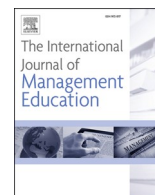


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Entrepreneurship education and established business activities: An international perspective

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ABSTRACT

This paper introduces a conceptual model with perceived opportunity and perceived capability as mediators in the process by which entrepreneurship education helps improve the established business activities. Specifically, we hypothesize that the prevalence of entrepreneurship education relates positively with the rate of established business activity, and that perceived opportunity and capability mediate this relationship. We find support for all our hypotheses using Poisson regression with the Global Entrepreneurship Monitor data collected from 826 participants across 107 countries during the 2001–2018 period. Our findings confirm that entrepreneurship education has a significant positive impact on the performance of established businesses by helping the entrepreneurs improve their perceived capabilities and opportunities. These findings extend the current research on the impact of entrepreneurship education on entrepreneurial activities at different stages of development for entrepreneurial businesses.

1. Introduction

Entrepreneurship education (EE) can contribute to economic growth by improving entrepreneurial activities (EA), as reflected by growing research on the link between EE and EA (e.g., [Abodohou & Su, 2020](#); [Abreu, Demirel, Grinevich, & Karataş-Özkan, 2016](#); [Audretsch, 2014](#); [Cohen, Hsu, & Shinnar, 2021](#)). Based on two alternative EE models—experiential model and contingency model ([Honig, 2004](#)), EE may influence EA by making entrepreneurial learning process experiential ([Politis, 2005](#)) and engaging individuals in key learning behaviors, such as exploratory and exploitative learning ([Nogueira, 2019](#); [Wang & Chugh, 2014](#)) to acquire entrepreneurial knowledge. This knowledge is needed to effectively cope with the liabilities of newness and recognize and act on entrepreneurial opportunities ([Hahn, Minola, Bosio, & Cassia, 2020](#); [Karlsson & Moberg, 2013](#); [Politis, 2005](#)). In addition, EE can impact EA (e.g., new business creation) by strengthening entrepreneurial self-efficacy ([McGee, Peterson, Mueller, & Sequeira, 2009](#); [Zhao, Seibert, & Hills, 2005](#)) and competencies ([Klarin, Inkizhinov, Nazarov, & Gorenkaia, 2021](#); [Santos, Neumeier, & Morris, 2019](#); [Vidal, Pittz, Hertz, & White, 2021](#)).

Some empirical studies also confirm the relationships between EE and EA ([Souitaris, Zerbinati, & Al-Laham, 2007](#)). [Walter and](#)

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Block (2016) show the strong link between entrepreneurship education and entrepreneurial activity (i.e., start a new business), with the sample of 11,230 individuals in 32 countries. Using data of 75 countries, Berrill, O'Hagan-Luff, and van Stel (2020) find that entrepreneurship education can reinforce the total early-stage entrepreneurial activities (either nascent or new entrepreneurial activities). Bergmann, Hundt, and Sternberg (2016) empirically find that entrepreneurship education has a positive effect on new business creations at the regional level with the 2011 Global University Entrepreneurial Spirit Students' Survey data and multi-level analysis techniques. Shirokova, Osiyevskyy, Morris, and Bogatyreva (2017) also adopt the same dataset to test the effect of EE on student entrepreneurs from 26 countries, and the results indicate that entrepreneurial curricula have positive effect on causation and effectuation approaches in nascent entrepreneurship activities. By utilizing the data about Stanford alumni, Eesley and Lee (2021) find that entrepreneurship education programs may not improve new business creation but can help the individuals understand themselves well becoming entrepreneurs. Rahman, Hasibuan, Syah, Sagala, and Prayogo (2022) also examine how entrepreneurship education in universities can teach and introduce business students to entrepreneurial thinking, which includes intrapreneurial spirits (Delić & Alibegović, 2016). This improves individuals' readiness to become entrepreneurs or persist in a professional environment.

Notwithstanding its useful contribution, the above research stream has a few limitations. For example, it focuses on the early stages of entrepreneurial activities and ignores the role of EE at later stages of entrepreneurial development despite significant differences in its role and impact. Early-stage entrepreneurial activities, which include new business creation activities within the first 42 months (Reynolds et al., 2005), cannot cover the whole stage of EA. Studies about EE and early-stage entrepreneurship activities show contradictory findings with two different types of results for the effect of EE on EA: a positive effect versus non-significant or negative effect (Dheer, 2017; Hahn et al., 2020; Liam, Lopes, Nassif, & Silva, 2015). Therefore, staying focus on the stream only shares a partial understanding about EA, which leads to the effect of EE on established business activities that persist for more than 42 months unclear and the findings about different stages of EA inconclusive. If we cannot have a clear boundary about the activities in two stages, the validity, reliability, and theoretical contributions about entrepreneurship research will be weakened (Whetten, 2009).

To clarify the boundary about entrepreneurship activities in different stage, they can be distinguished at two levels: early-stage entrepreneurial activities versus established businesses (Jafari-Sadeghi, 2020). However, only a few nascent studies have considered the effect of EE on established business activities. According to the GEM, 2015 Global Report, De Jager, Mthembu, Ngowi, and Chipunza (2017) discover that South Africa has the second-lowest established business rate in the world and propose that entrepreneurship education is necessary to involve the youth population in established businesses. Pocek, Politis, and Gabrielsson (2021) conduct a study on students who participated in an extra-curricular start-up program managed by three universities and find that immersion, comprehension, and co-participation learning can allow them to acquire competencies in running a business. Based on the results of ANOVA and post hoc analysis using 556 graduates in entrepreneurship education programs, Alsos et al. (2023) find that EE is associated with self-employment, hybrid entrepreneurship, and intrapreneurship in terms of one's perceived entrepreneurial knowledge, skill, and abilities. Although these studies show the effect of EE on established business activities, they only provide limited insights and do not reveal the mechanism through which EE affects established business activities at the national level.

