014; Mohamed et al., 2012; Rauch & Hulsink, 2015; Souitaris et al., 2007; Smith & Woodworth, 2012; Walter & Dohse, 2012). Therefore:

H6: Entrepreneurial education has a positive impact on students' entrepreneurial intentions.

Individuals in the process of career choice first develop intentions to then engage in professional behavior, that is, actions directed to the entry into the labor market by an individual, from the perspective of the Socio cognitive Theory of Career Development (Lent et al., 1994). Following this logic, several empirical studies have shown that greater entrepreneurial intentions are related to actions in the direction of entrepreneurship.

Some teaching approaches favor this relationship. The categorization most used by researchers divides entrepreneurial education into three approaches: education *about, for* and *through* entrepreneurship (Lackéus, 2015). Education *about* entrepreneurship has a theoretical focus in order to develop

a general understanding of the phenomenon (Kirby, 2007). Such courses are intended to assist students in assimilating and reflecting on existing content and resources. They usually resort to more traditional approaches, such as lectures and texts dealing with the theoretical basis of entrepreneurship (Penaluna, 2012). Teaching *for* entrepreneurship is a professionally oriented approach, aiming to provide entrepreneurs with the skills and knowledge necessary for the practice (Kirby, 2007; Lackéus, 2015). The goal is to foster an entrepreneurial mindset in students, usually through experiential learning, which seeks to enhance skills and abilities. This knowledge must be inserted in a specific context so that students can reflect on the future and visualize opportunities (Penaluna, 2012). Penaluna (2012) highlights the importance of a combination of theory and practice in curricula, that is, between learning *about* and *for* entrepreneurship, since practice must be supported by theory. Finally, teaching *through* entrepreneurship is a process-based approach, often through experience, in which students learn content through a real entrepreneurial procedure (Lackéus, 2015). Creation processes are used to assist students in understanding business, as well as skills and abilities (Kirby, 2007).

Especially in courses that adopt a logic of education "for" and "through" entrepreneurship, and not only "about" it (Lackéus, 2015), many students proceed to the execution of activities related to the initial stages of new businesses (Curtis et al., 2021). Examples of these activities include raising resources, hiring people, and acquiring facilities and/or equipment (Souitaris et al., 2007). Thus, higher values of nascent entrepreneurial behavior and "real" entrepreneurial behavior of students are expected (Gielnik et al., 2015; Premand et al., 2016; Rauch & Hulsink, 2015; Vasconcelos et al., 2020). Therefore:

H7: Entrepreneurial education has a positive impact on students' nascent entrepreneurial behavior.

H8: Entrepreneurial education has a positive impact on students' entrepreneurial behavior.

METHODOLOGY

This research is characterized by the quantitative approach, with primary data, and has a descriptive character, which seeks empirical evidence for theoretical precepts. Therefore, statistical data were analyzed to examine the impact of entrepreneurial education in light of the TPB. The quasi-experimental research design was implemented, in which the various measurements used were estimated twice, with an educational intervention between the two measurements. That is, the effects of the entrepreneurship course on undergraduate students were examined by measuring their entrepreneurial intentions, attitudes, self-efficacy, behaviors, knowledge and skills before and after taking the course (Easterby-Smith et al., 2015).

Data collection

The present study collected primary data through structured questionnaires among undergraduate students from six Brazilian universities, in 10 courses focused on entrepreneurship. Twelve teachers participated in the survey. Among the six universities, one is private and five are public. Survey questionnaires were made available on the Survey Monkey platform at the beginning of the courses (March/April 2019) and at the end of the courses (June/2019). Students were given access links to the questionnaires, which were completed electronically via mobile phones or computers. Most of the teachers provided a 15-minute time for filling up the questionnaire.

Sample

The social subjects surveyed, entrepreneurship students in Brazil, were chosen because they constitute the target population of the research, and not for convenience, as is commonly done in studies on entrepreneurial behavior (Vasconcelos et al., 2020). During the first data collection (at the beginning of the courses), among the 669 students who completed the questionnaire, 496 attended required courses in their curriculum, 113 elective courses and 55 students did not attend any entrepreneurship course. Most of these 55 students were freshmen in an engineering program whose curriculum did not include entrepreneurship subjects. During the second data collection (at the end of the course), 532 students completed the questionnaires. All these students took some entrepreneurship courses in the 1st semester of 2019. Not enough data were obtained from the control group (students who did not take entrepreneurship courses) during the 2nd data collection. In total, 786 students completed at least one of the questionnaires and 398 students completed the questionnaires in the pre- and post-research stages, which were considered for the final sample of the study for analysis purposes. Table 1 presents the descriptive data of the sample.

In the sample of 398 students, 72% are undergraduate students in engineering and 18% undergraduate students in administration and/or foreign trade. Students from three Brazilian states participated in the present study: students from Minas Gerais represented 74.62% of the sample, those from Paraná 23.12%, and those from Santa Catarina 2.26%. The students were predominantly from the 1st year (77.6%) and male (62.6%), and were attending their first undergraduate courses (94.2%). Most had two years or less of work experience (83.7%). Only 25.4% had participated in the development of a new business, product or process, and 34.0% had studied other subjects related to business, innovation and/or entrepreneurship before the course in focus.

Most of the answers obtained refer to required courses (87.7%). In terms of content, the courses taken by the students surveyed are similar and use approaches "about" and "for" entrepreneurship (Lackéus, 2015). In the elective courses, the four main content areas were: introduction to entrepreneurship (e.g., the emergence of entrepreneurship and main fronts of study on the subject, entrepreneurship ecosystem, profile of entrepreneurs); development of soft skills (e.g., creativity, identification of opportunities, analysis of the behavioral profile of students); generic content on strategy and business, including the development of business plans, and management and strategy tools; and development of business models, including Canvas analysis. As for the required courses, the four main content areas were: soft skills development; content on intra-entrepreneurship; specific content focused on entrepreneurship in an area or theme (e.g., entrepreneurship in the health sector, social entrepreneurship, technological entrepreneurship, software legislation); and content on agile innovation. Specific content aimed at entrepreneurship in several areas, such as intellectual and industrial property, innovation and entrepreneurship environment, Brazilian tax structure, financing of ventures are little addressed, as well as issues aimed at financial and managerial support to small business owners. The percentages of total class time devoted to activities directly related to the entrepreneurship project, given as practical activities to students, were: 38.0% in elective courses and 14.5% in required courses[2].

Regarding the pedagogical approaches used in the courses surveyed, the following activities were highlighted as the most frequent, both in elective and required courses: practical activities carried out in the classroom in groups (e.g., development of the business model Canvas), discussion and interaction between students and teachers to obtain knowledge and clarify questions, lectures by the teacher(s) with great interaction with the students and their presentations of group work on the development of a business model. ("*elevator pitch*") or a business plan.

Table 1

Descriptive analysis of sample characterization variables

Variables		n	%
University	University 1	274	68.84
	University 2	92	23.12
	University 3	4	1.01
	University 4	19	4.77
	University 5	9	2.26
Teacher of the entrepreneurship course	Teacher 1	26	6.53
	Teacher 2	21	5.28
	Teacher 3	256	64.32
	Teacher 5	7	1.76
	Teacher 7	4	1.01
	Teacher 8	19	4.77
	Teacher 9	6	1.51
	Teacher 10	59	14.82
Course	Course 1	26	6.53
	Course 2	21	5.28
	Course 3	256	64.32
	Course 5	7	1.76
	Course 7	4	1.01
	Course 8	19	4.77
	Course 9	6	1.51
	Course 10	59	14.82
Student's Program	Administration and/or ft[1]	71	17.84
	Engineering	278	69.85
	Accounting	29	7.29
	CS[2] and Other Exact Sciences Courses	3	0.75
	BS[3] (physiotherapy or pharmacy)	4	1.01
	Applied Social Sciences	8	2.01
	Others	5	1.26
Student's academic term	1st term	308	77.58
	2nd term	5	1.26
	3rd term	8	2.02
	4th term	1	0.25
	5th Term	2	0.50
	6th Term	6	1.51
	7th Term	35	8.82
	8th Term	4	1.01
	9th Term	14	3.53
	10th Term	9	2.27%
	11th Term	2	0.50%
	12th Term	3	0.76%
Student's Gender	Female	149	37.44
	Male	249	62.56

