Relationship Among Entrepreneurial Intention and Entrepreneurial Competency Development: A Study on Perceptions Through Engineering Students.

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Abstract

Entrepreneurial intention and entrepreneurial competencies are two essential components in the entrepreneurial process. Intention is the initial driving force that propels an individual to embark on entrepreneurship, while competencies provide the necessary tools to execute entrepreneurial endeavors successfully. Entrepreneurial intention is a key concept in the entrepreneurial world and plays a fundamental role in initiating and developing new businesses. Entrepreneurial intention is essential for economic growth, innovation, job creation, and individual empowerment. Nurturing and supporting entrepreneurial intention is crucial for developing a thriving and dynamic society. On the other hand, entrepreneurial competencies refer to developing personal qualities such as creativity, a willingness to innovate, self-confidence, achievement motivation, leadership, and tolerance for failure, among others. They correspond to a specific mindset that needs to be effectively channeled into attitudes that promote entrepreneurship and innovation. Both aspects are interdependent and mutually complement each other on the path to achieving entrepreneurial goals, and they have gained significant prominence in recent years, leading educational institutions to focus on understanding various aspects of this relationship. Given the aforementioned, this research aims to analyze the relationship between entrepreneurial intention and self-perceived development of entrepreneurial competencies in engineering students. The sample comprises 175 students aged 18 to 28, representing various engineering disciplines at a private Chilean university. A validated questionnaire was administered, incorporating a series of entrepreneurial competencies outlined by the European Union within three areas: (a) ideas and opportunities, (b) resources, and (c) taking action. Additionally, this questionnaire includes a section addressing various aspects of entrepreneurial projects: self-efficacy, intention, career choice, and motivation. Statistical methods were employed to analyze the questionnaire responses. The results allow us to highlight strong statistically significant correlations between areas associated with entrepreneurial competencies and the dimension of entrepreneurial intention related to the effective creation of an entrepreneurial project. Furthermore, it is worth mentioning that the entrepreneurial competency within the Resources Area, associated with financial and economic education, exhibits statistically significant and strong correlations with the "intention" dimension linked to entrepreneurial intention. The findings suggest the importance of fostering entrepreneurial intention and competencies in engineering students. These conclusions significantly impact entrepreneurship education and training in academic and business environments.

Keywords: Entrepreneurial Intention, Entrepreneurial competencies, Engineering Education, Student Perceptions.

Introduction

In the dynamic landscape of today's global economy, the nexus between entrepreneurial intention and the development of entrepreneurial competencies stands as a cornerstone for fostering innovation and economic growth. As we delve into entrepreneurial studies, it becomes increasingly evident that these two elements play a pivotal role in shaping the future of business and technological advancement. This research, focusing on the perceptions of engineering students, offers a unique lens through which we can understand this interplay, revealing insights that are not only academically intriguing but also practically imperative.

Entrepreneurial intention, the psychological inclination towards starting and managing a new business venture, is the seed from which the tree of entrepreneurship grows. It embodies the desire to bring ideas to life, driven by a blend of ambition, vision, and the will to innovate. This intention is more than just a fleeting thought or a daydream; it's a potent combination of motivation and aspiration that fuels the entrepreneurial journey. In the context of engineering students, this intention is particularly noteworthy. Often equipped with cutting-edge technical skills and a problem-solving mindset, these students represent a significant segment of the entrepreneurial landscape. When aligned with entrepreneurial competencies, their intentions can lead to groundbreaking innovations and significant contributions to society and the economy.

On the other side of this equation lie entrepreneurial competencies – the skills, knowledge, and attitudes necessary for successful entrepreneurship. These competencies include creativity, leadership, resilience, and a risk appetite. They are the toolkits that entrepreneurs use to navigate the challenging waters of business creation and growth. For engineering students, developing these competencies is crucial. It enables them to translate technical expertise into viable business ventures, thereby bridging the gap between theoretical knowledge and practical application.

The interplay between entrepreneurial intention and competency development is a dance of potential and actualization. While intention sparks the desire to engage in entrepreneurial activities, competencies provide the means to turn these aspirations into reality. This study aims to dissect this relationship, exploring how the development of entrepreneurial competencies and the entrepreneurial intentions of engineering students are related. It sheds light on a critical aspect of entrepreneurship education and training, which is increasingly becoming a focal point in academic and business circles.