In this context, we believe the perception acquired from EE can make sense from capability and seek good opportunities. First, EE can be used as a method to deal with uncertainties in entrepreneurial activity (Harmeling & Sarasvathy, 2013; Piperopoulos & Dimov, 2015) with knowledge and skills. Second, EE plays a significant impact on recognizing innovative opportunities (Cohen et al., 2021; Pereira, Bamel, Temouri, Budhwar, & Del Giudice, 2023), improving the quality of entrepreneurial efforts (Giotopoulos, Kontolaimou, & Tsakanikas, 2017), and self-efficacy (Saeed, Yousafzai, Yani-De-Soriano, & Muffatto, 2015) for enhancing the intentions to join entrepreneurial activities. Hence, this paper focuses on exploring the mechanism between EE and established business activity using perceived opportunity and perceived capability as mediators.

We use 826 observations across 107 countries from 2001 to 2018, of which we choose from Global Entrepreneurship Monitor (GEM), to examine the relationship by Poisson regression. The results show that EE plays a positive role in improving the established business activities, and the path is mediated by perceived opportunity and perceived capability fully. It indicates that EE can put major focus on cultivating the abilities of recognizing opportunities and the required skills and knowledge to make an established business persist for more than 42 months. This paper makes several important contributions. First, the effect of EE on established activities provides new insights for analyzing the suitability of EE in other stage of entrepreneurship. Second, the full mediating role of perception provides evidence that EE should focus on cultivating one's perceived capability and seeking good opportunities. This study contributes useful insights and implications about the importance of entrepreneurship education in promoting established business activities.

2. Theoretical foundation and hypothesis development

2.1. Entrepreneurship education and entrepreneurial activity

Human capital theory, which includes education, indicates that individuals' knowledge, skills, and other competencies can make a difference in achieving performance (Martin, McNally, & Kay, 2013; Ployhart & Moliterno, 2011). So, the education in entrepreneurship can also help one accumulate capital related to entrepreneurial activities. Entrepreneurial activity is a whole process which involves multifaceted, complex, and various steps (Kuratko, 2016; Shane & Venkataraman, 2000). Much of the effect that EE has on these different steps show two streams. EE plays a significant positive role in promoting EA. The students who take the entrepreneurship educational curriculum at different levels and different study fields can strengthen their attitudes toward entrepreneurship as a good career choice (Liam et al., 2015; Peterman & Kennedy, 2003). EE can enhance individuals' competencies (Segal, Borgia, & Schoenfeld, 2005) and help in identifying new business opportunities. More education may lead to more confidence in starting new

businesses (Li, Wu, & Wu, 2008) and keeping incomes from business venturing (Van der Sluis, Van Praag, & Vijverberg, 2008).

Martin et al. (2013) link EE and human capital and confirm that EE has a strong significant relationship with the type of entrepreneurship outcomes, which involves in business planning and financing, new business creation, persistence of running business, and income from established business. In addition, the positive effect of EE on EA can also be found from the perspective of environmental feature. Governments and public institutions all over the world prefer taking a sizable proportion of budget to develop educational facilities (Minniti, 2008), believing that more development of human capital can lead to more rapid growth of their economies. The society with a high-level of education can shape an entrepreneurial climate, thus increasing the rate of entrepreneurial activity (Dheer, 2017). Stam (2013) uses the data about different types of entrepreneurial activity also confirm that there is more knowledge spillover in developed and educated countries, thus triggering more entrepreneurial opportunities and higher rate of entrepreneurial activity.

Even though the positive role of EE has been widely discussed, some studies show different findings (Li et al., 2008; Van der Sluis, van Praag, & Vijverberg, 2004). For example, Oosterbeek, van Praag, and Ijsselstein (2010) use instrumental variables approach and find no effect of entrepreneurship educational program on students' self-evaluation skills and intention. Souitaris et al. (2007) support this argument by finding no significant effect of EE on individuals' perceived capability to be entrepreneurs. Lautenschläger and Haase (2011) even question EE, as a part of rational education system, cannot facilitate the identification of new business opportunities, creation and operation of new firms. Chang and Rieple (2013) even find a negative relationship between entrepreneurial curriculum and self-assessed skills.

One possible explanation for these findings is that entrepreneurs may have a more objective and rational understanding about their abilities and skills in entrepreneurship while undergoing entrepreneurship education. From the environmental feature level, it seems that the more people are educated, the more is the employment level developed in a society, thus decreasing the rate of entrepreneurial activity, resulting in the fear of startup failure (Dheer, 2017). Moreover, most of these studies ignore to analyze whether EE can explain variance about persistent activity in entrepreneurship. We believe that the contradictory arguments about the relationship between EE and EA, to some extent, depend on the stage in which EA is involved. Specifically, it is assumed that studying the role of EE in persistence of EA can confirm its specific effect and urge the scholars to analyze EA from "a whole process approach" to resolve the contradictions.