Variables		n	%
Type of Course	Required	349	87.69
	Elective	49	12.31
Type of University	Public	398	100.00
	Private	0	0.00
Student's educational level	Higher education in progress	375	94.22
	Complete higher education	15	3.77
	Postgraduate	7	1.76
	Master's Degree	1	0.25
Student's years of work	2 years or fewer	333	83.67
	3 to 5 years	31	7.79
	6 to 10 years	21	5.28
	11 to 15 years	9	2.26
	From 16 to 20 years	3	0.75
	More than 21 years	1	0.25
Participation in the dev. of some new business, product or process	Yes	101	25.38
	No	297	74.62
Current or past experience as an entrepreneur	Yes	96	24.12
	No	302	75.88
Years as an entrepreneur	Has no experience	301	75.63
	1 year or less	82	20.60
	2 years	8	2.01
	3 years	3	0.75
	More than 3 years	4	1.01
Number of times you have undertaken	None	301	75.63
	One	71	17.84
	Two	19	4.77
	Three	3	0.75
	4 or plus	4	1.01
Some relatives have succeeded as entrepreneurs	Yes	233	59.14
	No	161	40.86
Participation in other related courses	Yes	134	34.01
	No	260	65.99
Did you attend high school in public school?	Yes	203	54.13
	No	172	45.87
Family income	Less than 3 mw[4]	106	28.27
	Between 3 and 5 mw	94	25.07
	Between 5 and 10 mw	80	21.33
	Between 10 and 20 mw	67	17.87
	More than 20 mw	28	7.47
Informal experience of entrepreneurship	Yes	137	36.53
	No	238	63.47
Age - Mean; S.D.		20.34	4.29

Notes: 1 = Foreign trade; 2 = Computer science; 3 = Biological sciences; 4 = Minimum wages. Elaborated by the authors.

Credit hours ranged from 54 to 75 hours in elective courses and from 18 to 68 hours in required courses. The weighted averages, by the number of students surveyed per course of these workloads, were 65.4 hours for electives and 26.0 hours for required courses. Teachers of elective courses had from one to seven years of experience teaching entrepreneurship courses to undergraduate students at Brazilian universities, while teachers of required courses had from two to eight years of experience.

Data collection instrument

The questionnaire was prepared using measures previously developed and validated in reference publications in the literature (Alsos & Kolvereid, 1998; Chen et al., 1998; Cox et al., 2002; De Noble et al., 1999; Hashimoto, 2017; Kolvereid, 1996; Souitaris et al., 2007; Walter & Dohse, 2012). Still, the questionnaire was tested with five students in December 2018, selected with the help of the teacher of an entrepreneurship course. The test was administered in person, in a printed version. Based on the tests, we found that the time taken to complete the questionnaire was less than 15 minutes, which we consider reasonable, and that the students had no difficulties understanding the questions asked. Few adjustments were suggested on some items to increase the clarity of the questions. Table 2 shows in detail the scales used and their respective sources.

RESULTS

In order to define the constructs and create indicators to represent them, a confirmatory factor analysis was adjusted using the R software (version 3.6.1). Appendix A shows factor loadings of the items for each construct and the analysis of convergent validity, discriminant validity, dimensionality and reliability of the constructs of the measurement model. For all constructs, the Cronbach's Alpha and Composite Reliability indices were higher than 0.60, thus showing their reliability. According to the Kaiser criterion, all constructs were one-dimensional, presented

convergent validation, since the extracted variances (AVEs) were greater than 0.40, and discriminant validation, since the maximum shared variance of each construct was greater than the respective AVE.

The t-test of paired samples was used to test the impact of the courses on entrepreneurial attitudes, subjective social norms, perceived behavioral control, entrepreneurial self-efficacy, entrepreneurial knowledge and skills, entrepreneurial intentions, nascent entrepreneurial behavior and entrepreneurial behavior of the students considering the two collection times: Pre (1st data collection, at the beginning of the course) and Post (2nd data collection, after the end of the course). This analysis was conducted on two separate groups of the sample: students in required courses (349 students) and students in elective courses (49 students).

Using G*Power to calculate the sample size required for a paired t-test, we found that 44 individuals are necessary to achieve 90% test power, considering a medium effect size and 5% significance. Thus, with the present sample, we achieved sufficient power to compare pre- and post-times and both the elective and required groups.

Comparison of model indicators between times (Pre/Post)

Table 3 presents the descriptive analysis of the Likert scale items of the model for the required courses. Among the individuals who took required courses, there was a significant difference (p-value < 0.050) regarding the indicators of Entrepreneurial Attitudes, Entrepreneurial Self-efficacy (Research Phase), Entrepreneurial Self-efficacy (Implementation Phase), Management Knowledge and Skills, Entrepreneurial Intention and Nascent Entrepreneurial Behavior.

Table 4 describes the variation of the items in the Likert scale of the model for the elective courses. Among this group of students, there was a significant difference (p-value < 0.050) regarding the indicators of Entrepreneurial Attitudes, Entrepreneurial Self-efficacy (Planning Phase), Entrepreneurial Self-efficacy (Ordering Phase), Entrepreneurial Self-efficacy (Implementation Phase), Entrepreneurial Knowledge and Skills (in Marketing, Innovation, Risk-taking and Finance).

Table 5 shows the descriptive analysis of dichotomous items by time and type of course. It thus shows the percentages of responses, for each activity, referring to the behavior of the "nascent" entrepreneur and the "real" entrepreneurial behavior.

Table 6 compiles the results referring to the comparison between means of the model indicators (paired tests) between the times (pre/post) and by type of course. It is noteworthy that the scores were standardized (in relation to the standard deviation) for a better interpretation. The results show positive impacts on several indicators for students in elective courses and negative impacts on some indicators for students in required courses. Based on these data, the hypothesis tests performed were: H1 (Confirmed at 5% confidence level for the required course and rejected for the elective); H2 (Confirmed at 5% confidence level for both types of course); H3 (Rejected); H4 and H5 (Rejected for the required courses at 5% confidence level and confirmed for the electives); H6 (Confirmed at the 5% confidence level for the required course and rejected for the elective course); H7 (Confirmed at the 5% confidence level for both types of course); H8 (Rejected).

DISCUSSION OF RESULTS

For elective course students, there were significant positive impacts on entrepreneurial attitudes, knowledge and skills, self-efficacy and nascent entrepreneurial behavior. However, there were no significant changes in the perceived behavioral control, subjective social norms, entrepreneurial intentions and entrepreneurial behavior. Despite contradicting the expectations postulated in the hypothesis, the lack of significant impact on students' subjective social norms corroborates previous studies, such as Fayolle and Gailly (2015) and Walter and Dohse (2012).

Undergraduate courses hardly exert any influence on students' family, friends and other relationships, which may explain this finding. The entrepreneurial intention of the students in the elective courses increased, but this increase was not statistically significant. From the point of view of nascent behavior, the results show that preparation for entrepreneurship in general occurred through the development of a business model using tools such as the *Business Model Canvas*. These students felt more capable of carrying out the activities related to developing a new business, but the courses also showed that "there are several things out of their control" that can prevent them from succeeding as entrepreneurs. Perhaps this is why the perceived behavioral control has not undergone a significant increase after the course.

The students of elective courses showed, in the first data collection (Pre), higher rates of perceived behavioral control, entrepreneurial attitudes and intentions than those of required courses. Even so, the impact of entrepreneurial education on students in elective courses was greater than in required courses, in these and other variables analyzed. A possible explanation of these results is that entrepreneurship elective courses allowed students to acquire knowledge and skills to undertake, showed positive aspects of the entrepreneurial career and even motivated students to prepare for a career as an entrepreneur.