The research employs a comprehensive approach, using a validated questionnaire to assess the entrepreneurial competencies and intentions of 175 engineering students from a private Chilean university. These students, aged 18 to 28 years and hailing from various engineering disciplines, represent a diverse and relevant sample for this study.

The statistical analysis of the responses unveils a wealth of information about the connections between entrepreneurial competencies and intentions. By exploring these correlations, the study contributes to the academic understanding of entrepreneurship and offers practical insights for educational institutions, policymakers, and business leaders. It highlights the importance of nurturing entrepreneurial intentions and competencies, especially in engineering education, where the potential for innovation and economic contribution is immense.

Literature Review

Entrepreneurial intention (EI) and entrepreneurial competencies (EC) are two essential components in the entrepreneurial process, playing complementary and fundamental roles in executing business initiatives. Entrepreneurial intention is the initial driving force that leads an individual to embark on entrepreneurship, while competencies provide the necessary tools to execute entrepreneurial efforts successfully. This concept is critical in the business world. It plays a crucial role in initiating and developing new ventures, which is essential for economic growth, innovation, job creation, and individual empowerment. Fostering and supporting entrepreneurial intention is critical for developing a prosperous and dynamic society [1].

Entrepreneurial Intention

Entrepreneurial intention (EI) is a key concept in entrepreneurship research, focusing on the factors influencing the decision to start a business. This decision is often based on deliberate reasoning that mediates between personal reasons and actions, shaped by various internal and external factors [3]. EI represents an individual's inclination to initiate and develop a new enterprise, acting as a significant predictor of future business endeavors [4], [5].

Studies have shown that EI is influenced by a range of factors, including personal attitudes, social norms, perceived control, and self-efficacy. Models like Elfving's Context-Specific Entrepreneurial Intention model help understand these influences [6]. Krueger et al. [7] emphasize that EI results from a cognitive process integrating perceptions, beliefs, expectations, and values.

The role of entrepreneurial education is crucial in shaping EI, providing necessary skills and fostering an entrepreneurial mindset [8], [9]. Research reveals that engineering students generally have a positive attitude toward entrepreneurship, influenced by factors like Locus of Control, Need for Achievement, and Instrumental Readiness [4]. A study on students highlights that motivation and interest in entrepreneurship can significantly contribute to social and economic development if supported appropriately. It advocates for problem-based learning and political support for entrepreneurial training programs [10]. Another study found that entrepreneurial education (EE) positively affects EI, particularly among management and engineering students, although its impact varies according to the field of study [11].

In a developing country context, a study using the Theory of Planned Behavior (TPB) explored how attitudes, perceived behavioral control, and subjective norms impact EI among engineering students in Medellin, Colombia. This research underscores the influence of contextual factors on EI and the importance of entrepreneurial education in fostering entrepreneurship [12]. Furthermore, research in Malaysia indicates that self-efficacy, motivation, and independence are critical in enhancing students' EI, with educational programs needing to integrate these aspects to boost entrepreneurial pursuits [13]. Lastly, a study on business students highlighted that entrepreneurial confidence, risk consideration, and educational level significantly influence EI, with technological familiarity also playing a crucial role in shaping entrepreneurial aspirations [14].

In conclusion, Entrepreneurial Intention (EI) emerges as a multifaceted phenomenon, intrinsically linked to diverse psychological, educational, and contextual factors. From the influence of self-efficacy and motivation to the critical relevance of entrepreneurial education, it is clear that fostering EI requires a holistic approach. The reviewed research underscores the importance of integrating technical knowledge with entrepreneurial skills, especially in fields such as engineering and business. This highlights the essential task of educational institutions and policymakers to recognize and nurture these diverse elements that shape EI.

Entrepreneurial Competencies Development

Entrepreneurial Competencies (EC) are defined as the development of personal qualities, including creativity, self-confidence, leadership, and a tolerance for failure, which are essential for fostering an entrepreneurial mindset. This mindset is critical for attitudes that promote entrepreneurship and innovation, elements that are interdependent and have become increasingly significant in educational contexts in recent years [15].

Studies in Chile indicate that a considerable number of engineering students acknowledge the positive impact of their participation in entrepreneurship-focused courses and seminars on their entrepreneurial skills. This observation suggests a beneficial link between academic programs focused on entrepreneurship and enhancing students' self-efficacy in business-related activities [5]. Universities are pivotal in this process, providing a structured environment that supports the development of entrepreneurial attitudes among students.