2.2. Entrepreneurship education and established business activity

Entrepreneurship education means education and training system that aims at coaching to create or manage new business ventures at school stage and post-school stage, it can tell the prevalence and environmental feature of EE in a nation (Hechavarría & Ingram, 2019; Reynolds et al., 2005). Established business activity refers to those businesses that are currently running and have provided any payments to the owners for more than 42 months (Hechavarría & Ingram, 2019; Reynolds et al., 2005), including early-stage activity (e.g., nascent and new business creation) (Giotopoulos et al., 2017; Reynolds et al., 2005), which means survival and growth in the competitive market for achieving greater performance. EE can be offered at different levels and fields (Hahn et al., 2020) to help students acquire knowledge, skills, abilities, and human and social capital (Hahn et al., 2020; Peterman & Kennedy, 2003), and improve their cognitive capabilities to evaluate and explore the process of owning and managing established business ventures (Hechavarría & Ingram, 2019).

With the endowment of EE, new firms can overcome the disadvantages related to small size and liability of newness. The entrepreneurs can get more external knowledge based on the social capital to foster their absorptive abilities, so they can enhance the innovation levels of new firms (Plotnikova, Romero, & Martínez-Román, 2016) to keep the firms growing. EE can also form an external environment characteristic: knowledge spillover which implies that educated and developed countries have more opportunities to experience high rate of entrepreneurial activity (Dheer, 2017; Stam, 2013). Sadeghi, Nkongolo-Bakenda, Anderson, and Dana (2019) use an institution-based view of international entrepreneurship to highlight the role of many context-based and universal determinants in developing entrepreneurial activity across developed and emerging markets. Hechavarría and Ingram (2019) use GEM data to confirm this argument; they find that the nations offering strong entrepreneurship educational programs have higher rates of business venturing. Therefore, in a country with more educated individuals or groups in entrepreneurship, the higher level of knowledge, skills, and other competencies they can get, which can help them get greater performance outcomes. Thus, we hypothesize.

H1. The prevalence of entrepreneurship education is positively associated with the rate of established business activity.

2.3. Mediating role of perceived opportunity

Individuals may be able to use educational and training courses about entrepreneurship to improve their abilities to manage the process of opportunity identification, evaluation, and exploitation (De Tienne & Chandler, 2004), thus promoting them to take opportunities and enhance innovation levels of SMEs (Plotnikova et al., 2016). The experience about taking EE courses is a factor that can enrich human capital for improving instrumental skills (Honig, 2004), knowledge, and competencies, thus playing a positive role in new firm's performance (Plotnikova et al., 2016). Prior researches have shown that this positive effect is associated with recognizing and developing new opportunities (Shane, 2003).

Moreover, attending these courses can help the students construct and expand their own social networks to acquire external knowledge and information about good opportunities (Nowiński & Rialp, 2016) to establish and run a business (Greve & Salaff, 2003). Thus, the internal and external capital embedded in EE can help entrepreneurs identify opportunities and exploit those to make innovation for keeping firm survival and growth (Piening & Salge, 2015; Plotnikova et al., 2016). In addition, knowledge spillover

theory of entrepreneurship (Acs, Braunerhjelm, Audretsch, & Carlsson, 2009) suggests that if a country has more educated people, more entrepreneurial opportunities will be perceived for higher entrepreneurial activities (Dheer, 2017; Stam, 2013). Accordingly, we hypothesize.

H2. Perceived opportunity plays a significant mediating role in the effect of entrepreneurship education on established business activity.

2.4. Mediating role of perceived capability

Individuals' perceived capability focuses on the required skills and knowledge about entrepreneurship in any stage of EA. By taking EE courses or programs, the students can develop required knowledge, skills, and competencies, thus improving their perceived capabilities to manage the process about entrepreneurship such as gestation (González-López, Pérez-López, & Rodríguez-Ariza, 2020; Mwangi & Rotich, 2019), new business creation (e.g., Cassar & Friedman, 2009; Laguna, 2013), and operation of new businesses (e.g., McGee & Peterson, 2019). EE can also increase one's belief about performing entrepreneurship successfully (Chen, Greene, & Crick, 1998; Liam et al., 2015).

Specifically, entrepreneurship educational curriculums, which include guest speakers and case studies (Wilson, Kickul, & Marlino, 2007), can improve students' perceived capability by using personal comparison (Cox, Mueller, & Moss, 2002), role models, social persuasion, and business running simulations (Liam et al., 2015). With these kinds of education and training, it will play positive role in improving entrepreneurship outcomes, which involves in success of duration, financial performance, and personal income from owned business (Martin et al., 2013). Entrepreneurship education and training can also be linked with human capital, such that people with higher levels of knowledge and skills can use these to make SMEs to achieve innovations and higher performance (Ployhart & Moliterno, 2011). Based on this discussion, we put forth our final hypothesis.

H3. Perceived capability plays a significant mediating role in the effect of entrepreneurship education on established business activity.

Fig. 1 shows the conceptual model with all the hypotheses.

3. Methodology

3.1. Data and sample

In this paper, we test the hypotheses on a macro-level, so we get the dataset on the national level. The data is gathered from Global Entrepreneurship Monitor (GEM) and World Bank Development Indicators. The databases are considered as suitable secondary data source to study entrepreneurial activities and development quality in different countries (e.g., Berrill et al., 2020; Dheer, 2017; Hechavarría & Ingram, 2019; Walter & Block, 2016). From 1999, GEM carries out survey-based research on entrepreneurship and entrepreneurship ecosystems around the world. GEM has a network consortium which is associated with the top academic institutions in different nations to track the rates of entrepreneurship across different stages of entrepreneurial activities. The survey consists of two parts: Adult Population Survey (APS) and National Expert Survey (NES) (Reynolds et al., 2005). In APS, the individuals between 18 and 64 years old are asked to assess the characteristics, motivations, and attitudes toward entrepreneurship. The rates of entrepreneurship across different country are aggregated on the basis of these assessments. We gather the data about *gender, innovation, perceived opportunities, perceived capability, and entrepreneurial activity* from APS.

