



## The effect of entrepreneurship education on the determinants of entrepreneurial behaviour among higher education students: A multi-group analysis

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### ARTICLE INFO

#### Article History:

Received 7 February 2022

Accepted 1 January 2023

Available online 11 January 2023

#### Keywords:

Entrepreneurship; entrepreneurial alertness

Opportunity recognition

Entrepreneurial motivation

Entrepreneurial intention

Entrepreneurial behavior

Entrepreneurship education

### ABSTRACT

Entrepreneurship is generally considered the engine of social and economic development. Therefore, its promotion is of the utmost importance, especially in a context of crisis, such as the one currently experienced due to the COVID-19 pandemic. In order to identify the best approaches to foster entrepreneurship, this study aims to understand how entrepreneurship education impacts the development of entrepreneurial skills and behaviors in students. The results of this study show that the behavior associated with promoting new ventures can be predicted by specific individual characteristics. More specifically, individuals with greater prior knowledge, entrepreneurial alertness, opportunity recognition, entrepreneurial motivation, and entrepreneurial intention exhibit greater entrepreneurial behavior. In addition, the results of the multi-group analysis indicate that the proposed model works differently in students with some type of entrepreneurship training and in those with none. More specifically, students enrolled in entrepreneurship education are more likely to use prior knowledge and alertness to recognize new business opportunities and align their motivations toward starting a new venture than other students.

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### Introduction

Despite the different definitions found in the literature, entrepreneurship is usually defined as an individual's ability to turn ideas into viable new ventures. For this reason, entrepreneurship has been acknowledged as a key driver of economic growth (Badri & Hachicha, 2019; De Vita, Mari & Poggesi, 2014; Welsh, Memili & Kaciak, 2016), thereby having a significant impact on society.

Over the years, several public policies have been implemented in both developed and developing countries to foster entrepreneurship, such as the promotion of entrepreneurship education. However, studies are reporting conflicting findings regarding the impact of entrepreneurship education on students. On the one hand, some researchers argue that entrepreneurship education has an impact on the propensity of students to start a business; however, the extent to which education enables students to become more effective entrepreneurs is still unclear (Cope, Pittaway, Cope & Pittaway, 2007). On the other hand, other studies report that entrepreneurship education

programs are often surprisingly ineffective in helping the adult population (e.g., university students) to recognize the opportunities that foster start-up behavior (Oosterbeek, van Praag & Ijsselstein, 2010). These divergent results represent a relevant gap in the literature, which motivated the present study. In addition, a deeper analysis of how entrepreneurship education affects students' skills and intentions to start a business should enable policymakers to boost entrepreneurship (Volery, Müller, Oser, Naepflin & del Rey, 2013). Thus, the present study aims at understanding if the behavior associated with promoting a new venture can be predicted by specific individual traits, namely, prior knowledge, entrepreneurial alertness, opportunity recognition, entrepreneurial motivation, and entrepreneurial intention, and whether entrepreneurship education influences these traits. In doing so, the present study answers the call of Yi and Duval-Couetil (2021) for more rigorous research to measure the impact of entrepreneurship education. Considering that the world is currently facing the economic and social consequences of the COVID-19 pandemic, it is even more relevant to promote entrepreneurship, as the creation of new companies is crucial to relaunch the economies of the countries affected by the pandemic.

The present study builds on previous studies in three novel ways that contribute to the entrepreneurship research field. First, it

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examines all constructs in tandem, thereby providing a clearer understanding of the competencies that influence students' entrepreneurial behavior. Second, it explores the relationship between entrepreneurial alertness and the development of specific personal motivations, which is yet to be studied in the literature. By studying the effect of entrepreneurial alertness on entrepreneurial motivations, the present study provides a new perspective in comparison to previous studies that were focused either on intrinsic or extrinsic motivators and did not consider how these interact and depend on each other. Third, the comprehensive model of the present study has been tested using a multi-group approach that provides evidence of the differences between the models for two different groups: students enrolled in entrepreneurship education and those who were not. This model has not only provided more data on how to promote entrepreneurial behavior but also on the complementary aspects of different variables, i.e., how they impact each other and ultimately impact entrepreneurial behavior.

## Literature review and hypotheses

### *Relationship between prior knowledge, opportunity recognition, and entrepreneurial alertness*

According to Ardichvili and Cardozo (2000), prior knowledge refers to an individual's accumulated knowledge and information based on their job experience, non-work-related experience, and relevance of business education. Several studies have reported the effects of prior knowledge on opportunity recognition. For instance, Veilleux, Beliveau and Haskell (2018) examined the relationship between prior knowledge and opportunity recognition among five start-ups and five high-growth technology firms specialized in photonics located in Canada. They concluded that opportunity recognition is reinforced by the personal characteristics of entrepreneurial teams. Similarly, Kraus, Niemand, Angelsberger, Mas-Tur and Roig-Tierno (2017) analyzed survey data from 623 international business firms with headquarters in Germany, Austria, Switzerland, and Liechtenstein. The findings of the study suggest a strong relationship between prior international knowledge and international opportunity recognition.

However, other studies reported opposite results, such as Bhagavatula, Elfring, van Tilburg and van de Bunt's (2010) study involving a sample of Indian master weavers. These researchers found that individuals with higher levels of experience can mobilize more resources, but this experience has a detrimental effect on the recognition of opportunities since it leads to higher levels of network restriction or closure. Also, Ortega Álvarez, García Merino and Santos Álvarez (2015) demonstrated that a profit-seeking entrepreneur without prior institutional affiliation or experience can identify business opportunities which meet industry standards and regulations. Despite these studies, there is a general agreement that entrepreneurs discover opportunities related to the information that they already possess (Shane, 2000).

In turn, several studies have reported the effect of prior knowledge on entrepreneurial alertness (Arentz, Sautet & Storr, 2013; Li, Wang & Liang, 2015; Tang, Kacmar & Busenitz, 2012). For example, Arentz et al. (2013) studied the role of prior knowledge in the identification of opportunities in a controlled setting consisting of a computerized laboratory employing 64 students from George Mason University. The purpose was to analyze whether the entrepreneurs' ability to recognize their prior knowledge would influence opportunity recognition during the experiment. They concluded that the students who had acquired prior knowledge through previous treatment were more oriented toward the opportunity within the experiment.

In another research, Park, Sung and Im (2017) collected data from 177 respondents consisting of CEOs and team leaders from

entrepreneurial firms with less than five years of operation that had originated from business incubation centers. The authors concluded that prior knowledge positively impacts entrepreneurial alertness among entrepreneurs. Based on the above-discussed arguments, the following hypotheses were established:

**H1.** Prior knowledge has a positive and significant impact on opportunity recognition among university students.

**H2.** Prior knowledge has a positive and significant impact on entrepreneurial alertness among university students.

### *Relationship between entrepreneurial alertness, opportunity recognition, and entrepreneurial motivation*

According to Kirzner (1979, p. 48), entrepreneurial alertness refers to the "ability to notice without search opportunities that have hitherto been overlooked". Thus, alertness is "the degree to which decision-makers sense and anticipate entrepreneurial opportunities associated with the current and future states of their business environment [and] is part of a key mechanism through which entrepreneurial opportunities are recognized, constructed, and acted upon" (Roundy, Harrison, Khavul, Pérez-Nordtvedt & McGee, 2018, p. 192).