For the students of the required courses, there was negative variation in the indicators of entrepreneurial attitudes, perceived behavioral control and entrepreneurial intention. The research thus corroborates the findings of Oosterbeek et al. (2010) and Von Graevenitz et al. (2010), which showed negative impacts of participation in required entrepreneurship courses on students' entrepreneurial intention. These results are similar to those of Fayolle and Gailly (2015) and Walter and Dohse (2012), who found no significant impacts of entrepreneurship education on some aspects. Reinforcing the findings of Lima et al. (2014), Shinnar et al. (2014) and Oosterbeek et al. (2010), there was no significant impact on entrepreneurial self-efficacy. The null impact on entrepreneurial behavior is aligned with the results of Karimi et al. (2016). The only variable that showed positive variation for students in required courses was nascent entrepreneurial behavior, which was found for students in elective courses.

An important reflection regarding the elective entrepreneurship courses is the fact that students have chosen them themselves, which possibly contributes to having greater interaction with the teachers. As highlighted by Karimi et al. (2016), students of elective courses generally have an interest in entrepreneurial education and seek more knowledge and skills in this subject. With greater motivation, they tend to participate more actively in learning activities than students compelled to do so. In fact, additional questions included in the questionnaire, aimed at characterizing the pedagogical approaches, indicate that the electives surveyed present greater interaction of students with teachers and greater insertion of the teacher in the local entrepreneurship ecosystem, as Table 7 shows.

Experiences in the teaching environment, such as junior companies and academic centers, are considered essential for the success of entrepreneurial education, according to the ecosystem-based perspective (Ribeiro & Plonski, 2020). In line with Curtis et al. (2021), the present study revealed different impacts of entrepreneurship education for groups with higher student interaction with teachers, higher teacher embeddedness in the local entrepreneurship ecosystem, higher course loads, and length of time attended (up to 3rd period or above 3rd period) - the active and experiential learning approach (Lackéus, 2015).

Table 2

Variables adopted and research instruments

continued

Variable	Source	Code	Description	Measurement method
Reasons to become an entrepreneur (1)				
Economic potential	Kolvereid (1996)	RDER1	Opportunity to obtain high financial return.	Likert scale 1-5
Challenge		RDER2	Have an exciting job.	(1-Strongly disagree; 5-Strongly agree)
Independence		RDER3	Be able to choose your own work tasks.	
Independence		RDER4	Be your own boss.	
Authority		RDER5	Have the power to make decisions.	
Own achievement		RDER6	Fulfill your own dreams.	
Follow up work tasks		RDER7	Participate in the complete process of a business, following the work tasks from A to Z.	
Reasons to have a job (2)				
Safety	Kolvereid (1996)	RG01	Have stability at work.	Likert scale 1-5
Leisure		RG02	Have fixed working hours.	(1-Strongly disagree; 5-Strongly agree)
Social environment		RG03	Be a member of a social group.	
Avoiding responsibility		RG04	Avoid responsibility.	
Promotion		RG05	Have opportunities for professional growth through promotions.	
Entrepreneurial attitude	Kolvereid (1996)			[Sum of 1] - [Sum of 2]
Perceived behavioral control	Walter and Dohse (2012)	PBC1	It would be difficult for me to have my own business after finishing my studies.	Likert scale 1-5
		PBC2	If I wanted to, I could certainly conduct my own business after finishing my studies.	(1-Strongly disagree; 5-Strongly agree)
		PBC3	There are many things outside my control that discourage me from having my own business after I finish my studies.	
		PBC4	Whether or not to choose an entrepreneurial career after finishing my studies is my decision.	
Entrepreneurial intention	Walter and Dohse (2012)	CI1	There is no doubt that I will have my own business as soon as possible.	Likert scale 1-5
		CI2	I plan to have my own business within 5 years of finishing my studies.	(1-Strongly disagree; 5-Strongly agree)
		CI3	I plan to have my own business at some point after finishing my studies.	
Subjective social norms	Walter and Dohse (2012)	SN1	People I care about would like me to become an entrepreneur.	Likert scale 1-5
		SN2	I feel that my family and close friends encourage me to become an entrepreneur.	(1-Strongly disagree; 5-Strongly agree)
		SN3	The opinions of people I care about have a big influence on my career choice.	
Entrepreneurial self-efficacy[1]				
Research phase	Cox et al. (2002)	SELF1	Have an idea of an innovative new business.	Likert Scale 1-5
		SELF2	Identify market opportunities for a new business.	(1-No competence; 5-Full competence)
Planning phase		SELF3	Plan a new business.	
		SELF4	Write a formal business plan.	
		SELF5	Develop a business model using tools such as Business Model or Value Proposition Canvas.	
Ordering phase		SELF6	Raise capital to start a business.	
		SELF7	Convince other people or institutions to invest in your business.	
		SELF8	Convince others to work for you in a new business.	
Implementation phase		SELF9	Manage a small business.	
		SELF10	Expand a successful business	

Notes: [1] There were 3 items in the model about fundraising. The item "Convince a bank to lend you money to start a business" was removed, and the other items were adapted. The item on business model was added.
Elaborated by the authors.

Table 2

Variables adopted and research instruments

concluded

Variable	Source	Code	Description	Measurement method
Nascent entrepreneurial behavior				
Business planning[2]	Souitaris et al. (2007) and Alsos and Kolvereid (1998)	AE1	I prepared a business plan.	Check the activities you have already carried out or are currently carrying out for the creation of a new business in the near future (up to 2 years).
		AE2	I designed a business model using tools such as Business Model and Value Proposition Canvas.	
		AE3	I have developed a prototype or minimum viable product.	
		AE4	I organized the management team of the new business.	
		AE5	I searched for facilities and/or equipment.	
		AE6	I acquired facilities and/or equipment.	
		AE7	I developed a product/service.	
		AE8	I conducted market research.	
		AE9	I devoted my entire time to the new business.	
Financing of the new company	Souitaris et al. (2007) and Alsos and Kolvereid (1998)	AE10	I saved money to invest.	
		AE11	I invested my own money.	
		AE12	I applied for a bank loan.	
		AE13	I received a loan from the government.	
		AE14	I requested funding from the government.	
		AE15	I received funding from the government.	
		AE16	I registered the license of a patent.	
		AE17	I hired employees.	
		AE18	I promoted sales.	
Entrepreneurial behavior	Souitaris et al. (2007) and Alsos and Kolvereid (1998)	AE19	I registered a business officially.	Check the activities you have already carried out or are currently carrying out for the creation of a new business in the near future (up to 2 years).
		AE20	I received a first payment from a customer.	
		AE21	I made a positive net income (profit).	
Entrepreneurial knowledge and skills				
Marketing	Chen et al. (1998)	CCM1	Establish the positioning of a product in the market.	Likert Scale 1-5 (1-No competence; 5-Full competence)
		CCM2	Conduct market analysis.	
		CCM3	Expand a business to new markets and geographic territories.	
Innovation	Chen et al. (1998)	CCI1	Generate new ideas and new businesses.	
		CCI2	Identify market opportunities for new products and services.	
		CCI3	Develop new products and services.	
		CCI4	Implement new production, marketing and management methods.	
Management	Chen et al. (1998)	CCG1	Manage my time by setting goals.	
		CCG2	Define and achieve goals and objectives.	
		CCG3	CCG3- Define organizational roles, responsibilities and policies.	
	De Noble et al. (1999)	CCG4	Work productively in situations of continuous stress, pressure and conflict.	
		CCG5	Create a work environment that encourages people to try new things.	
		CCG6	Recruit and train new employees.	
Risk Taking	Chen et al. (1998)	CCAR1	Make decisions in situations of uncertainty and risk.	
		CCAR2	Take calculated risks	
		CCAR3	Take responsibility for ideas and decisions	
Finance	Chen et al (1998)	CCF1	Perform financial analyzes.	
		CCF2	Develop financial system and internal controls.	
		CCF3	Control costs in the management of a business.	
	De Noble et al. (1999)	CCF4	Develop and maintain good relationships with potential investors.	