In NES, each member country participates in the annual survey about environmental features that are expected to have a significant

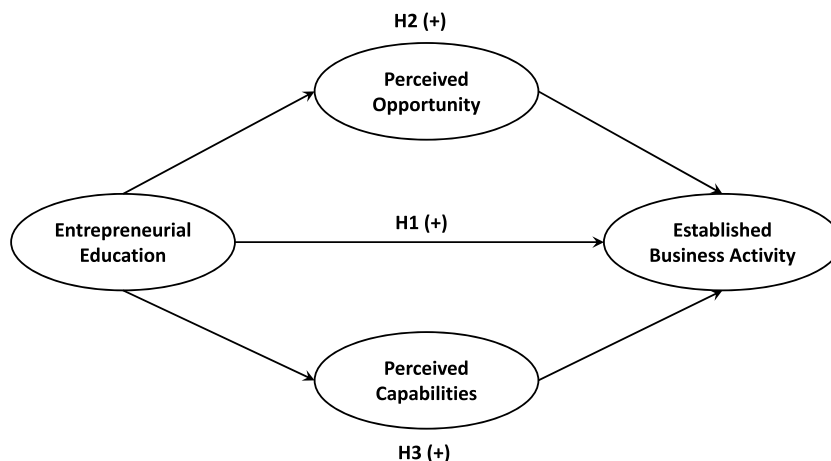


Fig. 1. Conceptual model.

role in entrepreneurial attitudes and activities rather than about the general economic factors. Specifically, at least 36 experts or informants, who are active entrepreneurs, entrepreneurship academics, government policy-makers, and providers of public and private services to entrepreneurs (e.g., venture capitalists and business angels) are selected (Hechavarría & Ingram, 2019). These experts and informants are invited to evaluate the most important conditions that can either improve or hinder entrepreneurial activity and development in their country. We got the nation-level data about *entrepreneurial finance, government policies, government entrepreneurship programs, R&D transfer, infrastructure, and entrepreneurship education* from NES.

World Bank Development Indicators, which covers 217 economies and more than 40 country groups, is a compilation of relevant, high-quality, and cross-country comparable data on global development. Since GDP and patent information has significant effects on entrepreneurial activity (e.g., Dheer, 2017; Hechavarría & Ingram, 2019; Kiebzak, Rafert, & Tucker, 2016; Walter & Block, 2016), we collect the data (i.e., GDP growth rate and patent applications) from World Bank Development Indicators across the year from 2001 to 2018. Although the data in GEM are collected every year, not every country is surveyed annually. So, the data about attitudes and environmental features toward entrepreneurship in some countries are missing. In order to reduce nonresponse rate and sample selection bias, we get a larger sample size and a broader coverage of different nations during the sample period from 2001 to 2018. Finally, we have the sample across 107 countries. Appendices 1 and 2 show the data source of different variables and the list of nations respectively.

3.2. Dependent variable

Established business activity. We measure the variable based on the established business ownership rate index. The index means the percentage of 18–64 years old population who are currently an owner-manager of an established business, i.e., owning and managing a running business that has paid salaries, wages, or other payments for more than 42 months (regarded as late-stage entrepreneurship profile). The data is collected with mobile phone or face-to-face interviews conducted by research scholars from across the world, with at least 2000 respondents in each nation (Dheer, 2017; Reynolds et al., 2005). Similar to the well-known and widely used index in GEM, another measure called Total Entrepreneurial Activity (e.g., De Clercq, Danis, & Dakhli, 2010; Dheer, 2017; Giotopoulos et al., 2017; Hechavarría & Ingram, 2019) can also offer the information to explore the mechanism of entrepreneurial activities across different countries (Lim, Oh, & De Clercq, 2016; Reynolds et al., 2005).

3.3. Independent variable

Entrepreneurship education. It involves in education at school stage and post-school stage. The first measure of entrepreneurship education at school stage captures the extent to which the training in creating or managing SMEs is incorporated within the education system at primary and secondary school levels. The second measure of entrepreneurship education at post-school stage captures the extent to which the training in creating or managing SMEs is incorporated within the education system in higher education such as vocational, college, business schools, etc. To measure the index combining the measures of entrepreneurship education at both school stage and post-school stage, active entrepreneurs, entrepreneurship academics, government policy-makers, and providers of public and private services to entrepreneurs are asked to provide their assessments with the Likert scale of 1 (highly insufficient) to 9 (highly sufficient) on a country level.

3.4. Mediators

The two mediators are measured using perceived opportunity rate index and perceived capability rate index in GEM (Giotopoulos et al., 2017; Wennberg, Pathak, & Autio, 2013; Yang, Li, & Wang, 2020). In the first one, it captures the percentage of 18–64 years old population who see good opportunities to start a firm in the area where they live. In the second one, it captures the percentage of 18–64 years old population who believe they have the required skills and knowledge to start a business. The respondents (excluding the individuals in any stage of entrepreneurial activity) are interviewed by research scholars by means of telephone or face-to-face interviews (Dheer, 2017; Reynolds et al., 2005).

3.5. Control variables

Gender. Dilli and Westerhuis (2018) and Bernat, Lambardi, and Palacios (2017) find that there is a gender gap in different entrepreneurial activities with the secondary data such as GEM and Development Bank of Latin America. Thus, we include gender as our control variable. Based on the individual characteristics in APS aggregated on the country level, we measure gender by female/male ratio, which is the percentage of female population at 18–64 age group who are either a nascent entrepreneur or owner-manager of a new business divided by the equivalent percentage of their male counterparts.