Several authors (e.g., Ardichvili, Cardozo, & Ray, 2003; Baron, 2006; Sharma, 2019; Tang et al., 2012) have studied the role of entrepreneurial alertness in the process of opportunity recognition. For example, Zanella, Solano, Hallam and Guda (2019) verified a positive relationship between individual alertness and opportunity identification after surveying 276 managers and founders of small and medium enterprises (SMEs) located in Mexico. This relationship was mediated by firms' strategic posture. Also, Hajizadeh and Zali (2016) concluded that entrepreneurial alertness has a positive impact on opportunity recognition after studying 64 nanotechnology firms located in Tehran, Iran. In sum, entrepreneurial alertness is relevant for entrepreneurs to acquire (scan and search), organize (associate and connect), and interpret (evaluate and judge) the information needed to recognize new opportunities (Tang et al., 2012). So, entrepreneurially alert people are more likely to recognize a profitable opportunity (Boudreaux, Nikolaev & Klein, 2019).

According to Kirzner's theory, alertness is also defined as "a motivated propensity of man to formulate an image of the future" (Kirzner, 1985, p. 56). 'Motivated propensity' is explained as the energization and direction of the behavior of individuals toward the desired stimulus. According to Santos and García (2011), the motivational orientation of entrepreneurs in the case of international opportunities changes as they gain experience, which simultaneously changes their alertness and their information concerns. Furthermore, Santos and García (2011) also observed that entrepreneurs display a range of different motivations and distinct states of alertness. So, there is a strong concomitance between entrepreneurial alertness and motivation.

Obschonka, Hakkarainen, Lonka and Salmela-Aro (2017) studied the role of personality characteristics and age-appropriate entrepreneurial competencies (leadership, self-esteem, creativity, and proactivity motivation) in the prediction of entrepreneurial alertness and career intention by surveying 523 students from high schools in Helsinki, Finland. They concluded that the effects of personality on alertness were mediated by leadership and proactivity motivation. They also concluded that highly motivated students who emphasize their academic achievements might not develop a strong entrepreneurial motivation. Their results also showed that after controlling for the effect of personality and/or competence factors, entrepreneurial alertness and entrepreneurial intention are independent career development constructs.

Similarly, Tang (2009) researched the individual and environmental factors shaping entrepreneurial alertness using data from a sample of 365 nascent entrepreneurs located in the United States that

were collected from the Panel Study of Entrepreneurial Dynamics (PSED). This author found a positive relationship between achievement motivation and entrepreneurial alertness in nascent entrepreneurs when focusing on job promotion. According to the regulatory focus theory, focus on job promotion may serve as a strong motivation for entrepreneurs to stay alert to market opportunities. Therefore, based on these arguments, the following hypotheses were proposed:

**H3.** Entrepreneurial alertness has a positive and significant impact on opportunity recognition among university students.

**H3a.** Entrepreneurial alertness mediates the path between prior knowledge and opportunity recognition.

**H4.** Entrepreneurial alertness has a positive and significant impact on entrepreneurial motivation among university students.

#### *Relationship between entrepreneurial motivation, opportunity recognition, and entrepreneurial intention*

Aldrich and Zimmer (1986, p. 3) suggested that entrepreneurial activity “can be conceptualized as a function of opportunity structures and motivated entrepreneurs with access to resources”. Researchers have studied personal motivations and how they impact entrepreneurship, namely through opportunity identification and new venture formation (Ruven & Leonie, 2018), since developing entrepreneurship theories requires considering a person's motivation when making entrepreneurial decisions and how differences in motivation influence the entrepreneurial process (Shane, Locke & Collins, 2003). For example, an individual's perception of risk and opportunities can influence their decision to start a new venture (Shane & Venkataraman, 2000). In this case, even if personal motivation is caused by different factors, it ultimately comes from either inside one's self (high emotional feelings when launching new firms) or one's external environment (admiration from society or money received from ventures). Therefore, motivation can either be intrinsic or extrinsic (Carsrud, Brännback, Elfving & Brandt, 2009). Intrinsic motivation refers to the entrepreneurs' interest in tasks that lead to satisfaction, while extrinsic motivation triggers behaviors that are performed to gain rewards or avoid negative consequences (Carsrud et al., 2009). Thus, intrinsic motivation comprises those behaviors that are performed solely based on personal interest and satisfaction (Ryan & Deci, 2000). However, intrinsic and extrinsic motivations are not mutually exclusive and an individual can be motivated by both in any entrepreneurial activity (Carsrud, Brännback, Elfving & Brandt, 2009).

Business-oriented entrepreneurs strive for benefits such as money, power, prestige, and position. However, these are not the only possible motives for creating a venture, as has been recently highlighted in the field of social entrepreneurship, for instance. Here, social gains, rather than financial gains, are considered the main motivational factor. Therefore, while the main motivator for opportunistic entrepreneurs may be the desire for economic achievement or success (without thinking about whether their actions are right or wrong), other entrepreneurs usually have survival-oriented motivations (Carsrud & Brännback, 2011).

Auster and Aldrich (1984, p. 47) argued that “opportunities are irrelevant unless taken advantage of, and people vary widely in their ability to seize opportunities”. In the same vein, Shane et al. (2003, p. 271) mentioned that “people also differ widely in their motivation to seize opportunities”. Therefore, entrepreneurial motivation is fostered by *push* and *pull* factors (Wilson, Kickul & Marlino, 2007), which relate to necessity or opportunity-driven entrepreneurship (Williams & Round, 2009). Therefore, knowing what motivates people to pursue an opportunity is of prime importance to foster entrepreneurial behavior (Carsrud et al., 2009).

Furthermore, Santos and García (2011) conducted a study on entrepreneurs in the Spanish natural stone sector and found a close relationship between the emergence of an opportunity and entrepreneurs' motivations. Therefore, the rise of an opportunity is based on the deliberate actions of entrepreneurs (Krueger, 2000; Sarason, Dean & Dillard, 2006). Thus, it can be concluded that alertness is directly linked to the entrepreneurs' scanning process, which is in turn guided by their motivation to recognize opportunities.

Despite the different motivations to start a new venture, there is a consensus in the literature that entrepreneurial motivation affects entrepreneurial intention. For instance, Tung, Hung, Phuong, Loan and Chong (2020) analyzed the relationship between start-ups and the determinants of entrepreneurial intentions among five universities located in Vietnam and the Philippines. They collected data from 819 students enrolled in the fourth year and found a positive relationship between entrepreneurial motivation (measured as self-motivation for entrepreneurship) and perceived feasibility, which is a precursor to entrepreneurial intention. In this regard, perceived feasibility is the perception of how difficult or easy it is to engage in the actual behavior of creating a start-up. Similarly, Purwana and Suhud (2018) researched the impact of entrepreneurial motivation on entrepreneurial intention. After collecting data from 626 students from vocational school in Jakarta, they found that entrepreneurial motivation has a positive impact on entrepreneurial intention among students.

Murnieks et al. (2019) stated that although research on entrepreneurial motivation has developed rapidly, it has grown in different theoretical silos that tend to isolate reasons based on the different phases of business development (e.g., initiation, growth, and exit) rather than realize that an individual often goes through all of these stages and various forms of motivation throughout the entrepreneurial journey. To understand this issue on a deeper level, as well as to analyze whether entrepreneurial motivation leads students to recognize opportunities, the following hypotheses were proposed:

**H5.** Entrepreneurial motivation has a positive and significant impact on opportunity recognition among university students.