Additionally, there is a growing consensus that entrepreneurial competencies should be an integral part of the industrial engineering curriculum. This integration helps to balance the demands between traditional employment and entrepreneurial activities, promoting entrepreneurship as a viable career option beyond the confines of business schools [16]. The influence of collaborative learning on entrepreneurship in higher education has also been documented. A study shows a positive and significant impact of collaborative learning on students' engagement in entrepreneurial activities, with indirect effects mediated by entrepreneurial culture quantified at 28.29% and 6.6% [17]. This underscores the importance of collaborative learning as a tool to enhance entrepreneurial engagement in educational settings.

The work of Hamouda and Ledwith further supports the inclusion of entrepreneurial skills in engineering education, highlighting essential competencies such as innovation, problem-solving, and risk management. Their study argues that incorporating entrepreneurial education into engineering programs enhances employability and fosters economic innovation [18]. This multidisciplinary approach is crucial for adapting educational strategies across various disciplines.

Furthermore, additional research emphasizes the importance of exposing students to entrepreneurial role models. This shows that such exposure increases the attractiveness of entrepreneurship, thereby developing students' desire and confidence in creating businesses. This approach should be tailored to fit the diverse profiles of students, aligning with the principles of human capital theory that correlate entrepreneurial education with increased entrepreneurial intentions [19].

From the aforementioned, it follows that in the context of engineering education, entrepreneurial intention and the development of entrepreneurial competencies are fundamental. Entrepreneurial Intention is the inclination to start businesses, influenced by personal attitudes and social factors, while Entrepreneurial Competencies include skills such as creativity and leadership. Integrating these concepts in engineering education is crucial, emphasizing the need for practical experiences and an environment that promotes an entrepreneurial mindset. Both aspects prepare students for the challenges of the current and future job market, and educational institutions play a vital role in fostering an ecosystem that supports both entrepreneurial intention and competencies, contributing to economic and social development. This study delves into the relationship between competencies and entrepreneurial intention.

In the following sections, we will present the methodology, detail the research design, describe the sample population, explain the tools used for data collection, and outline the steps taken for data analysis. Afterward, we will present the results, starting with the primary descriptive data about the sample and initial findings, followed by the comparative and correlational studies. Then, we will delve into the discussion section, where we will interpret the results within the context of existing literature and theory. This section will also explore the practical implications of our findings for educational institutions. Finally, we will conclude by offering a reflective summary of the significance of the study and its contributions to entrepreneurial education research.

Methodology

Survey

A Cronbach's Alpha of 0.890 was attained during the survey validation process for the Entrepreneurial Competencies dimension and 0.876 for the Entrepreneurial Intention dimension. Table 1 shows the corresponding Cronbach´s Alpha reliability analysis by dimensions.

Descriptive statistics were used in sample characterization for data analysis. Likewise, non-parametric tests were carried out as there was no normal distribution; chi-square, Kruskal Wallis test, and Spearman's correlations were conducted using the SPSS statistical software.

Participants

We administered the validated survey on entrepreneurial competencies and entrepreneurial intentions, which also included questions concerning job preference related to the degree of preference students have for working in different places (private sector, public sector, or self-employment).

The instrument was applied to undergraduate students enrolled in Innovation & Entrepreneurship Workshop 2 of Engineering at a private Chilean university. Of the 175 responses, 11.4% came from female students and 88.6% from male students. As for the age range, 63.43% were students between 18 and 20, 14.86% were students between 21 and 23, 8.57% were students between 24 and 26, and 13.14% were older than 26.

Table 1. Survey dimensions - Cronbach's Alpha reliability analysis

	Dimensions	*Number of items*	*Scale*
Entrepreneurial Competencies (α=0.890)	*Area 1: Ideas and Opportunities (α=0.736)*	5	1 – 2. Basic level 3 – 4. Intermediate level 5 – 6. Advanced level
	Area 2: Resources (α=0.711)	5	
	Area 3: Taking Action (α=0.741)	5	
Entrepreneurial Project	*Entrepreneurial Self-Efficacy (α=0. 877)*	5	1. None 2. A little 3. Something 4. Quite a bit 5. A lot 6. Totally
	Entrepreneurial Intention (α=0.875)	4	
	Motivation (α=0.769)	10	1. Strongly Disagree 2. Disagree 3. Slightly Disagree 4. Slightly Agree 5. Agree 6. Strongly Agree
	Career Choice	4	7. Not important at all 8. Not very important 9. Slightly important 10. Somewhat important 11. Quite important 12. Very important

Results

This report will begin with a descriptive analysis of different dimensions. Then, we will introduce the correlations between *entrepreneurial competencies*, *entrepreneurial intention*, *entrepreneurial self-efficacy*, *career choice,* and *motivation*. Lastly, we will present the study examining the differences between groups of students regarding their career and job situations of their parents.