Innovation. Giotopoulos et al. (2017) suggest that the innovation in terms of new product market combinations can be referred to the determinant of entrepreneurial activity. So, we use this variable as a control one. To measure this variable, the respondents were asked to assess whether their products are new to the customers and if there are few businesses selling products with the same characteristics, motivations, and attitudes toward entrepreneurship. The rates are also aggregated on a country level.

The other control variables include *entrepreneurial finance, government policies, government entrepreneurship programs, R&D Transfer, and infrastructure*. These variables are indicators of the entrepreneurship framework conditions, which have a positive influence on the prevalence of entrepreneurship (e.g., Hechavarría & Ingram, 2019; Shirokova et al., 2017). The government policies consist of two

measures: support and relevant policies and tax and bureaucratic policies. The infrastructure includes commercial and legal infrastructure as well as physical infrastructures. Each variable is evaluated by the national experts on a country level (1 = highly insufficient, 9 = highly sufficient). GDP change has a positive impact on entrepreneurial activity (e.g., Dheer, 2017; Hechavarría & Ingram, 2019; Walter & Block, 2016). A non-linear relationship is found for patent and entrepreneurial activity (Kiebzak et al., 2016) Hence, GDP growth rate and patent (logged values of patent applications by residents) are included as control variables.

4. Data analysis and results

Table 1 reports mean, standard deviation, and correlations of the variables. Before we conduct the regression analysis, we standardize the variables to reduce the dimensional issue. To test multicollinearity, we compute the variance inflation factor (VIF) for the variables included in each regression equation. The results indicate that the maximum VIF value is 3.98 among all the equations. Following the suggestions from De Clercq, Lim, and Oh (2014), Dheer (2017), and Hechavarría and Ingram (2019), we also calculate the mean VIF value for each equation, and the maximum value is 2.18. All the VIF values are below the threshold of 10.0 (Hair, Tatham, Anderson, & Black, 2006; Wooldridge, 2013), which indicates that there is no multicollinearity in our sample. In Table 1, the correlation results show that there are significant positive correlations between perceived opportunity and established business activity ($r = 0.260, p < 0.001$), between perceived capability and established business activity ($r = 0.393, p < 0.001$), and between entrepreneurship education and perceived opportunity ($r = 0.136, p < 0.001$). The results provide initial evidence for the analysis on the effect of entrepreneurship education on established business activity.

4.1. Hypotheses test

To test the hypotheses, Poisson regression analysis is used in this study. When we use this regression, we need to consider some specific constraints: independent, positive, and probability (e.g., Frome, 1983, pp. 665–674; Lawless, 1987; Wooldridge, 2013). In this study, first, the entrepreneurial activities of each nation are independent with each other. Second, the original data for the variables

Table 1
Descriptive statistics and correlation matrix.

	1	2	3	4	5	6	7	8
1. Established business activity	1							
2. Entrepreneurship education	-0.032	1						
3. Perceived opportunity	0.260***	0.136***	1					
4. Perceived capability	0.393***	-0.052	0.593***	1				
5. GDP growth rate	0.093*	0.053	0.256***	0.086*	1			
6. Patent (logged)	-0.126**	-0.037	-0.311***	-0.522***	-0.084*	1		
7. Gender	0.365***	0.091**	0.331***	0.359***	0.174***	-0.155***	1	
8. Innovation	-0.221***	0.203***	0.069	-0.103*	-0.042	0.122*	-0.213***	1
9. R&D transfer	-0.183***	0.575***	-0.165***	-0.441***	-0.029	0.383***	-0.194***	0.326***
10. Entrepreneurial finance	-0.170***	0.452***	-0.071*	-0.375***	0.087*	0.440***	-0.137***	0.177***
11. Support & relevant policy	-0.121***	0.415***	-0.008	-0.271***	0.111**	0.284***	-0.022	0.231***
12. Tax & bureaucratic policy	-0.080*	0.454***	0.092**	-0.232***	0.124***	0.061	-0.068*	0.251***
13. Government entrepreneurship program	-0.168***	0.436***	-0.004	-0.266***	0.019	0.219***	-0.075*	0.300***
14. Commercial infrastructure	-0.137***	0.520***	-0.008	-0.188***	-0.046	0.116**	-0.202***	0.252***
15. Physical infrastructure	-0.129***	0.218***	-0.067†	-0.296***	-0.017	0.157***	-0.158***	0.152***
Mean	7.818	2.435	40.953	49.888	2.898	2.907	0.635	25.783
Standard Deviation	5.255	0.328	16.344	14.913	3.379	1.099	0.217	10.376
	9	10	11	12	13	14	15	
1. Established business activity								
2. Entrepreneurship education								
3. Perceived opportunity								
4. Perceived capability								
5. GDP growth rate								
6. Patent (logged)								
7. Gender								
8. Innovation								
9. R&D transfer	1							
10. Entrepreneurial finance	0.665***	1						
11. Support & relevant policy	0.599***	0.544***	1					
12. Tax & bureaucratic policy	0.576***	0.449***	0.620***	1				
13. Government entrepreneurship program	0.703***	0.493***	0.680***	0.599***	1			
14. Commercial infrastructure	0.579***	0.565***	0.300***	0.427***	0.467***	1		
15. Physical infrastructure	0.471***	0.370***	0.306***	0.466***	0.519***	0.461***	1	
Mean	2.389	2.586	2.571	2.397	2.594	3.048	3.739	
Standard Deviation	0.404	0.471	0.491	0.578	0.487	0.38	0.501	

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

that are aggregated on a country level are positive integers. Third, it is a probability event for the entrepreneurial activities to become the established activities, i.e., to persist for more than 42 months. Table 2 presents the results about the hypotheses test. In Model 1, only the control variables are included. The LR Chi² value is significant (Chi² = 352.22, p = 0.000), indicating that the model fits the data.