Notes: [2] The item "I prepared a business model using tools such as Business Model and Value Proposition Canvas" was added.
Elaborated by the authors.

Table 3

Descriptive analysis of the Likert scale items of the model by time for required courses

Construct	Item	Pre			Post		
		Mean	S.D.	CI - 95%[1]	Mean	S.D.	CI - 95%[1]
Reasons to become an entrepreneur	RFER1	4.23	0.72	[4.15; 4.31]	4.19	0.72	[4.11; 4.27]
	RFER2	4.49	0.70	[4.41; 4.56]	4.47	0.72	[4.40; 4.54]
	RFER3	3.48	0.90	[3.38; 3.57]	3.63	0.86	[3.54; 3.72]
	RFER4	3.44	1.10	[3.32; 3.55]	3.43	1.04	[3.32; 3.54]
	RFER5	4.21	0.73	[4.13; 4.28]	4.07	0.86	[3.98; 4.16]
	RFER6	4.79	0.46	[4.74; 4.84]	4.72	0.55	[4.67; 4.78]
	RFER7	3.66	1.05	[3.55; 3.77]	3.66	1.07	[3.54; 3.77]
	Sum	28.30	3.36	[27.94; 28.67]	28.18	3.52	[27.8; 28.54]
Reasons to have a job	RFE1	4.38	0.84	[4.29; 4.46]	4.34	0.81	[4.25; 4.42]
	RFE2	3.15	1.07	[3.03; 3.26]	3.22	1.09	[3.10; 3.34]
	RFE3	3.58	1.13	[3.48; 3.70]	3.60	1.04	[3.49; 3.71]
	RFE4	1.55	0.76	[1.47; 1.63]	1.89	1.00	[1.80; 1.99]
	RFE5	4.42	0.74	[4.34; 4.50]	4.33	0.83	[4.24; 4.41]
	Sum	17.08	2.61	[16.80; 17.34]	17.38	2.81	[17.08; 17.66]
Entrepreneurial attitude		11.22	3.74	[10.85; 11.62]	10.80	3.97	[10.37; 11.22]
Subjective social norms	SN1	3.25	1.21	[3.11; 3.38]	3.17	1.12	[3.05; 3.28]
	SN2	3.02	1.27	[2.88; 3.15]	3.04	1.20	[2.92; 3.15]
	SN3	3.19	1.19	[3.06; 3.32]	3.22	1.11	[3.10; 3.34]
Perceived behavioral control	PBC1	3.20	1.20	[3.09; 3.33]	3.28	1.18	[3.15; 3.40]
	PBC2	3.05	1.22	[2.92; 3.16]	3.04	1.17	[2.92; 3.15]
	PBC3	3.28	1.19	[3.16; 3.39]	3.35	1.09	[3.23; 3.46]
	PBC4	3.97	1.10	[3.86; 4.09]	3.86	1.11	[3.74; 3.97]
Entrepreneurial self-efficacy							
Research phase	SELF1	3.31	0.84	[3.22; 3.40]	3.14	0.99	[3.03; 3.24]
	SELF2	3.38	0.85	[3.29; 3.46]	3.19	0.98	[3.08; 3.29]
Planning phase	SELF3	3.34	0.90	[3.24; 3.43]	3.20	1.01	[3.09; 3.31]
	SELF4	2.96	1.03	[2.84; 3.06]	2.89	1.09	[2.78; 3.00]
	SELF5	2.30	1.13	[2.18; 2.41]	2.88	1.17	[2.76; 3.01]
Ordering phase	SELF6	2.70	1.04	[2.59; 2.81]	2.69	1.04	[2.58; 2.80]
	SELF7	3.11	1.06	[2.99; 3.22]	3.00	1.12	[2.89; 3.12]
	SELF8	3.27	1.03	[3.17; 3.38]	3.13	1.09	[3.03; 3.25]
Implementation phase	SELF9	3.47	1.01	[3.36; 3.57]	3.26	1.09	[3.15; 3.38]
	SELF10	3.15	1.07	[3.04; 3.26]	3.03	1.04	[2.92; 3.13]
Entrepreneurial intention	CI1	2.84	1.33	[2.69; 2.98]	2.80	1.30	[2.66; 2.93]
	CI2	2.91	1.27	[2.77; 3.03]	2.83	1.20	[2.72; 2.96]
	CI3	3.67	1.27	[3.54; 3.80]	3.53	1.22	[3.40; 3.66]
Entrepreneurial knowledge and skills							
Marketing	CCM1	2.99	0.92	[2.89; 3.08]	2.92	1.02	[2.81; 3.03]
	CCM2	3.01	1.01	[2.90; 3.11]	2.98	1.06	[2.85; 3.09]
	CCM3	2.79	1.03	[2.68; 2.89]	2.79	1.05	[2.68; 2.90]
Innovation	CCI1	3.27	0.96	[3.16; 3.37]	3.17	1.06	[3.06; 3.27]
	CCI2	3.25	0.86	[3.15; 3.34]	3.11	0.99	[3.01; 3.21]
	CCI3	3.11	0.89	[3.01; 3.20]	3.04	0.99	[2.94; 3.14]
	CCI4	3.04	1.01	[2.94; 3.15]	3.01	1.07	[2.89; 3.11]
Management	CCG1	3.58	0.97	[3.48; 3.68]	3.38	1.10	[3.26; 3.50]
	CCG2	3.79	0.86	[3.70; 3.89]	3.56	1.06	[3.44; 3.67]
	CCG3	3.56	0.96	[3.46; 3.66]	3.37	1.09	[3.27; 3.48]
	CCG4	3.36	1.02	[3.25; 3.46]	3.15	1.04	[3.04; 3.27]
	CCG5	3.66	0.91	[3.56; 3.76]	3.41	1.06	[3.30; 3.52]
	CCG6	3.39	1.02	[3.28; 3.49]	3.16	1.05	[3.06; 3.27]
Risk taking	CCAR1	3.13	0.94	[3.03; 3.22]	3.10	1.04	[2.99; 3.21]
	CCAR2	3.43	0.96	[3.33; 3.54]	3.31	1.06	[3.20; 3.42]
	CCAR3	3.74	0.90	[3.65; 3.83]	3.54	1.04	[3.44; 3.65]
Finance	CCF1	3.03	1.10	[2.91; 3.14]	3.00	1.09	[2.87; 3.11]
	CCF2	2.85	1.13	[2.72; 2.95]	2.79	1.08	[2.68; 2.90]
	CCF3	3.24	1.04	[3.13; 3.35]	3.08	1.10	[2.97; 3.20]
	CCF4	3.51	1.04	[3.40; 3.62]	3.31	1.12	[3.19; 3.42]

Notes: [1]Bootstrap Interval. Elaborated by the authors.

Table 4

Descriptive analysis of the Likert scale items of the model by time for elective courses