Table 2 presents the descriptive results for each of the items that comprise the three entrepreneurial competence areas, namely Area 1: Ideas & Opportunities (M=4.30, SD=0.80), Area 2: Resources (M=4.04, SD=0.90), and Area 3: Taking Action (M=4.29, SD=0.87).

Table 3 provides the descriptive results regarding the items contributing to the sub-dimensions constituting the "Entrepreneurial Project." The subdimensions of *entrepreneurial self-efficacy* (M=3.33, SD=1.11) and *entrepreneurial intention* (M=3.77, SD=1.33) can be considered as a single entity. However, the nature of the items that make up the *motivation* subdimension does not allow for calculating a single value representing the dimension. This is because the items within the *motivation* subdimension address different types of motivation that students may have for starting their own businesses. A similar situation occurred with the sub-dimension of *career choice* that questioned the intentions to follow different career options.

Table 2. Descriptive analysis results per area of entrepreneurial competencies.

	Competencies	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev*
Area 1: Ideas & Opportunities	Identify opportunities	175	1	6	3.9	1.12
	Creativity	175	1	6	4.1	1.223
	Vision	175	1	6	4.5	1.129
	Evaluate ideas	175	1	6	4.49	0.976
	Ethical and sustainable thinking	175	1	6	4.49	1.263
Area 2: Resources	Self-awareness and self-confidence	175	1	6	4.14	1.294
	Motivation and perseverance	175	1	6	4.47	1.355
	Mobilize resources	175	1	6	3.94	1.153
	Financial and economic education	175	1	6	3.55	1.465
	Engage other people	175	1	6	4.09	1.349
Area 3: Taking action	Take the initiative	175	1	6	3.92	1.448
	Planning and management	175	1	6	4.39	1.241
	Handle uncertainty, ambiguity, and risk	175	1	6	3.97	1.111
	Work with other people	175	1	6	4.39	1.222
	Learn from experience	175	1	6	4.75	1.201

To examine the relationships among the variables of interest, Table 4 presents the results of the Spearman correlation between the subdimensions of entrepreneurial competencies and project creation, as well as the purpose of entrepreneurial intention. The study revealed that there were strong and statistically significant positive correlations between students' perceptions of their competence levels in "Ideas & Opportunities," "Resources," and "Taking Action" (as shown in Table 4). Of particular importance for the study was the correlation between Entrepreneurial Competencies and Entrepreneurial Intention and Entrepreneurial Self-Efficacy. In this regard, there was a strong and statistically significant positive correlation between "Resources" and "Entrepreneurial Self-Efficacy" ($\rho = 0.605$, $p < 0.001$). Additionally, there were moderate and statistically significant positive correlations between "Entrepreneurial Self-Efficacy" and "Ideas & Opportunities" ($\rho = 0.569$, $p < 0.001$) as well as "Taking Action" ($\rho = 0.546$, $p < 0.001$). Concerning “Entrepreneurial Intention,” statistically significant positive and moderate correlations were found with "Ideas & Opportunities" ($\rho = 0.416$, $p < 0.001$), "Resources" ($\rho = 0.398$, $p < 0.001$), and with "Taking Action" ($\rho = 0.408$, $p < 0.001$). As can be seen in Table 4, a statistically significant and moderate correlation was found between “Entrepreneurial Intention” and “Entrepreneurial Self-Efficacy” ($\rho = 0.530$, $p < 0.001$).

Regarding the sub-dimension of the Entrepreneurial Project called "Motivation," Table 5 indicates that we have found a statistically significant moderate positive correlation between "Entrepreneurial Intention" and "M2. To achieve personal success", "M4. To have novelty and changes in life", "M5. To have more independence" and "M7. To feel personal fulfillment”.

Table 3. Descriptive analysis results per dimension of Entrepreneurial Project.