The results show that patent ($\beta = 0.043$, $p < 0.05$), gender ($\beta = 1.330$, $p < 0.001$), and infrastructure (commercial & legal, and physical) have positive effects on the established entrepreneurial activity. Significant negative associations exist for established entrepreneurial activity with innovation ($\beta = -0.010$, $p < 0.001$), entrepreneurial finance ($\beta = -0.215$, $p < 0.001$), and government entrepreneurship program ($\beta = -0.343$, $p < 0.001$). In Model 2, the independent variable is added in the analysis to examine the effect of entrepreneurship education on the established business activity. The overall regression model is significant (Chi² = 357.16, $p = 0.000$), implying the regression model matches the data. The result illustrates that there is a significant positive relationship between entrepreneurship education and established business activity ($\beta = 0.173$, $p < 0.05$), thus H1 is supported.

To test H2, we included the independent variable and mediated variable (perceived opportunity) in the analysis. Model 3 examines the effect of entrepreneurship education on perceived opportunity and the result shows a positive association between entrepreneurship education and perceived opportunity ($\beta = 0.282$, $p < 0.001$). Model 5 examines the mediating effect of perceived opportunity on the relationship between entrepreneurship education and established business activity. The overall regression model is significant (Chi² = 365.49, $p = 0.000$), indicating the model matches the data. The results illustrate that the effect of entrepreneurship education on established business activity is not significant ($\beta = 0.130$, $p > 0.05$), and the effect of perceived opportunity is positively significant ($\beta = 0.004$, $p < 0.01$). Based on the significant main effect of entrepreneurship education on established business activity and the significant effect of entrepreneurship education on perceived opportunity, we can conclude that H2 is supported.

To test H3, we include the independent variable and mediated variable (perceived capability) in the analysis. Model 4 examines the effect of entrepreneurship education on perceived capability and the result illustrates a significant relationship between entrepreneurship education and perceived capability ($\beta = 0.171$, $p < 0.001$). Model 6 examines the mediating effect of perceived capability on the relationship between entrepreneurship education and established business activity. The regression model is significant (Chi² = 534.41, $p = 0.000$), implying that the model used in our study fits the data. The result demonstrates that the effect of entrepreneurship education on established business activity is not significant ($\beta = 0.065$, $p > 0.05$) and the effect of perceived capability is significant ($\beta = 0.010$, $p < 0.001$). Based on the findings of the significant main effect of entrepreneurship education on established business activity and the significant effect of entrepreneurship education on mediation, H3 is also supported.

Based on the findings, it can be concluded that EE has a long-term and growth-oriented effect on entrepreneurship. That is, EE is not only related to new business creation in the early stages (Alsos et al., 2023) but also to entrepreneurial activities in late-stage that lasts for more than 42 months. EE can also enhance entrepreneurs' perceived capabilities and opportunities to start and develop a business, such as owning and managing a running business that pays salaries, wages, or other payments. In practice, Saeed Talaat, the co-founder of a fintech startup in 2017, suggests that educational services are still needed to sustain entrepreneurship in a new normal, given the downward trend in the pandemic (GEM, 2020/2021). Students in entrepreneurship courses, who are interviewed, express that they perceive tools and methods (e.g., design thinking, skills, competence) to tackle complex problems in established business (Lynch, Kamovich, Longva, & Steinert, 2021). This study shows that the nature of EE determines the type of entrepreneurial activity significantly, creating an environmental context (Pittaway & Cope, 2007) that triggers motivational framework for entrepreneurship (Piperopoulos & Dimov, 2015). When coupled with perceptions, this frame can strengthen efforts for persisting entrepreneurship, whether theoretically-oriented or practically-oriented.

Table 2
Regression analysis output.

	DV: Established business activity		DV: Perceived opportunity	DV: Perceived capability	DV: Established business activity	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.858***	0.783***	3.150***	4.417***	0.681**	0.031
GDP growth rate	-0.01	-0.011	0.016***	-0.004	-0.014 [†]	-0.01
Patent (logged)	0.043*	0.059**	-0.041***	-0.077***	0.066**	0.097***
Gender	1.330***	1.268***	0.318***	0.356***	1.224***	1.106***
Innovation	-0.010***	-0.011***	0.006***	0.003***	-0.012***	-0.012***
R&D transfer	0.089	0.016	-0.375***	-0.323***	0.081	0.172 [†]
Entrepreneurial finance	-0.215***	-0.231***	0.095***	-0.027	-0.249***	-0.213***
Support & relevant policy	0.011	-0.013	-0.067*	-0.018	-0.003	-0.005
Tax & bureaucratic policy	-0.054	-0.055	0.02	-0.066**	-0.057	-0.018
Government entrepreneurship program	-0.343***	-0.340***	0.199***	0.132***	-0.375***	-0.398***
Commercial infrastructure	0.463***	0.424***	-0.037	0.003	0.431***	0.428***
Physical infrastructure	0.105*	0.119*	-0.005	-0.094***	0.124*	0.164***
Entrepreneurship education	-	0.173*	0.282***	0.171***	0.13	0.065
Perceived opportunity	-	-	-	-	0.004**	-
Perceived capability	-	-	-	-	-	0.010***
LR chi ² (11)	352.22	357.16	534.41	754.62	365.49	381.95

[†]p < 0.1; *p < 0.05; **p < 0.01; ***p < 0.001.