Construct	Item	Pre			Post		
		Mean	S.D.	CI - 95%[1]	Mean	S.D.	CI - 95%[1]
Reasons to become an entrepreneur	RFER1	4.14	0.82	[3.90; 4.35]	4.27	0.78	[4.04; 4.47]
	RFER2	4.35	0.99	[4.06; 4.59]	4.61	0.57	[4.45; 4.78]
	RFER3	3.45	1.02	[3.14; 3.71]	3.82	0.78	[3.59; 4.02]
	RFER4	3.37	1.29	[3.02; 3.71]	3.51	1.00	[3.24; 3.78]
	RFER5	4.41	0.50	[4.29; 4.55]	4.29	0.61	[4.12; 4.45]
	RFER6	4.76	0.60	[4.57; 4.90]	4.76	0.60	[4.59; 4.90]
	RFER7	3.43	1.12	[3.10; 3.74]	3.71	1.06	[3.41; 4.00]
	Sum	27.90	3.76	[26.84; 28.92]	28.96	2.96	[28.12; 29.76]
Reasons to have a job	RFE1	3.98	1.09	[3.67; 4.31]	3.78	1.03	[3.51; 4.06]
	RFE2	2.59	1.04	[2.31; 2.88]	2.73	0.97	[2.45; 3.02]
	RFE3	3.12	1.18	[2.78; 3.43]	3.16	1.20	[2.80; 3.49]
	RFE4	1.43	0.68	[1.24; 1.61]	1.57	0.65	[1.41; 1.73]
	RFE5	4.24	0.92	[3.98; 4.47]	4.16	0.85	[3.92; 4.39]
	Sum	15.37	2.62	[14.61; 16.08]	15.41	2.54	[14.69; 16.10]
Entrepreneurial attitude		12.53	4.12	[11.47; 13.69]	13.55	3.86	[12.43; 14.57]
Subjective social norms	SN1	3.27	1.06	[2.98; 3.57]	3.14	1.21	[2.82; 3.49]
	SN2	3.16	1.11	[2.84; 3.47]	2.90	1.19	[2.59; 3.22]
	SN3	3.08	1.22	[2.73; 3.43]	3.16	1.14	[2.84; 3.47]
Perceived behavioral control	PBC1	2.65	1.25	[2.33; 3.02]	2.78	1.26	[2.43; 3.12]
	PBC2	3.47	1.16	[3.14; 3.80]	3.55	1.10	[3.22; 3.86]
	PBC3	3.20	1.26	[2.86; 3.53]	2.88	1.15	[2.57; 3.20]
	PBC4	3.88	1.15	[3.53; 4.18]	3.94	1.18	[3.61; 4.25]
Entrepreneurial self-efficacy							
Research phase	SELF1	3.41	1.00	[3.12; 3.67]	3.53	0.98	[3.22; 3.80]
	SELF2	3.37	1.01	[3.08; 3.65]	3.78	0.98	[3.49; 4.02]
Planning phase	SELF3	3.27	1.08	[2.96; 3.59]	3.80	0.82	[3.53; 4.00]
	SELF4	2.96	1.04	[2.67; 3.24]	3.51	0.92	[3.24; 3.78]
	SELF5	2.33	1.30	[1.98; 2.69]	3.43	1.19	[3.08; 3.73]
Ordering phase	SELF6	2.02	0.97	[1.76; 2.29]	2.82	0.95	[2.55; 3.08]
	SELF7	2.65	0.97	[2.39; 2.94]	3.27	0.93	[3.00; 3.49]
	SELF8	3.14	0.94	[2.88; 3.41]	3.39	0.98	[3.12; 3.65]
Implementation phase	SELF9	3.35	1.05	[3.04; 3.65]	3.80	0.96	[3.51; 4.06]
	SELF10	3.02	0.99	[2.76; 3.27]	3.43	0.98	[3.16; 3.69]
Entrepreneurial Intention	CI1	3.02	1.28	[2.65; 3.35]	3.18	1.30	[2.80; 3.53]
	CI2	3.08	1.17	[2.78; 3.43]	3.14	1.34	[2.78; 3.51]
	CI3	3.92	1.02	[3.61; 4.18]	3.94	1.21	[3.57; 4.27]
Entrepreneurial knowledge and skills							
Marketing	CCM1	2.94	1.13	[2.61; 3.23]	3.18	1.03	[2.90; 3.49]
	CCM2	3.04	1.17	[2.71; 3.35]	3.53	0.96	[3.27; 3.78]
	CCM3	2.53	0.94	[2.29; 2.80]	3.22	0.92	[2.98; 3.47]
Innovation	CCI1	3.20	0.98	[2.92; 3.45]	3.57	0.98	[3.27; 3.84]
	CCI2	3.29	1.02	[2.98; 3.55]	3.67	0.97	[3.39; 3.92]
	CCI3	3.16	1.07	[2.86; 3.45]	3.69	0.89	[3.41; 3.92]
	CCI4	2.96	1.12	[2.63; 3.27]	3.53	1.12	[3.24; 3.84]
Management	CCG1	3.53	0.77	[3.31; 3.73]	3.55	0.96	[3.29; 3.80]
	CCG2	3.76	0.72	[3.55; 3.96]	3.78	0.94	[3.51; 4.04]
	CCG3	3.53	0.89	[3.31; 3.78]	3.65	0.93	[3.39; 3.92]
	CCG4	3.43	1.04	[3.12; 3.71]	3.55	1.04	[3.24; 3.84]
	CCG5	3.61	1.02	[3.31; 3.90]	3.71	0.89	[3.45; 3.96]
	CCG6	3.24	0.90	[3.00; 3.49]	3.49	0.89	[3.22; 3.73]
Risk taking	CCAR1	3.20	0.89	[2.96; 3.45]	3.57	1.00	[3.29; 3.84]
	CCAR2	3.47	1.02	[3.18; 3.78]	3.82	0.93	[3.57; 4.06]
	CCAR3	3.76	0.90	[3.51; 4.00]	4.02	0.97	[3.75; 4.24]
Finance	CCF1	2.84	1.12	[2.55; 3.16]	3.24	1.15	[2.92; 3.55]
	CCF2	2.63	1.09	[2.35; 2.94]	3.10	1.10	[2.80; 3.41]
	CCF3	3.02	1.07	[2.71; 3.31]	3.45	1.12	[3.12; 3.71]
	CCF4	3.39	1.04	[3.08; 3.67]	3.61	0.95	[3.35; 3.88]

Notes: [1]Bootstrap Interval. Elaborated by the authors.

Table 5

Descriptive analysis of the dichotomous items of the model by time and type of course

Construct	Item		Required				Elective			
			Pre		Post		Pre		Post	
			n	%	n	%	n	%	n	%
Nascent Entrepreneurial Behavior										
Business Planning	AE1	No	316	90.5	302	86.5	39	79.6	34	69.4
		Yes	33	9.5	47	13.5	10	20.4	15	30.6
	AE2	No	342	98.0	310	88.8	45	91.8	38	77.6
		Yes	7	2.0	39	11.2	4	8.2	11	22.4
	AE3	No	327	93.7	300	86.0	40	81.6	39	79.6
		Yes	22	6.3	49	14.0	9	18.4	10	20.4
	AE4	No	337	96.6	332	95.1	46	93.9	44	89.8
		Yes	12	3.4	17	4.9	3	6.1	5	10.2
	AE5	No	335	96.0	330	94.6	46	93.9	43	87.8
		Yes	14	4.0	19	5.4	3	6.1	6	12.2
	AE6	No	339	97.1	338	96.8	47	95.9	48	98.0
		Yes	10	2.9	11	3.2	2	4.1	1	2.0
	AE7	No	321	92.0	310	88.8	39	79.6	36	73.5
		Yes	28	8.0	39	11.2	10	20.4	13	26.5
	AE8	No	330	94.6	318	91.1	46	93.9	38	77.6
		Yes	19	5.4	31	8.9	3	6.1	11	22.4
	AE9	No	342	98.0	338	96.8	48	98.0	47	95.9
		Yes	7	2.0	11	3.2	1	2.0	2	4.1
Financing of the new company	AE10	No	292	83.7	308	88.3	39	79.6	40	81.6
		Yes	57	16.3	41	11.7	10	20.4	9	18.4
	AE11	No	316	90.5	322	92.3	40	81.6	39	79.6
		Yes	33	9.5	27	7.7	9	18.4	10	20.4
	AE12	No	348	99.7	348	99.7	49	100.0	49	100.0
		Yes	1	0.3	1	0.3	0	0.0	0	0.0
	AE13	No	348	99.7	349	100.0	49	100.0	49	100.0
		Yes	1	0.3	0.0	0.0	0	0.0	0	0.0
	AE14	No	349	100.0	348	99.7	49	100.0	49	100.0
		Yes	0	0.0	1	0.3	0	0.0	0	0.0
	AE15	No	349	100.0	349	100.0	49	100.0	49	100.0
		Yes	0	0.0	0.0%	0.0	0	0.0	0	0.0
	AE16	No	348	99.7	346	99.1	48	98.0	48	98.0
		Yes	1	0.3	3	0.9	1	2.0	1	2.0
	AE17	No	346	99.1	346	99.1	49	100.0	49	100.0
		Yes	3	0.9	3	0.9	0	0.0	0	0.0
	AE18	No	334	95.7	339	97.1	46	93.9	44	89.8
		Yes	15	4.3	10	2.9	3	6.1	5	10.2
Entrepreneurial Behavior	AE19	No	347	99.4	344	98.6	46	93.9	47	95.9
		Yes	2	0.6	5	1.4	3	6.1	2	4.1
	AE20	No	335	96.0	335	96.0	40	81.6	44	89.8
		Yes	14	4.0	14	4.0	9	18.4	5	10.2
	AE21	No	334	95.7	334	95.7	45	91.8	45	91.8
		Yes	15	4.3	15	4.3	4	8.2	4	8.2

Note: Elaborated by the authors.