**H5a.** Entrepreneurial motivation mediates the relationship between entrepreneurial alertness and opportunity recognition.

**H6.** Entrepreneurial motivation has a positive and significant impact on entrepreneurial intentions among university students.

#### *Relationship between opportunity recognition and entrepreneurial intention*

Several authors have explored the relationship between opportunity recognition and entrepreneurial intention. For example, Hassan, Saleem, Anwar and Hussain (2020) studied the impact of opportunity recognition on entrepreneurial intention. After surveying 334 Indian students with a business and management background, they concluded that opportunity recognition has a significant positive impact on the entrepreneurial intention of students. Similarly, Ryu and Kim (2020) researched the relationship between opportunity recognition and entrepreneurial intention at a national level. For this analysis, they used data from 15 countries included in the Global Entrepreneurship Monitoring (GEM), the Gender Gap Index (GGI) of the World Economic Forum (WEF). The authors found that opportunity recognition positively affects entrepreneurial intention.

Likewise, Botha and Taljaard (2019) used data from a sample of 342 nascent and existing entrepreneurs from South Africa. The purpose of their study was to investigate whether the entrepreneurial intentions and entrepreneurial competencies of various individuals influence each other. The authors observed a strong positive relationship between opportunity recognition and entrepreneurial intention. In another study, Wannamakok and Chang (2020) collected data

from a sample of 9716 women participating in the GEM survey. The authors found that opportunity recognition has a significant and positive influence on women's entrepreneurial intention. Therefore, the decision about a new venture initiative would be taken after detecting a viable business opportunity (Liñán, 2007). Accordingly, the following hypotheses were formulated:

**H7.** Opportunity recognition has a positive and significant impact on entrepreneurial intentions among university students.

**H7a.** Opportunity recognition mediates the relationship between entrepreneurial motivation and entrepreneurial intention.

#### *Relationship between entrepreneurial intention and entrepreneurial behavior*

The study of personal behavior is a topic addressed in many research fields, from psychology to economics. According to Feola et al. (2019), the theory of planned behavior (TPB) is the model most commonly used to measure an individual's behavior. It establishes that intention is a consciously planned behavior (Bird, 1988; Krueger et al., 2000). Therefore, entrepreneurial intention is considered an antecedent of the actual entrepreneurial behavior (Fayolle et al., 2006). Although many people have intentions to develop their businesses, only a few manage to turn those intentions into real actions, and entrepreneurship is about actions instead of mere intentions (Kautonen, van Gelderen & Fink, 2015). This means that without the actual behavior, entrepreneurship is not substantiated.

Shirokova, Osiyevskyy and Bogatyreva (2016) found a significant positive association between entrepreneurial intentions and start-up activities in which the student entrepreneurs are engaged in. Moreover, this association is reinforced by a set of factors such as the entrepreneurial background of the entrepreneur's family and the entrepreneur's age, gender (the link for males is stronger), and university entrepreneurial environment. So, further strengthening entrepreneurial intention resulted in more engagement from the entrepreneurs toward entrepreneurial behavior (Van Gelderen, Kautonen & Fink, 2015), which serves to predict the willingness of individuals to put more effort into business processes and activities.

Similarly, Shinnar, Powell and Zhou (2018) researched how to predict the impact of intention on behavior by using data from a sample of 179 students from a public university in the southeastern United States collected in four different waves (T1-T4). They found a positive relationship between entrepreneurial intentions and entrepreneurial behavior among the students and determined that this link is moderated by the gender of each individual. In this regard, women are less likely to act on their entrepreneurial intentions. Based on these findings, entrepreneurial intention is an essential predictor of entrepreneurial behavior toward starting a new venture. Thus, the following hypothesis was formulated:

**H8.** Entrepreneurial intention has a positive and significant impact on entrepreneurial behavior among university students.

#### *Entrepreneurship education*

In the literature, several studies measuring the impact of entrepreneurship education arrived at conflicting results (Dickson, Solomon & Weaver, 2008; Fayolle, 2013; Krueger, 1993). The reason for this may be related to different factors. On the one hand, most studies on the impact of entrepreneurship education have specific methodological weaknesses, namely related to internal validity and external validity, which limit the generalization of findings, stressing the need for more empirical studies (Yi & Duval-Couetil, 2021). This issue was also raised in Rideout and Gary's (2013) review, as well as Martin, McNally, and Kay's (2013) and Bae, Qian, Miao and Fiet's (2014) meta-analysis studies. On the other hand, the use of different

pedagogical methods, program durations, and learning objectives makes the comparability of the outcomes of entrepreneurship education programs a challenge.

Despite the difficulties inherent in measuring the impact of an education program (as in other areas of knowledge), there is a general agreement that entrepreneurship education has a broad impact on individuals, as it exposes them to new possibilities for personal and professional development. In fact, several authors have highlighted the role of entrepreneurship education in the promotion of entrepreneurial intention and behavior (Matsheke & Dhurup, 2017), innovation (Efobi & Orkoh, 2018), and future employment prospects for students (Vesper & Gartner, 1997). According to Martin et al. (2013), entrepreneurship education is positively related to two categories of outcomes: a) human capital assets, which consist of knowledge and skills, competencies, motivation, and entrepreneurial intention; and b) entrepreneurial outcomes, which comprise actual entrepreneurial behaviors such as start-up activities. These authors also found that positive outcomes are more robust in academic-focused interventions than in training-focused interventions. Likewise, Nabi et al. (2016) concluded in their systematic review that most articles claim a positive link between entrepreneurship education and personal change (e.g., attitudes, skills and knowledge, feasibility, and entrepreneurial intentions). Thus, the assumption underlying the promotion of entrepreneurship education is that it promotes personal changes in the individuals who attend these initiatives. In this regard, students enrolled in entrepreneurship education programs are expected to develop their characteristics differently from their non-enrolled counterparts. Thus, the following hypothesis was proposed:

**H9.** The predictive model would be variant across students enrolled in entrepreneurship education and those who were not.

#### *Conceptual model*

The former discussion leads to the research model presented in Fig. 1. In this model, it is suggested that students' prior knowledge, entrepreneurial alertness, and entrepreneurial motivation have a direct impact on opportunity recognition. Moreover, entrepreneurial motivation and opportunity recognition have a positive effect on entrepreneurial intention, which, in turn, is positively related to entrepreneurial behavior. This model has two innovative features. On the one hand, it explores how personality traits impact opportunity recognition and in turn how opportunity recognition impacts the entrepreneurial behavior of students. On the other hand, it highlights the influence of the relationships between the different variables, expanding the current understanding of how personality traits influence entrepreneurial behavior.