4.2. Robustness test

For robustness purpose, we repeat the analysis with alternative measures and subsample (e.g., Chang & Wu, 2014; Dheer, 2017; Laamanen, 2007; Petrenko, Aime, Ridge, & Hill, 2016). First, we use total early-stage entrepreneurial activity (TEA) as an alternative dependent variable. TEA has been widely used to represent entrepreneurial activity in many studies (e.g., Bergmann et al., 2016; Berrill et al., 2020; Dheer, 2017; Giotopoulos et al., 2017; Hechavarría & Ingram, 2019) and it is regarded as the firm birth stage in GEM. TEA serves as a link between firms' conception stage and firms' late-stage, meaning that only when the firms get through TEA can they have a likelihood to reach late-stage entrepreneurial activity (i.e., the established business activity) (cf. GEM, 2017/2018). The results are similar those reported in Table 2.

Specifically, the main effect of entrepreneurship education is significantly positive ($\beta = 0.521$, $p < 0.001$). The mediation effects of perceived opportunity ($\beta = 0.012$, $p < 0.001$) and perceived capability ($\beta = 0.022$, $p < 0.001$) are also significant. We also adopt paired sample *t*-test to analyze the difference between the control (using dependent variable of established business activity) and experimental group (using the alternative dependent variable of TEA). The sample *t*-test result demonstrates that there is no difference for the analyses using alternative measures of dependent variable ($t = -1.089$, $p = 0.390$).

Second, we use the data over another time period (from 2012 to 2018) to repeat our analysis. During 2008–2012, there was a global financial crisis with a lot of uncertainty and risk, which could exert negative impacts on the entrepreneurial activities (e.g., credit crunch, limited external source of finance, lack of product market innovation, etc.) (Bartz & Winkler, 2016; Bernanke & Gertler, 1989; Wadhvani, Kirsch, Welter, Gartner, & Jones, 2020). If the potential entrepreneurs hesitate to take actions, the entrepreneurial activity would be affected negatively. In this condition, entrepreneurship education can make a difference in knowing entrepreneurship and crisis, discovering opportunities, and cultivating knowledge and skills. Therefore, we narrow down the sample over the time period from 2012 to 2018.

The results using the alternative sample period are also similar to those reported in Table 2. The effect of entrepreneurship education on established business activity is significant ($\beta = 0.148$, $p < 0.1$). The mediating effects of perceived opportunity ($\beta = 0.004$, $p < 0.01$) and perceived capability ($\beta = 0.014$, $p < 0.001$) are also significant. We use the paired sample *t*-test to analyze the difference between the control (sample period of 2001–2018) and experimental group (sample period of 2012–2018). The result demonstrates that there is no difference between the two group ($t = 0.771$, $p = 0.521$).

5. Discussion and implications

5.1. Theoretical contributions

This study provides some novel insights into the literature on EE and EA. First, we extend the current research by investigating the role of entrepreneurship education in late-stage entrepreneurial activity, specifically established business activities that persist for more than 42 months. Previous studies on the effect of EE on EA mainly focus on nascent activities and new business creation within the first 42 months (e.g., Bergmann et al., 2016; Berrill et al., 2020; Eesley & Lee, 2021; Shirokova et al., 2017; Walter & Block, 2016). Those studies ignore the stage that persists for more than 42 months and show a partial relationship between EE and EA. In this study, we expand the focal stage to established business ownership and find that entrepreneurship education has a significant role in promoting the rate of established business activity across nations, offering a new direction for comprehensively understanding the relationship between EE and EA.

Second, our finding not only responds to current debates about the different effects of EE on EA, but it also provides a proof that EE can have a positive impact on EA throughout the whole process of entrepreneurship. Previous studies have shown that EE can have positive and negative effects on early-stage entrepreneurship activities (e.g., Dheer, 2017; Hahn et al., 2020; Liam et al., 2015). However, activities in this stage cannot represent the whole process of entrepreneurship, such previous works leave open the question of what the impact of EE on EA would be in late-stage. Entrepreneurial activity is a multifaceted process, which involves some sub-steps (Kuratko, 2016; Shane & Venkataraman, 2000). This study focuses on late-stage entrepreneurship (the rate of established business activity) and demonstrates the positive impact of EE. Our finding provides a new insight to resolve the contradictions in a whole process approach to entrepreneurial activity.

Third, this study contributes to the emerging research on EE and late-stage entrepreneurial activity by introducing a new mechanism. Past studies have examined the relationship between EE and entrepreneurial activities in established businesses (e.g., Alsos et al., 2023; De Jager et al., 2017), particularly in terms of entrepreneurial learning (Pocek et al., 2021), perception of knowledge, skills, and abilities (e.g., Alsos et al., 2023; Saeed et al., 2015). However, these studies do not explain the mechanism through which EE influences established business activities across different nations. This study uses GEM data from 107 countries and focuses on the role of perceived opportunity and perceived capability. The results indicate that both factors mediate the relationship between EE and late-stage entrepreneurial activity. In addition, this study distinguishes between early-stage and established business activity and enriches the understanding of how perception-related factors play a significant role throughout the entrepreneurial process.