Table 6

Comparison of model indicators between times by type of course

Construct		Required	Elective
		Mean (Standard-Error)	Mean (Standard-Error)
Entrepreneurial Attitudes	Post	-0.23 (0.05)	0.46 (0.14)
	Pre	-0.12 (0.05)	0.21 (0.15)
	p-value	**0.014**	**0.046**
Perceived Behavior Control	Post	-0.15 (0.05)	0.33 (0.14)
	Pre	-0.09 (0.05)	0.25 (0.14)
	p-value	**0.069**	0.359
Subjective Social Norms	Post	-0.14 (0.05)	-0.21 (0.14)
	Pre	-0.11 (0.05)	-0.04 (0.12)
	p-value	0.351	0.360
Entrepreneurial Intention	Post	-0.18 (0.05)	0.15 (0.15)
	Pre	-0.1 (0.05)	0.08 (0.13)
	p-value	**0.033**	0.519
Nascent Entrepreneurial Behavior	Post	-0.12 (0.05)	0.37 (0.16)
	Pre	-0.23 (0.04)	0.07 (0.12)
	p-value	**0.007**	**0.089**
Entrepreneurial Behavior	Post	-0.11 (0.04)	0.14 (0.17)
	Pre	-0.13 (0.04)	0.33 (0.21)
	P-value	0.597	0.390
Entrepreneurial Self-efficacy	Post	-0.10 (0.05)	0.36 (0.11)
	Pre	0 (0.04)	-0.13 (0.11)
	p-value	0.369	**<0.001**
Knowledge and Skills	Post	-0.14 (0.05)	0.37 (0.12)
	Pre	0 (0.04)	-0.06 (0.11)
	p-value	0.294	**0.000**

Note: Elaborated by the authors.

The elective courses, whose students are above the third term of the course and whose workloads are greater than those of the required courses, probably allowed a greater depth in the practical activities carried out, aimed at the creation of a new real business, in a more interactive way between teacher, monitors and students. The extensive course load, with a larger part of it dedicated to the entrepreneurship project, highlights the complexity of entrepreneurship education, which seems to require maturation time for experiential learning cycles. Previous literature (Lackéus, 2020) corroborates the understanding that the strongest effects come from hands-on, experiential approaches oriented toward learning by doing, i.e., the "hands-on" approach. It is noteworthy that most of the students of the required courses were in the 1st term of their programs. The maturity of these students is usually lower. Many “freshmen” are focused on achieving approval for technical courses and do not engage adequately in other courses. Without proper commitment, the results achieved tend to be lower. However, a greater number of variables presented statistically more significant results in the comparison between elective and required courses than in the comparison between other groups (greater or less interaction of students with the teacher, workload, term, insertion of the teacher in the local entrepreneurship ecosystem).

CONCLUSIONS

The present study aims to evaluate the impacts of entrepreneurial education on students of entrepreneurship courses at the undergraduate level of Brazilian universities. Thus, it addresses a relevant knowledge gap in this field, namely the dilemma of the effectiveness of entrepreneurship education. Sustained by conflicting and not always comparable empirical results (Nabi et al., 2017), this dilemma means that doubts remain about the best ways to foster entrepreneurship. The present study showed that elective entrepreneurship courses had greater positive impacts on the analyzed constructs (i.e., perceived behavioral control, entrepreneurial attitudes, entrepreneurial intention, and nascent entrepreneurial behavior) than required ones. Interestingly, required subjects negatively impacted entrepreneurial attitudes and intention, as well as perceived behavioral control; and increased only nascent entrepreneurial behavior.

Based on the TPB, the present study expands our theoretical understanding by incorporating entrepreneurial knowledge and skills into established models of entrepreneurship within the scope of educational interventions. It thus responds to the call of Lortie and Castogiovanni (2015) to expand the TPB's background by integrating new constructs to explain entrepreneurial intention. For the application in the field of entrepreneurship, this is a key addition to the theory, in order to take into account an expanded understanding of entrepreneurial education that goes beyond the establishment of new businesses as the sole objective (Curtis et al., 2021; Lackéus, 2020). In addition, this study offers an important methodological contribution, as it performs a comparative analysis of several entrepreneurship courses through a robust empirical strategy, before and after education intervention (Rideout & Gray, 2013). Studies on the impacts of entrepreneurial education in Brazilian higher education had been restricted to post-intervention approaches and in a single course (Ribeiro & Plonski, 2020).

From a practical point of view, the results provide relevant insights for government agencies that formulate education and entrepreneurship policies and for universities that implement entrepreneurial education. The central message suggests that entrepreneurship courses should be offered on an elective basis, as their effectiveness depends to a large extent on students' intrinsic motivation. That is, required "mass" entrepreneurial education for students in the first stages of their undergraduate studies proved to be ineffective. It is worth noting, however, as a limitation of the present study, that the course load, the interaction of students with teachers and the insertion of teachers in the local entrepreneurship ecosystem of the required courses analyzed are lower, which may also have contributed to the lower impacts of these courses. Thus, the present study does not allow the conclusion that required courses that encourage students to know more and be interested in entrepreneurship are inefficient, but it challenges universities to reflect on the validity of maintaining entrepreneurship courses as required without due practical knowledge, interaction with teachers and insertion into the local entrepreneurship ecosystem.

Other limitations of the present study are the use of students' perceptions (subjective indicators) to measure the impacts of entrepreneurial education and the fact that the sample is not representative of entrepreneurship courses in Brazilian universities. In addition, the impacts were measured soon after the end of the courses, which does not always reflect the long-term impacts. It is possible that, only after a few years, students realize that the entrepreneurship course helped them develop their entrepreneurial intentions, behaviors and self-efficacies.

Conducting a third data collection, especially with students from the required courses in the sample, could contribute to a better understanding of the long-term impacts of entrepreneurship education. It would be interesting to apply the questionnaire in classes taught by the same teacher, with the same methodology, the same course load and at the same university, with a difference only in the type of course. Future studies that further clarify the differences (demographic and psychological) between students would represent a significant advance as well. Finally, the teaching of entrepreneurship does not occur only through courses, but also in conjunction with other resources offered by the institutional

Table 7

Descriptive analysis and comparison of teaching methods by type of course in the students' view