	Item	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev*
Entrepreneurial Self-efficacy	I am prepared to set up a viable company.	175	1	6	2.98	1.268
	I can control the processes of creating a new business.	175	1	6	3.48	1.362
	I know the practical details necessary to establish a company.	175	1	6	3.26	1.394
	I know how to develop a business project.	175	1	6	3.28	1.4
	If I attempted to start a company, I could have a high probability of success.	175	1	6	3.63	1.362
Entrepreneurial Intention	I am ready to do anything to become an entrepreneur.	175	1	6	3.9	1.438
	My professional goal is to become an entrepreneur.	175	1	6	3.75	1.66
	I will make every effort to start and develop my own business.	175	1	6	3.98	1.54
	I have seriously considered creating a business one day.	175	1	6	3.69	1.82
Motivation	To have social power and prestige.	175	1	6	3.06	1.524
	To achieve personal success.	175	1	6	5.04	1.2
	To obtain pleasure and entertainment.	175	1	6	4.33	1.495
	To have novelty and changes in life.	175	1	6	4.61	1.35
	To have more independence.	175	1	6	5.1	1.143
	To avoid a routine job.	175	1	6	4.59	1.462
	For a feeling of personal fulfillment.	175	1	6	4.76	1.445
	To have greater freedom at work.	175	1	6	4.79	1.307
	To have job stability.	175	1	6	4.77	1.428
	As a last resort, because I have no other options.	175	1	6	2.47	1.618
Career choice	Work in a private company	175	1	6	4.86	1.098
	Work in a public company	175	1	6	3.4	1.49
	Work in public administration (civil servant)	175	1	6	2.73	1.403
	Self-employment (start my own business)	175	1	6	4.27	1.647

Table 4. Spearman correlation analysis – Entrepreneurial competencies vs Entrepreneurial intention (project creation and purpose).

			Entrepreneurial Competencies			*Entrepreneurial Project*	
			Area 1: Ideas & Opportunities	*Area 2: Resources*	*Area 3: Taking action*	*Entrepreneurial Self-Efficacy*	*Entrepreneurial Intention*
Entrepreneurial Competencies	*Area 1: Ideas & Opportunities*	CC	--				
		Sig. (two-tailed)	.				
		N	175				
	Area 2: Resources	CC	.674**	--			
		Sig. (two-tailed)	<.001	.			
		N	175	175			
	Area 3: Taking action	CC	.728**	.760**	--		
		Sig. (two-tailed)	<.001	<.001	.		
		N	175	175	175		
Entrepreneurial Project	*Entrepreneurial Self-Efficacy*	CC	.569**	.605**	.546**	--	
		Sig. (two-tailed)	<,001	<.001	<,001	.	
		N	175	175	175	175	
	Entrepreneurial Intention	CC	.416**	.398**	.408**	.530**	--
		Sig. (two-tailed)	<.001	<.001	<.001	<.001	.
		N	175	175	175	175	175

** The Correlation is significant at the 0.01 level (two-tailed).

Concerning students´ "Career Choice," as can be seen in Table 6, we found a strong statistically significant positive correlation between "C4. Self-employment" and "Entrepreneurial Intention" ($\rho = 0.700$, $p < 0.001$).

For further detail, it is possible to review the correlations between entrepreneurial competencies, entrepreneurial self-efficacy, and entrepreneurial intention. In Table 5, we can observe statistically significant positive and moderate correlations between entrepreneurial self-efficacy and the entrepreneurial competencies "Identify opportunities," "Evaluate ideas," "Mobilize resources," "Financial and economic education," "Take the initiative," and "Learn from experience." For the case of entrepreneurial intention, the only entrepreneurial competency that presents a statistically significant positive and moderate correlation was "Identify opportunities."

Discussion

Through a literature review and detailed statistical analyses, this study has delved into the relationship between entrepreneurial intention and the development of entrepreneurial competencies in engineering students. The findings illustrate how these two factors are interconnected within the context of engineering education.

Table 5. Spearman correlation analysis – Entrepreneurial competencies, Entrepreneurial Self-Efficacy, Entrepreneurial Intention and Motivation.