5.2. Practical implications

This study also provides some managerial implications for entrepreneurs. First, our findings suggest that EE at even later stages of businesses development can be effective in addressing problems with their survival and growth. Educational institutions and entrepreneurs should take some constructive steps to exert the maximum utility of entrepreneurship education. Specifically, educational

institutions can develop programs at school-stage and post-school stage to help their students develop entrepreneurial orientation, under the guidance of teachers and entrepreneurial experts. This may involve simulating a true-to-life corporate operation including market segmentation, hiring, financing, marketing, logistics, and business evaluation. Similarly, the entrepreneurs may cultivate the awareness of lifelong learning and possibly even pay for further education of their employees in areas that may lead them to become more effective in their roles.

Second, coupled with perceptions, entrepreneurship education can strengthen one's efforts for persisting entrepreneurship. The finding calls for more focused curriculums primarily in educational institutions. The educational institutions can consider offering structured curricula related to self-perception, which can be available on an as needed basis, long term and focused on specific issues. They can design courses to shape students' entrepreneurial mindset to recognize good opportunity, leadership, and required knowledge and skills. They can also enrich existing courses by supporting research about corporate renewal and business expansion. When developing educational programmes and courses, institutions should also consider contextual elements such as the suitability of certain elements for a "learning through" approach to enhance entrepreneurs' perceptions of design or iterative thinking, related knowledge and skills, and competence.

Third, to keep the positive role of EE and perception in late-stage entrepreneurial activity, policy makers can take some actions to promote entrepreneurial education to help entrepreneurs develop their capabilities and seek new opportunities. Specifically, they can develop policies and regulations to reduce the bureaucratic burden of educational institutions; provide appropriate budgets for educational programs that support entrepreneurial activities in high growth; and supervise effective implementation of related policies. In addition, while entrepreneurial activity can persist in challenging circumstances, it may struggle to succeed even in the most favorable conditions due to differences in national or regional contexts. Therefore, policy-makers should also take these differences into account to promote quality education in schools and colleges, including entrepreneurship training.

6. Limitations and future research

This study has some limitations that future research may address. First, the effect of entrepreneurship education on established business activity focuses on the role of educational environment features. In this study, we assess the role of entrepreneurship education from the perspective of environment, i.e., the extent to which training and education in creating or managing businesses puts a positive impact on the rate of established business activity. However, education is a long-term investment. The effect of entrepreneurship education on entrepreneurial activities has a certain time dependence as it may take a long time to influence entrepreneurship behaviors and outcomes in future. Future studies can explore this issue beyond the environmental feature of entrepreneurship education and track how entrepreneurship education affects entrepreneurial activities over time.

Second, our data, which is aggregated on a country level, may conceal individual-level differences. In other words, this study cannot provide a comprehensive picture about the variation in entrepreneurship education and perception among individuals. In addition, our study does not examine the various entrepreneurship education programs that individuals may undertake and the influence of each type of education program has on established businesses. Further studies are encouraged to investigate the individuals' different perceptions and entrepreneurship education programs at different stages of entrepreneurial activities with survey and self-reported metrics. Integrating the individual-level data with country-level data would help deepen our understanding of the role of EE. Finally, in this paper we study established business activity, but there are different types of entrepreneurship, such as high growth entrepreneurship and social entrepreneurship (Dacin, Dacin, & Matear, 2010; Short, Moss, & Lumpkin, 2009; Stenholm, Acs, & Wuebker, 2013). Hence, future research may explore the antecedents and mechanisms for these different types of entrepreneurs.

Statements and declarations

The authors do not have financial or non-financial interests that are directly or indirectly related to the work submitted for publication.

Data statement

This study uses data from the publicly available GEM database that can be accessed and analyzed by anyone to verify our results.

Data availability

The authors do not have permission to share data.

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Appendix 1. Data source of different variables

Variables	Data source
Established business activity	APS in GEM
Entrepreneurship education	NES in GEM
Perceived opportunity	APS in GEM
Perceived capability	
Entrepreneurial finance	NES in GEM
Government policies ^a	
Government entrepreneurship programs	
R&D Transfer	
Infrastructure	
GDP growth rate	World Bank Development Indicators
Patent ^b	

^a include support and relevance, and taxes and bureaucracy.

^b patent application resident.

Appendix 2. List of nations

Algeria	Costa Rica	India	Montenegro	Senegal	United Kingdom
Angola	Croatia	Indonesia	Morocco	Serbia	United States
Argentina	Cyprus	Iran	Namibia	Singapore	Uruguay
Australia	Czech Republic	Ireland	Netherlands	Slovakia	Vanuatu
Austria	Denmark	Israel	New Zealand	Slovenia	Venezuela
Bangladesh	Dominican Republic	Italy	Nigeria	South Africa	Vietnam
Barbados	Ecuador	Jamaica	North Macedonia	South Korea	Zambia
Belgium	Egypt	Japan	Norway	Spain	
Belize	El Salvador	Jordan	Pakistan	Sudan	
Bolivia	Estonia	Kazakhstan	Palestine	Suriname	
Bosnia and Herzegovina	Ethiopia	Kosovo	Panama	Sweden	
Botswana	Finland	Latvia	Peru	Switzerland	
Brazil	France	Lebanon	Philippines	Syria	
Bulgaria	Georgia	Libya	Poland	Thailand	
Burkina Faso	Germany	Lithuania	Portugal	Tonga	
Cameroon	Ghana	Luxembourg	Puerto Rico	Trinidad and Tobago	
Canada	Greece	Madagascar	Qatar	Tunisia	
Chile	Guatemala	Malawi	Romania	Turkey	
China	Hungary	Malaysia	Russia	Uganda	
Colombia	Iceland	Mexico	Saudi Arabia	United Arab Emirates	

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