Variables		Required	Elective	p[1]-value	Variables		Required	Elective	p[1]-value
		n - %	n - %				n - %	n - %	
Lectures by the teacher(s) focused on theory without much interaction with the students	No time dedicated	62 - 27.8	16 - 38.1	0.066	Practical activities carried out individually in class	No time dedicated	79 - 46.7	14 - 43.8	0.612
	Between 0 and 20% of class time	51 - 22.9	7 - 16.7			Between 0 and 20% of class time	33 - 19.5	7 - 21.9	
	Between 21 and 40% of class time	57 - 25.6	12 - 28.6			Between 21 and 40% of class time	30 - 17.8	4 - 12.5	
	Between 41 and 60% of class time	36 - 16.1	1 - 2.4			Between 41 and 60% of class time	18 - 10.7	3 - 9.4	
	Between 61 and 80% of class time	17 - 7.6	6 - 14.3			Between 61 and 80% of class time	9 - 5.3	4 - 12.5	
	Between 81 and 100% of class time	0 - 0.0	0 - 0.0			Between 81 and 100% of class time	0 - 0.0	0 - 0.0	
Lectures by the teacher(s) with much interaction with students	No time dedicated	41 - 18.2	9 - 20	0.499	Student presentations of group work on the development of a model or a business plan (Pitch)	No time dedicated	79 - 40.7	22 - 51.2	0.743
	Between 0 and 20% of class time	60 - 26.7	8 - 17.8			Between 0 and 20% of class time	43 - 22.2	8 - 18.6	
	Between 21 and 40% of class time	55 - 24.4	11 - 24.4			Between 21 and 40% of class time	35 - 18.0	5 - 11.6	
	Between 41 and 60% of class time	47 - 20.9	9 - 20			Between 41 and 60% of class time	26 - 13.4	6 - 14	
	Between 61 and 80% of class time	22 - 9.8	8 - 17.8			Between 61 and 80% of class time	11 - 5.7	2 - 4.7	
	Between 81 and 100% of class time	0 - 0.0	0 - 0.0			Between 81 and 100% of class time	0 - 0.0	0 - 0.0	
Discussion on content of entrepreneurship books	No time dedicated	52 - 36.4	17 - 45.9	0.688	Student presentations - analysis of articles or books on entrepreneurship defined by the teacher	No time dedicated	57 - 42.9	8 - 36.4	0.856
	Between 0 and 20% of class time	34 - 23.8	8 - 21.6			Between 0 and 20% of class time	27 - 20.3	6 - 27.3	
	Between 21 and 40% of class time	28 - 19.6	8 - 21.6			Between 21 and 40% of class time	32 - 24.1	4 - 18.2	
	Between 41 and 60% of class time	19 - 13.3	3 - 8.1			Between 41 and 60% of class time	10 - 7.5	2 - 9.1	
	Between 61 and 80% of class time	10 - 7.0	1 - 2.7			Between 61 and 80% of class time	7 - 5.3	2 - 9.1	
	Between 81 and 100% of class time	0 - 0.0	0 - 0.0			Between 81 and 100% of class time	0 - 0.0	0 - 0.0	
Discussion of case studies	No time dedicated	67 - 33	13 - 31.0	0.909	Discussion and interaction between students and teachers to gain knowledge and clarification of questions	No time dedicated	82 - 39.4	14 - 34.1	0.159
	Between 0 and 20% of class time	40 - 19.7	9 - 21.4			Between 0 and 20% of class time	48 - 23.1	6 - 14.6	
	Between 21 and 40% of class time	45 - 22.2	11 - 26.2			Between 21 and 40% of class time	46 - 22.1	8 - 19.5	
	Between 41 and 60% of class time	35 - 17.2	5 - 11.9			Between 41 and 60% of class time	19 - 9.1	8 - 19.5	
	Between 61 and 80% of class time	16 - 7.9	4 - 9.5			Between 61 and 80% of class time	13 - 6.3	5 - 12.2	
	Between 81 and 100% of class time	0 - 0.0	0 - 0.0			Between 81 and 100% of class time	0 - 0.0	0 - 0.0	
Lectures by entrepreneurs	No time dedicated	82 - 37.6	13 - 28.9	0.162	Visits to external institutions (e.g.: technology parks, entrepreneurs, potential investors)	No time dedicated	48 - 48.5	5 - 45.5	0.264
	Between 0 and 20% of class time	58 - 26.6	8 - 17.8			Between 0 and 20% of class time	20 - 20.2	1 - 9.1	
	Between 21 and 40% of class time	47 - 21.6	16 - 35.6			Between 21 and 40% of class time	19 - 19.2	5 - 45.5	
	Between 41 and 60% of class time	18 - 8.3	3 - 6.7			Between 41 and 60% of class time	7 - 7.1	0 - 0.0	
	Between 61 and 80% of class time	13 - 6.0	5 - 11.1			Between 61 and 80% of class time	5 - 5.1	0 - 0.0	
	Between 81 and 100% of class time	0 - 0.0	0 - 0.0			Between 81 and 100% of class time	0 - 0.0	0 - 0.0	
Lectures by experts on specific entrepreneurship topics (e.g., innovation, leadership, creativity, people management)	No time dedicated	91 - 44.4	12 - 31.6	0.422	Student interaction with the teacher(s)	Very low	10 - 4.2	4 - 8.7	0.008
	Between 0 and 20% of class time	42 - 20.5	8 - 21.1			Low	32 - 13.6	1 - 2.2	
	Between 21 and 40% of class time	45 - 22.0	9 - 23.7			Average	87 - 36.9	12 - 26.1	
	Between 41 and 60% of class time	17 - 8.3	5 - 13.2			High	85 - 36.0	18 - 39.1	
	Between 61 and 80% of class time	10 - 4.9	4 - 10.5			Extensive	22 - 9.3	11 - 23.9	
	Between 81 and 100% of class time	0 - 0.0	0 - 0.0		Insertion of the teacher into the ecosystem Local Entrepreneurship	Very low	23 - 9.7	4 - 8.7	0.004
Practical activities carried out in the classroom in groups (ex: elaboration in the Canvas of a classroom business)	No time dedicated	51 - 23.8	10 - 23.3	0.634		Low	48 - 20.3	4 - 8.7	
	Between 0 and 20% of class time	58 - 27.1	14 - 32.6			Average	89 - 37.7	12 - 26.1	
	Between 21 and 40% of class time	50 - 23.4	6 - 14.0			High	65 - 27.5	18 - 39.1	
	Between 41 and 60% of class time	39 - 18.2	8 - 18.6			Extensive	11 - 4.7	8 - 17.4	
	Between 61 and 80% of class time	16 - 7.5	5 - 11.6		Teacher encouragement to participate in extracurricular events on entrepreneurship	Very low	29 - 12.3	4 - 8.7	0.635
	Between 81 and 100% of class time	0 - 0.0	0 - 0.0			Low	44 - 18.6	6 - 13	
						Average	68 - 28.8	12 - 26.1	
						High	61 - 25.8	16 - 34.8	
						Extensive	34 - 14.4	8 - 17.4	

Notes: [1]Simulated Chi-Square Test. Elaborated by the authors.

environment (Ribeiro & Plonski, 2020). New studies that adopt a holistic logic of analysis, addressing emphases of entrepreneurship rather than courses, can advance knowledge on the topic in the country.

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Conflit of interest statement

The authors declare that there is no conflict of interest.

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Endnotes:

1 Among higher education students in Brazil, 5.7% already undertake (entrepreneurs), 21% think about undertaking in the future (potential entrepreneurs) and 73.3% of students do not intend to open a business (non-entrepreneurs) (Sebrae and Endeavor, 2016).

2 Averages weighted by the number of responding students of each course.

Authors' statement of individual contributions

Roles	Contributions			
	Arruda C.	Burcharth A. L. L. A.	Barcellos E. P.	Lourencini S. P.
Conceptualization	■	■	■	
Methodology		■	■	
Software			■	■
Validation	■		■	
Formal analysis			■	
Investigation			■	■
Resources	■			
Data Curation			■	■
Writing - Original Draf			■	■
Writing - Review & Editing		■	■	■
Visualization		■	■	
Supervision	■	■		
Project administration	■			
Funding acquisition	■	■		

Note: Acc. CRediT (Contributor Roles Taxonomy): https://credit.niso.org/

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Appendix A

Validation of the overall measurement model (factor loadings of the items for each construct and the analyses of convergent validity, discriminant validity, dimensionality and reliability of the constructs of the measurement model)