#### **Methods**

##### *Participants*

A total of 1470 questionnaires were administered to students of three universities. Out of these, 1290 were considered valid (87.8%). Participants were enrolled in one of three Portuguese universities: the University of Aveiro (40.3%), the University of Porto (35.9%), and the University of Coimbra (23.8%). Of all participants, 609 (47.2%) were male and 681 (52.8%) were female. Concerning their field of study, 649 (50.3%) students were from the scientific area of exact sciences and engineering, followed by 302 (23.4%) students from social sciences and humanities, and 261 (20.2%) students from the field of life sciences and health. Only 78 (6.0%) students were from the field of natural and environmental sciences. Moreover, 392 (30.4%) students had entrepreneurship training and 898 (69.4%) had no training in this field. Table 1 summarizes the sample's main demographic



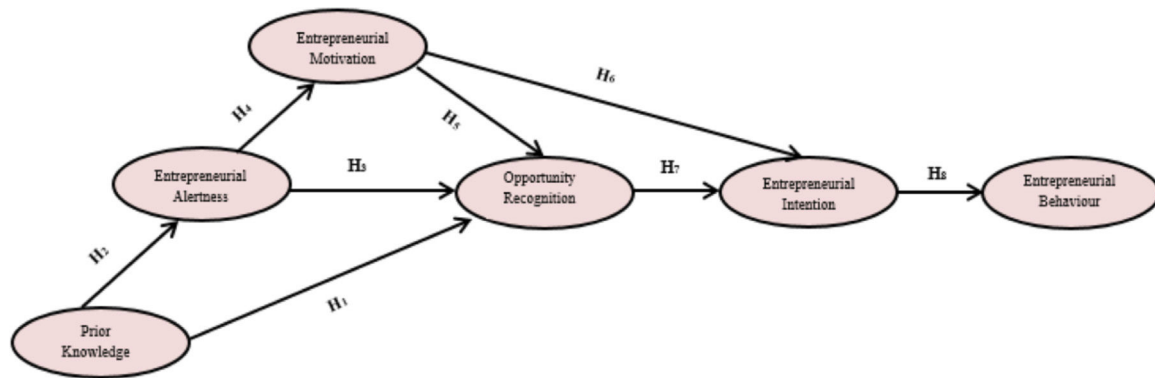


Fig. 1. Research model.

variables. Although a non-probabilistic convenience sampling technique was used, the current sample size is considered to be appropriate since it is above the desired level of at least 10 to 15 responses per item, as prescribed by Hair, Black, Babin, Anderson & Tatham, 2010 and Kline, 2011. Moreover, Barclay, Thompson & Higgins, 1995 showed that the size of a sample should be at least ten times greater than the largest number of predictors in each model, a requirement that is met in the current study.

#### Procedure

In a cross-sectional design, the data were collected from university students through a self-administered questionnaire (Appendix A). A questionnaire package containing an information sheet, a consent form, and the designed questionnaire was given to students. The questionnaires were presented to students in libraries, labs, study rooms, and classrooms with the due authorization of the universities.

#### Measures

The questionnaire elicited information about sociodemographics (gender, age, degree of studies, scientific area, and attendance of entrepreneurship training), prior knowledge, entrepreneurial alertness, entrepreneurial motivation, opportunity recognition, entrepreneurial intention, and entrepreneurial behavior. The research instrument was translated, adapted, and cross-culturally validated. First, with the assistance of five Portuguese experts and researchers in the entrepreneurship field, some of the wording was modified in the Portuguese version of the scale to improve the clarity of the items, without affecting their original conceptual bases. Second, a

pilot study with 10 Portuguese students was performed to identify any unclear items and determine if the instructions were clear and how much time was needed to complete the questionnaire. No problematic items or instructions were identified and the average time to complete the survey was approximately 20 min.

#### Prior knowledge

There are several prior knowledge scales in the literature. The most relevant are the ones proposed by Marvel and Lumpkin (2007), with a composite reliability of 0.84, and Ozgen (2003), with a composite reliability of 0.71. Due to the context of the present study (higher education students), the scale proposed by Ozgen (2003) seemed more appropriate. This 5-point Likert scale contains 6 items and participants are asked to rate how much they agree with each item from 'strongly disagree' (1) to 'strongly agree' (5). In the present study, the internal consistency (Cronbach's  $\alpha$ ) was 0.672.

#### Entrepreneurial alertness

The most widely used scale to measure entrepreneurial alertness was developed by Tang et al. (2012). This 7-point Likert agreement scale encompasses 13 items that can be rated from 'strongly disagree' (1) to 'strongly agree' (7). It consists of three subscales aimed at assessing the ability to 1) scan and search information (e.g., 'I have frequent interactions with others to acquire new information'), with 6 items; 2) associate and connect pieces of information (e.g., 'I see links between seemingly unrelated pieces of information'), with 3 items; and 3) evaluate and judge opportunities (e.g., 'I can distinguish between profitable opportunities and not-so-profitable opportunities'), with 4 items. In our study, the internal consistency (Cronbach's  $\alpha$ ) was 0.865.

#### Entrepreneurial motivation

Several authors have developed entrepreneurial motivation scales. This study employed the 11-item agreement scale developed by Almobaarekab and Manolova (2013). This scale covers a wide range of motives, such as financial gains, independence, self-achievement, and achievement of a vision, which can be rated from 1 (strongly disagree) to 7 (strongly agree). In this study, the internal consistency (Cronbach's  $\alpha$ ) was 0.872.

#### Opportunity recognition

The literature contains several opportunity recognition scales. Given the context of the present study, the 6-item scale developed by Ozgen and Baron (2007) seemed the most appropriate. This 5-point Likert scale assesses alertness to opportunities (e.g., 'I have a special "alertness" or sensitivity toward new venture opportunities') and the ability to recognize business opportunities (e.g., 'I frequently identify opportunities to start up a new business') and ranges from 'strongly disagree' (1) to 'strongly agree' (5). In the original version, the scale

**Table 1**  
Samples demographic characteristics.

		Frequency	%
University	Aveiro	520	40.3
	Porto	463	35.9
	Coimbra	307	23.8
Gender	Male	609	47.2
	Female	681	52.8
Age	< 20 years	435	33.7
	20 - 25 years	745	57.8
	26 - 30 years	51	4.0
	> 30 years	59	4.6
Training	Yes	392	30.4
	No	898	69.4
Scientific Area	Life Sciences	261	20.2
	Natural Sciences	78	6.0
	Exact Sciences	649	50.3
	Social Sciences	302	23.4

presented a good internal consistency, with a Cronbach's  $\alpha$  value of 0.80. In the present study, the internal consistency (Cronbach's  $\alpha$ ) was 0.873.

Entrepreneurial intention

There are several entrepreneurial intention scales in the literature. In the present study, the scale developed by Linan and Chen (Linan & Chen, 2009) was adopted. It is a 6-item scale that in its original form had a Cronbach's  $\alpha$  value of 0.943. This 7-point Likert scale is used to measure the pure intention to become an entrepreneur (e.g., 'I am ready to do anything to be an entrepreneur') and ranges from 'strongly disagree' (1) to 'strongly agree' (7). In the present study, the internal consistency (Cronbach's  $\alpha$ ) was 0.940.

Entrepreneurial behavior

The literature includes many entrepreneurial behavior scales. In the present study, the scale developed by Kautonen, Gelderen, and Fink (Kautonen et al., 2015), which has a Cronbach's  $\alpha$  value of 0.85, was adopted. This scale encompasses 10 items that assess engagement in start-up early stage activities, such as writing a business plan or registering a company. Each item of this 7-point scale is rated from 'strongly disagree' (1) to 'strongly agree' (7). In our study, the internal consistency (Cronbach's  $\alpha$ ) was 0.937.

Entrepreneurship education

Entrepreneurship education was considered a control variable so as to analyze its influence on the proposed model. Respondents were asked if they had attended any entrepreneurship training, both as an extra-curricular training activity or a subject within a course curriculum, and this information was recorded using a binary scale (0 = No, 1 = Yes).

Data analysis

The Kolmogorov-Smirnov test and absolute values of skewness and kurtosis were used to test data normality. Moreover, descriptive, preliminary, and correlational analyses were performed using the IBM SPSS-25 software, and the mediation analysis was performed using the IBM AMOS-24 structural equation modeling program.

A two-step strategy was followed, in line with the recommendations of Anderson and Gerbing (1988). In the first step, a confirmatory factor analysis was conducted to test the goodness of fit indices (GFIs) and the reliability and validity of the proposed measurement model. The assessment of the model fit was established considering multiple indicators, namely the  $\chi^2$  value to the degree of freedom ratio ( $\chi^2/df$ ), the GFI, the adjusted goodness of fit index (AGFI), the comparative fit index (CFI), the normed fit index (NFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA). The fit of the model was considered good for a  $\chi^2/df$  less than 5, a CFI and TLI greater than 0.95, and a RMSEA below 0.06 (Bentler & Bonett, 1980; Blunch, 2012).

The internal consistency of the factors was determined by measuring the composite reliability and the construct validity was tested. According to Fornell and Larcker (1981), the convergent validity of a measurement model should be tested based on the following criteria: factor loading; scale composite or construct reliability; and the average variance extracted (AVE). Table 2 shows the reference values when assessing validity and reliability data.

In the second phase, the structural model was executed to test hypotheses 1 to 8. As the structural model was considered adequate to predict entrepreneurial behavior, a multi-group analysis was conducted to identify differences between the path coefficients of the models for the students enrolled in entrepreneurship education and those who were not. This enabled the testing of hypothesis 9. In this regard, the analysis of the invariance of the structural model was

**Table 2**  
Subcategories of construct validity and reliability.

Statistic	Reference values
Factorial Validity	SFL $\geq 0.5$ , ideally $\geq 0.7$
Individual item reliability	SMC $> 0.25$
Convergent Validity	AVE <sub>i</sub> $\geq 0.5$
Discriminant validity	Coefficients of the HTMT $< 0.85$
Composite Reliability	CR $\geq 0.7$
Cronbach's Alpha	$\alpha \geq 0.6$

Note: SFC – standardized factor loadings; AVE - average variance extracted; CR - Composite Reliability; HTMT - Heterotrait-Monotrait ratio of correlations; SMC - Squared Multiple Correlations.

performed by constraining a series of nested models, in line with Byrne, Shavelson and Muthén (1989) and Tan and Pektaş (2020). As proposed by Tan and Pektaş (2020), measurement invariance encompasses configural invariance (unconstrained model), metric invariance (weighted measurement model), and scalar invariance (structural covariances). Configural invariance refers to whether the proposed model is the same across all groups (Chung et al., 2016) and tests if the same pattern of item-factor loadings exists across the groups being compared. Metric invariance refers to the equivalence among regression coefficients, i.e., it determines if the responses given to the latent variables are equivalent (Tan & Pektaş, 2020). Finally, scalar invariance refers to the equivalence of factor covariances across groups and is assessed through a model where all factor loadings, factor variances, and factor covariances are constrained (Tan & Pektaş, 2020).

Results

Preliminary analysis

The obtained skewness value was divided by the standard error of skewness, resulting in a Z score value between the threshold level of  $\pm 3.3$  (Doane & Seward, 2011; Tabachnick & Fidell, 1996), thereby indicating the normality of the data. Moreover, the kurtosis values of less than 7 indicate that there was no strong deviation from a normal distribution (Finney & DiStefano, 2013), which also ensures the normality of the data. To further check the normality issues, histograms were drawn and it was observed that all variables have a proper bell shape.

The measurement model

From a total of 57 items, and taking into account an acceptable factor loading cut-off of 0.4 (Wülfers, 2013), the following items were deleted: 3 items from the factor EA, 4 items from the factor PK, 2 items from the factor OR, and 6 items from the factor EM (see Appendix A). As stated by several authors, the deletion of items from a reflective construct does not alter its conceptual meaning (Jarvis, MacKenzie & Podsakoff, 2003; MacKenzie, Podsakoff & Jarvis, 2005). MacKenzie et al. (2005) further clarified that in reflective measures, the direction of causality from constructs to items ultimately explains the variation in the measures due to the construct.

The Fornell-Larcker principle is generally used to examine discriminant validity. According to Hair et al. (2017), "It (Fornell-Larcker criterion) compares the square root of the AVE values with the latent variable correlations. Specifically, the square root of each construct's AVE should be greater than its highest correlation with any other construct". The evidence of discriminant validity is presented in Table 3, with the square root of the AVE placed on the diagonally and the adjacent correlation coefficient values placed on the off-diagonally. As can be observed, the value of the square root of the AVE for

**Table 3**  
Fornell-Larcker Criterion.

Latent Variables	EB	EM	EA	PK	EI	OR
EB	<b>0.779</b>					
EM	0.141***	<b>0.745</b>				
EA	0.260***	0.175***	<b>0.722</b>			
PK	0.201***	0.244***	0.560***	<b>0.714</b>		
EI	0.428***	0.379***	0.281***	0.241***	<b>0.851</b>	
OR	0.499***	0.318***	0.451***	0.412***	0.680***	<b>0.797</b>
CR	0.939	0.856	0.867	0.701	0.940	0.874
AVE	0.608	0.555	0.522	0.510	0.725	0.635

each dimension is greater than the values of the lower-left triangle presented on the off-diagonal, thus establishing discriminant validity (Hair, Ringle & Sarstedt, 2013).

The fit of the model to the sample data was considered appropriate ( $\chi^2/df = 3.34$ , GFI = 0.93, TLI = 0.96, RMSEA = 0.043). In the case of the measurement component, all indicators were found to be reliably associated ( $p < 0.001$ ) with the corresponding factors.

#### The structural model

In the case of the structural model, the goodness of fit statistics (CMIN/DF ( $\chi^2/df$ ) = 3.91, GFI = 0.919, AGFI = 0.902, CFI = 0.956, NFI = 0.942, TLI = 0.950, IFI = 0.956, and RMSEA = 0.048) indicate an appropriate fit according to the guidelines suggested by Hair et al. (2013). Table 4 presents the outcomes of the estimated direct relationship between all the studied latent variables. Overall, the results show that all relationships are statistically significant. The path coefficient is statistically significant for the relationship between prior knowledge and opportunity recognition ( $\beta = 0.25$ ,  $p < 0.001$ ); prior knowledge and entrepreneurial alertness ( $\beta = 0.75$ ,  $p < 0.001$ ); entrepreneurial alertness and opportunity recognition ( $\beta = 0.31$ ,  $p < 0.001$ ); entrepreneurial alertness and entrepreneurial motivation ( $\beta = 0.29$ ,  $p < 0.001$ ); entrepreneurial motivation and opportunity recognition ( $\beta = 0.14$ ,  $p < 0.001$ ); entrepreneurial motivation and entrepreneurial intentions ( $\beta = 0.15$ ,  $p < 0.001$ ); opportunity recognition and entrepreneurial intentions ( $\beta = 0.84$ ,  $p < 0.001$ ); and entrepreneurial intention and entrepreneurial behavior ( $\beta = 0.53$ ,  $p < 0.001$ ). Therefore, the data support all the previously developed hypotheses. In addition, 50% of the variance associated with entrepreneurial intention was explained by prior knowledge, entrepreneurial alertness, entrepreneurial motivation, and opportunity recognition. Nevertheless, only 18% of the variance associated with entrepreneurial behavior was explained by entrepreneurial intention.