Constructs	Items	Initial model				Final model			
		F.C.[1]	Com.[2]	Weight	C.I. 95%[3]	F.C.[1]	Com.[2]	Weight	C.I. 95%[3]
Entrepreneurial Attitudes		1.00	1.00	1.00	[1.00; 1.00]	1.00	1.00	1.00	[1.00; 1.00]
Subjective Social Norms	SN1	0.94	0.88	0.54	[0.51; 0.56]	0.94	0.89	0.55	[0.53; 0.57]
	SN2	0.93	0.86	0.50	[0.48; 0.52]	0.93	0.87	0.52	[0.50; 0.54]
	SN3	0.30	0.09	0.10	[0.04; 0.15]	-	-	-	-
Perceived Behavioral Control	PBC1	0.84	0.71	0.42	[0.38; 0.45]	0.84	0.71	0.42	[0.39; 0.45]
	PBC 2	0.82	0.68	0.41	[0.38; 0.45]	0.82	0.68	0.41	[0.38; 0.45]
	PBC 3	0.69	0.48	0.32	[0.28; 0.36]	0.69	0.48	0.32	[0.28; 0.36]
	PBC 4	0.48	0.23	0.19	[0.14; 0.23]	0.48	0.23	0.19	[0.15; 0.23]
Marketing	CCM1	0.87	0.76	0.37	[0.36; 0.38]	0.87	0.76	0.37	[0.36; 0.38]
	CCM2	0.90	0.81	0.37	[0.37; 0.38]	0.90	0.81	0.37	[0.37; 0.38]
	CCM3	0.89	0.80	0.38	[0.37; 0.39]	0.89	0.80	0.38	[0.37; 0.39]
Innovation	CCI1	0.88	0.78	0.28	[0.27; 0.29]	0.88	0.78	0.28	[0.27; 0.29]
	CCI2	0.90	0.81	0.31	[0.30; 0.31]	0.90	0.81	0.31	[0.30; 0.31]
	CCI3	0.89	0.79	0.28	[0.28; 0.29]	0.89	0.79	0.28	[0.28; 0.29]
	CCI4	0.82	0.68	0.28	[0.27; 0.29]	0.82	0.68	0.28	[0.27; 0.29]
Management	CCG1	0.82	0.68	0.19	[0.18; 0.20]	0.82	0.68	0.19	[0.18; 0.20]
	CCG2	0.88	0.77	0.21	[0.21; 0.22]	0.88	0.77	0.21	[0.21; 0.22]
	CCG3	0.85	0.72	0.20	[0.19; 0.21]	0.85	0.72	0.20	[0.19; 0.21]
	CCG4	0.78	0.60	0.18	[0.17; 0.19]	0.78	0.60	0.18	[0.17; 0.19]
	CCG5	0.84	0.71	0.21	[0.21; 0.22]	0.84	0.71	0.21	[0.21; 0.22]
	CCG6	0.81	0.66	0.21	[0.20; 0.22]	0.81	0.66	0.21	[0.20; 0.22]
Risk Taking	CCAR1	0.90	0.81	0.37	[0.36; 0.38]	0.90	0.81	0.37	[0.36; 0.38]
	CCAR2	0.92	0.84	0.37	[0.36; 0.38]	0.92	0.84	0.37	[0.36; 0.38]
	CCAR3	0.90	0.81	0.37	[0.36; 0.38]	0.90	0.81	0.37	[0.36; 0.38]
Finance	CCF1	0.91	0.83	0.27	[0.27; 0.28]	0.91	0.83	0.27	[0.27; 0.28]
	CCF2	0.90	0.82	0.27	[0.26; 0.28]	0.90	0.82	0.27	[0.26; 0.28]
	CCF3	0.92	0.85	0.29	[0.28; 0.30]	0.92	0.85	0.29	[0.28; 0.30]
	CCF4	0.80	0.64	0.30	[0.29; 0.31]	0.80	0.64	0.30	[0.29; 0.31]
Employment Prospects		1.00	1.00	1.00	[1.00; 1.00]	1.00	1.00	1.00	[1.00; 1.00]
Family Commitments	FAMC1	0.14	0.02	-0.67	[-0.95; 1.13]	-	-	-	-
	FAMC2	-0.81	0.65	1.13	[-0.95; 1.16]	1.00	1.00	1.00	[1.00; 1.00]
Entrepreneurial Self-efficacy (Research Phase)	SELF1	0.91	0.83	0.52	[0.51; 0.53]	0.91	0.83	0.52	[0.51; 0.53]
	SELF2	0.92	0.85	0.57	[0.55; 0.58]	0.92	0.86	0.57	[0.55; 0.58]
Entrepreneurial Self-efficacy (Planning Phase)	SELF3	0.88	0.77	0.45	[0.44; 0.47]	0.88	0.77	0.45	[0.44; 0.47]
	SELF4	0.90	0.80	0.40	[0.39; 0.41]	0.90	0.80	0.40	[0.39; 0.41]
	SELF5	0.78	0.61	0.32	[0.31; 0.34]	0.78	0.61	0.32	[0.31; 0.34]
Entrepreneurial Self-efficacy (Ordering Phase)	SELF6	0.83	0.69	0.36	[0.35; 0.37]	0.83	0.69	0.36	[0.35; 0.37]
	SELF7	0.92	0.85	0.39	[0.38; 0.40]	0.92	0.85	0.39	[0.38; 0.40]
	SELF8	0.89	0.79	0.39	[0.38; 0.40]	0.89	0.79	0.39	[0.38; 0.40]
Entrepreneurial Self-efficacy (Implementation Phase)	SELF9	0.93	0.87	0.52	[0.51; 0.53]	0.93	0.87	0.52	[0.51; 0.53]
	SELF10	0.94	0.88	0.55	[0.54; 0.56]	0.94	0.88	0.55	[0.54; 0.56]
Entrepreneurial Intention	BI1	0.89	0.79	0.38	[0.37; 0.40]	0.89	0.78	0.38	[0.36; 0.39]
	BI2	0.90	0.81	0.40	[0.38; 0.41]	0.90	0.82	0.40	[0.38; 0.41]
	BI3	0.87	0.75	0.35	[0.34; 0.37]	0.87	0.75	0.36	[0.34; 0.37]
Nascent Entrepreneurial Behavior		1.00	1.00	1.00	[1.00; 1.00]	1.00	1.00	1.00	[1.00; 1.00]
Entrepreneurial Behavior		1.00	1.00	1.00	[1.00; 1.00]	1.00	1.00	1.00	[1.00; 1.00]

Notes: [1] Factor Load; [2]Commonality; [3] Bootstrap Interval. Elaborated by the authors.

Constructs	Itens	C.A.[1]	C.R[2]	Dim. [3]	EVA[4]	M.S.V.[5]
Entrepreneurial Attitudes	1	1.00	1.00	1.00	1.00	0.22
Subjective Social Norms	2	0.86	0.93	1.00	0.88	0.25
Perceived Behavioral Control	4	0.69	0.81	1.00	0.52	0.21
Entrepreneurial Knowledge and Skills (Marketing)	3	0.87	0.92	1.00	0.79	0.57
Entrepreneurial Knowledge and Skills (Innovation)	4	0.90	0.93	1.00	0.77	0.66
Entrepreneurial Knowledge and Skills (Management)	6	0.91	0.93	1.00	0.69	0.56
Entrepreneurial Knowledge and Skills (Risk Taking)	3	0.89	0.93	1.00	0.82	0.56
Entrepreneurial Knowledge and Skills (Finance)	4	0.91	0.94	1.00	0.79	0.53
Employment Prospects	1	1.00	1.00	1.00	1.00	0.15
Family Commitments	1	1.00	1.00	1.00	1.00	0.15
Entrepreneurial Self-efficacy (Research Phase)	2	0.81	0.92	1.00	0.84	0.66
Entrepreneurial Self-efficacy (Planning Phase)	3	0.81	0.89	1.00	0.73	0.53
Entrepreneurial Self-efficacy (Ordering Phase)	3	0.86	0.91	1.00	0.78	0.56
Entrepreneurial Self-efficacy (Implementation Phase)	2	0.86	0.93	1.00	0.88	0.56
Entrepreneurial Intention	3	0.86	0.92	1.00	0.78	0.25
Nascent Entrepreneurial Behavior	1	1.00	1.00	1.00	1.00	0.12
Entrepreneurial Behavior	1	1.00	1.00	1.00	1.00	0.31

Notes: [1]Cronbach's alpha, [2]Composite Reliability, [3]Dimensionality, [4]Extracted Variance; [5]Maximum Shared Variance. Elaborated by the authors.