#### The mediation analysis

Mediation refers to the possible presence of a mediator variable between the predictors and the outcome variable. According to Shrout and Bolger (2002), mediation exists when a causal

**Table 4**  
Structural Model Results.

Hypothesis	Relationship	$\beta$ -Value	S.E.	C.R.	P-Value	Results
H1	PK → OR	0.253***	0.059	4.249	0.000	Supported
H2	PK → EA	0.751***	0.064	11.65	0.000	Supported
H3	EA → OR	0.310***	0.042	7.367	0.000	Supported
H4	EA → EM	0.297***	0.05	5.968	0.000	Supported
H5	EM → OR	0.145***	0.018	8.119	0.000	Supported
H6	EM → EI	0.157***	0.021	7.454	0.000	Supported
H7	OR → EI	0.844***	0.045	18.744	0.000	Supported
H8	EI → EB	0.537***	0.039	13.728	0.000	Supported

**Table 5**  
Mediation (Indirect Effect) Results.

Hypothesis	Relationship	$\beta$ -Value	LB	UP	Results
H <sub>3a</sub>	PK → EA → OR	0.265	0.201	0.345	Supported
H <sub>5a</sub>	EA → EM → OR	0.043	0.026	0.065	Supported
H <sub>7a</sub>	EM → OR → EI	0.123	0.090	0.162	Supported

relationship between dependent and independent variables is explained by a third variable. To examine the existence of mediating relationships, the coefficient for indirect effects was estimated. The mediation relationships were then tested by using the bootstrapping procedure with 5000 resamples. Table 5 presents the results of these procedures. Overall, the results show that all relationships are statistically significant since the upper and lower bounds for the estimated coefficients do not contain the zero value (Cheung & Lau, 2008). As a result, the mediating relationships previously hypothesized are supported.

#### Entrepreneurship education

Concerning the effect of entrepreneurship training, a multi-group SEM analysis was performed to examine any changes in the measurement parameters and structural relationships in the proposed model. Byrne et al. (1989) suggested an invariance routine limiting the measurement model to factor loading, factor correlation, and structural parameters explaining hypothesized structural relationship. To analyze the invariance factor loading, it was hypothesized that the factor loading for both groups was equal. The chi-square value difference test between the baseline model and the constraint model was significant and noticeable (CMIN = 62.30,  $p < 0.05$ ). This shows that the factor loading of the two groups was variant. The chi-square value in the structural parameter between the baseline model and the constraint model was also noticeable (CMIN = 31.26,  $p < 0.05$ ), showing that the structural parameter between the two groups was variant.

Finally, for factor correlation, the chi-square value difference test between the baseline model and constraint model was not significant and noticeable (CMIN = 3.32,  $p > 0.05$ ), showing that the factor correlation of the two groups was invariant. The detailed results of the invariance model are presented in Table 6.

Further comparison of the two models was performed by testing the equivalence of two parameters at a time, with critical ratios, as proposed by Costa, Marôco, Pinto-Gouveia and Ferreira (2017). The current study also followed Bentler's (1980) suggestion of using the critical ratio, also known as (Z), to study the hypothetical path difference between groups. The detailed path difference of the hypothesized model is presented in Table 7. The results show that the factor loadings differ significantly between the two samples since all Z values are higher than 1.96.

The results show that the effects of prior knowledge on entrepreneurial alertness, entrepreneurial motivation on entrepreneurial intention, and opportunity recognition on entrepreneurial intention are strongest for the group of respondents with entrepreneurship education/training.

#### Table 8.

**Table 6**  
Invariance tests across entrepreneurship education groups.

Model Comparison	Df diff	CMIN diff	p-values
Unconstrained vs Measurement weights	27	62.30	.000
Measurement weights vs Structural weights	8	31.26	.000
Structural weights vs Structural covariance's	1	3.32	.068

**Table 7**  
Two-by-two analysis.

	Students enrolled in EE			Students not enrolled in EE		
	Path Coef.	p Values	C.R.	Path Coef.	p Values	C.R.
PK → OR	.27***	.009	2.603	.29***	.001	3.718
PK → EA	.75***	.001	6.466	.65***	.001	9.639
EA → OR	.30***	.001	5.767	.33***	.001	4.757
EA → EM	.29***	.003	3.001	.31***	.001	4.969
EM → OR	.14***	.001	3.589	.14***	.001	7.420
EM → EI	.16***	.001	7.171	.15***	.001	4.092
OR → EI	.83***	.001	10.240	.80***	.001	15.481
EI → EB	.52***	.001	8.257	.52***	.001	10.207

Note: \*\*\* indicates 1% level of significance.

## Discussion

This study aimed to examine whether it is possible to predict behaviors associated with promoting new ventures in students by looking at their specific individual traits, namely, prior knowledge, entrepreneurial alertness, opportunity recognition, entrepreneurial motivation, and entrepreneurial intention, and whether entrepreneurship education influences the relationship between these behaviors and traits. The results support our *H1: Prior knowledge has a positive and significant impact on opportunity recognition among university students*; *H2: Prior knowledge has a positive and significant impact on entrepreneurial alertness among university students*; and *H3: Entrepreneurial alertness has a positive and significant impact on opportunity recognition among university students*. These results point in the same direction as those of other researchers, such as [Chen, Chan, Hung & Lin, \(2020\)](#) (2020), [Kraus, Niemand, Angelsberger, Mas-Tur and Roig-Tierno \(2017\)](#), and [Zanella, Solano, Hallam and Guda \(2019\)](#), who also found a positive relationship between prior knowledge, entrepreneurial alertness, and opportunity recognition. At the same time, our results refute those of [Bhagavatula et al. \(2010\)](#), who claimed that the prior experience of an entrepreneur has a detrimental effect on perceived opportunity recognition due to higher levels of closure. According to our results, entrepreneurs are more likely to recognize opportunities when they have more knowledge about the needs of the customers and the market, as well as new market trends, such as customer demand for new products. In addition, entrepreneurs that master entrepreneurial alertness, which Galio and Katz (2001) described as an information-handling skill, are better able to assess, judge, or decide on opportunities ([Mitchell et al., 2002](#))

**Table 8**  
Hypotheses testing results.

Hypotheses	Results
<b>H<sub>1</sub>:</b> Prior knowledge has a positive and significant impact on opportunity recognition among university students.	Supported
<b>H<sub>2</sub>:</b> Prior knowledge has a positive and significant impact on entrepreneurial alertness among university students.	Supported
<b>H<sub>3</sub>:</b> Entrepreneurial alertness has a positive and significant impact on opportunity recognition among university students.	Supported
<b>H<sub>4</sub>:</b> Entrepreneurial alertness has a positive and significant impact on entrepreneurial motivation among university students.	Supported
<b>H<sub>5</sub>:</b> Entrepreneurial motivation has a positive and significant impact on opportunity recognition among university students.	Supported
<b>H<sub>6</sub>:</b> Entrepreneurial motivation has a positive and significant impact on entrepreneurial intentions among university students.	Supported
<b>H<sub>7</sub>:</b> Opportunity recognition has a positive and significant impact on entrepreneurial intentions among university students.	Supported
<b>H<sub>8</sub>:</b> Entrepreneurial intention has a positive and significant impact on entrepreneurial behavior among university students.	Supported
<b>H<sub>9</sub>:</b> The predictive model would be variant across students enrolled in entrepreneurship education and those who were not.	Supported

Regarding the indirect effects, H3a was confirmed, i.e., entrepreneurial alertness mediated the path between prior knowledge and opportunity recognition. Thus, it can be concluded that the more alert entrepreneurs pay more attention to market knowledge and relevant market opportunities.

Our results also support hypotheses *H4: Entrepreneurial alertness has a positive and significant impact on entrepreneurial motivation among university students*; *H5: Entrepreneurial motivation has a positive and significant impact on opportunity recognition among university students*; and *H6: Entrepreneurial motivation has a positive and significant impact on entrepreneurial intentions among university students*. According to [Ryan and Deci \(2000\)](#), motivation concerns energy, direction, persistence, and activation, as well as the intention to act in a certain way, thus playing a role in predicting human behavior. The results of the present study suggest that paying attention to business ideas can provide intrinsic motivation, as this concerns “the inherent tendency to seek out novelty and challenges, to extend and exercise one’s capacity” ([Ryan & Deci, 2000](#), p. 70). Thus, the greater the entrepreneurial alertness of the students, the greater their entrepreneurial motivation. [Santos and García \(2011\)](#) also found a strong concomitance between entrepreneurial alertness and motivation, with entrepreneurs displaying a range of different motivations according to different states of alertness. In turn, entrepreneurial motivation has a positive relationship with opportunity recognition and entrepreneurial intention, which is in line with the findings of [Tung, Hung, Phuong, Loan and Chong \(2020\)](#) and [Purwana and Suhud \(2018\)](#). Nevertheless, according to the theory of cognitive assessment (TEC) proposed by Deci and Ryan in 1985, since intrinsic motivation is inherent, it will only be catalyzed when individuals are in conditions that lead to its expression, which highlights the relevance of designing supportive entrepreneurial ecosystems.

In the case of hypothesis H5a, it was found that entrepreneurial motivation mediates the relationship between entrepreneurial alertness and opportunity recognition. Therefore, it can be concluded that the more motivated students recognize opportunities more easily through their ability to deal with market information.

Despite the positive relationship, the entrepreneurial motivations of students are the weakest predictor of opportunity recognition. This result indicates that self-motivation toward entrepreneurship is not the main driver of opportunity recognition, which contradicts the results of [Al-Jubari \(2019\)](#), who argues that the satisfaction of the motivational factors (autonomy, competence, and relatedness) of the self-determination theory (SDT) play a significant role in enhancing the entrepreneurial intention of students, where 48% of the variance was explained by the studied constructs.

Hypotheses *H7: Opportunity recognition has a positive and significant impact on entrepreneurial intentions among university students*; and *H8: Entrepreneurial intention has a positive and significant impact on entrepreneurial behavior among university students* are also supported by the results of the present study. Therefore, students who recognized an interesting opportunity expressed greater entrepreneurial intention and, consequently, greater entrepreneurial behavior. These results corroborate the findings obtained in studies carried out by several researchers, such as [Hassan, Saleem, Anwar and Hussain \(2020\)](#), [Ryu and Kim \(2020\)](#), and [Botha and Taljaard \(2019\)](#). Interestingly, the structural component analysis revealed that opportunity recognition was the strongest predictor of entrepreneurial intention, suggesting that the identification of an interesting business opportunity may be the primary driver of the intention to start a new venture. Thus, the entrepreneurial intentions of students appear to be fostered by their ability to recognize opportunities, which, in turn, is influenced by their prior knowledge, alertness, and motivations. Regarding the hypothesis H7a, our results support this hypothesis, since it appears that opportunity recognition mediates the relationship between entrepreneurial motivation and entrepreneurial intention. Thus, it can be concluded that the recognition of a relevant



business opportunity improves the intentions of students toward starting a new venture.

Moreover, the entrepreneurial behavior of students is supported by their intentions to start a new venture. Several studies have also stressed that opportunity recognition and entrepreneurial intentions are vital functions of the entrepreneurial process (Ardichvili, Cardozo & Ray, 2003b; Lars & Kolvereid, 2006). Furthermore, these results are in line with those of other researchers who stated that opportunity recognition/identification could be added as an additional variable to the TPB to predict the intentions of individuals (Karimi, Biemans, Lans, Chizari & Mulder, 2016).

Finally, our results support hypothesis H9: *The predictive model would be variant across students enrolled in entrepreneurship education and those who were not.* These results indicate that students with entrepreneurship education/training respond to items differently than those with no training, which means that the strengths of the relationships between specific scale items and their respective underlying constructs are not the same across these two groups. Therefore, these results indicate that the proposed model is operating in different ways and the underlying constructs do not have the same factorial and metric structure among students with some kind of entrepreneurship education compared to those with none. In this case, results show that students enrolled in entrepreneurship education are better able to use prior knowledge to improve their alertness toward recognizing new business opportunities and aligning their motivations to create a new venture. Thus, it can be concluded that participating in entrepreneurship education/training encourages the development of specific personality traits related to promoting a new venture. These results contradict those obtained in some previous studies that found entrepreneurship education to have a negative impact on entrepreneurial intentions and behavior (Nowiński, Hadoud, Lančarić, Egerová & Czeglédi, 2019) since students enrolled in entrepreneurship education are less intent on starting a venture in the future. Moreover, our results refute those obtained by Kim, Kim, Lee and Jeong (2020), who measured the impact of entrepreneurship education on high school students and observed that the scores of opportunity discovery and entrepreneurial intention were almost equal or even lower than those of the control group; as well as those of Oosterbeek et al., 2010, who stated that entrepreneurship education programs are often surprisingly ineffective in helping the adult population (e.g., university students) to recognize the opportunities that foster start-up behavior. Although the differences observed in other studies may be caused by different teaching methods, our results clearly show the relevance of entrepreneurship teaching in the development of entrepreneurial motivations, intentions to start new ventures, and skills related to the recognition of opportunities.

## Conclusions

The results of the present study indicate that it is possible to predict behaviors associated with promoting new ventures in students by looking at their specific individual traits, namely, prior knowledge, entrepreneurial alertness, recognition of opportunities, entrepreneurial motivation, and entrepreneurial intention. Nevertheless, despite the positive relationship, the entrepreneurial motivations of students were found to be the weakest predictor of opportunity recognition, and, in turn, opportunity recognition was the strongest predictor of entrepreneurial intention. This suggests that the identification of an interesting business opportunity may be the primary driver of intending to start a new venture in the case of higher education students.

Furthermore, it appears that entrepreneurship education influences the development of specific individual traits. In this regard, it was observed that the students who attended entrepreneurship courses had a greater ability to detect opportunities based on their previous knowledge and to align their motivations toward starting a new

business. These results highlight the relevance of entrepreneurship education in promoting young entrepreneurship, which is crucial to foster social and economic development in today's world.

## Implications

The present study has several theoretical implications for the field of entrepreneurship research in general and the field of entrepreneurship education in particular. First, it contributes to a better understanding of the main determinants of entrepreneurial behavior among higher education students. Given that there are several studies on this topic with divergent results, it is important to develop studies that go beyond the most common biases in this type of analysis, namely the selection of the analyzed population, the sample size, and the methodology for data analysis. Second, the existing literature on mediation analysis and multi-group analysis in the field of entrepreneurship is somewhat limited in its scope. The present study incorporates the critical construct of entrepreneurial alertness toward start-up behavior to explain the entrepreneurial process. Third, the application of entrepreneurial motivation as a construct in the proposed model constitutes a worthy addition to the body of literature on entrepreneurship. The study of Entrepreneurial motivation toward opportunity recognition and entrepreneurial intention among students are somewhat limited in the literature. Shane et al., 2003 explained that human motivation influences the decisions of individuals in terms of pursuing entrepreneurial opportunities. Nevertheless, Carsrud & Brännback, 2011 illustrated that entrepreneurial motivation has been ignored in the last decades.

The present study also has practical implications. On the one hand, its results are relevant at the level of public policies, as they demonstrate that the promotion of education in entrepreneurship is indeed important for young people to develop a set of personal skills that they can use throughout their professional lives, as well as in the creation of new companies. On the other hand, the results emphasize the need for the pedagogical practices used in entrepreneurship teaching to be focused on developing meta-competencies related to entrepreneurship, which are a combination of cognitive, functional, and social competencies (Le Deist & Winterton, 2005), and not just knowledge acquisition. In this regard, teachers must seek to transmit not only knowledge on entrepreneurial processes and business plan development, but also skills and social competencies that can be developed through active or practical teaching methods.

## Limitations and future research

As in any research work, the present study has a few limitations that must be addressed. First, the data were collected from three universities located in the North and Center regions of Portugal through convenient sampling. Thus, the results cannot be validated and generalized for the entire Portuguese student population. This implies the need to replicate this study in another population.

A second limitation of the present study is the social response bias of college students, i.e., some students may answer all questions positively to maintain their image. However, the researchers took care to guarantee the confidentiality of the respondents, as mentioned at the beginning of the questionnaire. Nevertheless, future studies could use different instruments and methods to collect student data, which would allow more accurate measurements of students' perceptions.

Third, the data were collected using a single source, which can lead to common method variance. This is usually related to the measurement method rather than the constructs that the measures represent (Podasakoff, MacKenzie, Lee & Podasakoff, 2003). According to Podasakoff et al. (2003), common method variance is the primary source of measurement errors, which cause validity issues among the measures. Nevertheless, replying to Podasakoff et al. (2003), who argued that common method variance may threaten the validity of

the constructs, [Spector \(2006\)](#) and [Conway and Lance \(2010\)](#) explained that this bias is often exaggerated and that a single-source self-reported questionnaire is quite suitable for data collection. According to [Chan \(2009\)](#), a self-reported questionnaire is entirely attributable when the data collected deal with perceptions, behaviors, beliefs, etc. Considering that the present study proposed to measure behaviors, intentions, etc., a single-source self-reported questionnaire was adequate to collect the data from university students.

Finally, the present study focuses on the topic of student entrepreneurship; however, the role of universities is ignored. Universities are relevant actors in the entrepreneurial ecosystem and can have a strong impact on the development of students' cognitive skills and abilities. Thus, future studies should also analyze the role of teaching institutions in the development of students' entrepreneurial meta-competencies, namely in terms of their culture and the strategies they define in order to support entrepreneurship.

## Funding

This work is funded by national funds through FCT – Fundação para a Ciência e a Tecnologia, I.P., under the Scientific Employment Stimulus - Institutional Call - reference [CEECINST/00026/2018](#).

## Acknowledgments

This work was supported by the Research Unit on Governance, Competitiveness and Public Policies (UIDB/04058/2020) + (UIDP/04058/2020), funded by national funds through the FCT - Fundação para a Ciência e a Tecnologia.

## Appendix A

### Measurement Scales

Construct	Source	Content
Prior Knowledge	Ozgen (2003)	PK1 I acquire information from mistakes that happen during work.
		PK2 I can bring information relating to my field to mind very quickly and easily.
		PK3 My knowledge of my field is broad.
		PK4 My present venture is highly based on my previous work experience.
		PK5 My education plays a significant role in recognizing opportunities.
		PK6 My understanding of the local community and their needs plays a significant role in recognizing opportunities.
Entrepreneurial Alertness	Tang et al. (2012)	EA1 I have frequent interactions with others to acquire new information.
		EA2 I always keep an eye out for new business ideas when looking for information.
		EA3 I read news, magazines, or trade publications regularly to acquire new information's.
		EA4 I browse the internet every day.
		EA5 I am an avid information seeker.
		EA6 I am always actively looking for new information.
		EA7 I see links between seeming unrelated piece of information.
		EA8 I am good at connecting dots.

(continued)

		EA9	I often see connections between previously unconnected domains of information.
		EA10	I have a gut feeling for potential information.
		EA11	I can distinguish between profitable opportunities and not-so-profitable opportunities.
		EA12	I have a knack for telling high-values opportunities apart from the low-value opportunities.
		EA13	When facing multiple opportunities, I am able to select the good ones.
Entrepreneurial motivation	Almobaireekab and Manolova (2013)	EM1	Financial gain.
		EM2	There is no job.
		EM3	To be independent.
		EM4	To provide job opportunities.
		EM5	To have a higher social position.
		EM6	To be more flexible in the work.
		EM7	To use my creativity.
		EM8	To develop more experience.
		EM9	Self-achievement.
		EM10	To have control.
Opportunity recognition	Ozgen and Baron (2007)	EM11	To achieve my vision.
		OR 1	While going about routine day to day activities, I see potential new venture ideas all around me.
		OR 2	I have special "alertness" or sensitivity toward new venture opportunities.
		OR 3	"Seeing" potential new venture opportunities do not come very naturally to me.
		OR 4	I frequently identify the ideas that can be converted into new products and services.
		OR 5	I generally lack ideas that may materialize into profitable enterprise.
		OR 6	I frequently identify the opportunities to start up new business.
Entrepreneurial intention	Linan and Chen (2009)	EI1	I am ready to do anything to be an entrepreneur.
		EI2	My professional goal is to become an entrepreneur.
		EI3	I am determined to create a business venture in the future.
		EI4	I have very seriously thought about starting a firm.
		EI5	I have got the intention to start a firm one day.
		EI6	I intend to start a firm within 5 years of graduation.
Entrepreneurial behavior	Fink (2015)	EB1	Discussed product or business idea with potential customers.
Kautonen, Gelderen &		EB2	Collected information about markets or competitors.
		EB3	Written a business plan.
		EB4	Started product/service development.
		EB5	Started marketing or promotion efforts.
		EB6	Purchased material, equipment or machinery for the business.
		EB7	Attempted to obtain external funding.
		EB8	Applied for a patent, copyright or trademark.
		EB9	Registered the company.
		EB10	Sold product or service .

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