			Entrepreneurial Competencies			*Entrepreneurial Self-efficacy*	*Entrepreneurial Intention*
			Area 1: Ideas & Opportunities	*Area 2: Resources*	*Area 3: Taking action*		
Motivation	*To have power and social prestige*	CC	-0.06	0.014	-0.006	.153*	.297**
		Sig. (two-tailed)	0.433	0.858	0.939	0.043	<.001
		N	175	175	175	175	175
	To achieve personal success	CC	.295**	.297**	.297**	.163*	.491**
		Sig. (two-tailed)	<.001	<.001	<.001	0.031	<.001
		N	175	175	175	175	175
	To obtain pleasure and entertainment	CC	0.145	.172*	0.087	.229**	.272**
		Sig. (two-tailed)	0.056	0.023	0.253	0.002	<.001
		N	175	175	175	175	175
	To have novelty and changes in life	CC	.175*	.187*	0.136	.232**	.465**
		Sig. (two-tailed)	0.021	0.013	0.073	0.002	<.001
		N	175	175	175	175	175
	To have more independence	CC	.249**	.234**	.193*	.277**	.416**
		Sig. (two-tailed)	<.001	0.002	0.011	<.001	<.001
		N	175	175	175	175	175
	To avoid a routine job	CC	.224**	.235**	0.09	.249**	.359**
		Sig. (two-tailed)	0.003	0.002	0.237	<.001	<.001
		N	175	175	175	175	175
	To feel personal fulfillment	CC	.268**	.231**	.200**	.267**	.476**
		Sig. (two-tailed)	<.001	0.002	0.009	<.001	<.001
		N	175	175	175	175	175
	To have greater freedom at work	CC	0.12	0.052	0.038	0.131	.293**
		Sig. (two-tailed)	0.113	0.496	0.619	0.084	<.001
		N	175	175	175	175	175
	To have job stability	CC	0.103	-0.018	0.051	0.133	.296**
		Sig. (two-tailed)	0.178	0.815	0.503	0.082	<.001
		N	175	175	175	175	175
	Because I have no other options	CC	-0.106	-0.032	-0.001	0.02	-.152*
		Sig. (two-tailed)	0.161	0.673	0.994	0.797	0.045
		N	175	175	175	175	175

* The correlation is significant at the 0.05 level (two-tailed).

** The correlation is significant at the 0.01 level (two-tailed).

Table 6. Spearman correlation analysis – Entrepreneurial competencies, Entrepreneurial intention, Entrepreneurial Self-efficacy and Career Choice.

			Entrepreneurial Competencies			*Entrepreneurial Self-efficacy*	*Entrepreneurial Intention*
			Area 1: Ideas & Opportunities	*Area 2: Resources*	*Area 3: Taking action*		
Career Choice	*Work in a private company*	CC	0.083	0.136	.171*	0.063	-0.033
		Sig. (two-tailed)	0.276	0.074	0.024	0.41	0.663
		N	175	175	175	175	175
	Work in a public company	CC	0.141	0.092	0.099	0.132	0.103
		Sig. (two-tailed)	0.065	0.229	0.193	0.083	0.176
		N	175	175	175	175	175
	Work in public administration	CC	.156*	0.119	.168*	.156*	0.119
		Sig. (two-tailed)	0.04	0.118	0.027	0.04	0.116
		N	175	175	175	175	175
	Self-employment	CC	.281**	.247**	.222**	.351**	.700**
		Sig. (two-tailed)	<.001	0.001	0.003	<.001	<.001
		N	175	175	175	175	175

* The correlation is significant at the 0.05 level (two-tailed).
** The correlation is significant at the 0.01 level (two-tailed).

Beginning with the descriptive results obtained for students' perceptions of the development of entrepreneurial competencies, it is notable that in all three areas, students perceive themselves to have an intermediate level of development, considering the scale presented in Table 1. Table 2 shows the mean scores obtained for each area: "Ideas & Opportunities" (M=4.3), "Resources" (M=4.04), and "Taking Action" (M=4.29). These areas are fundamental for entrepreneurial development, as suggested in the literature by [5], [15]. Therefore, the results indicate an opportunity for improvement in developing these competencies in the three defined areas.

Going into more detail, the area of “Ideas & Opportunities” is associated with students' ability to identify and develop new business opportunities. In this sample, students perceive themselves to have an intermediate development of these competencies. Specifically, the results show that the specific competencies of “Vision,” “Evaluate Ideas,” and “Ethical and Sustainable Thinking” have the highest averages, with “Identify Opportunities” having the lowest average. This last result is important to consider since, according to [7], identifying opportunities is a critical aspect of the cognitive process leading to entrepreneurial intention.

An opportunity is the potential for positive change in a given context. To realize this potential, resources are required to transform the opportunity into a business. The "Resources" area is important as it involves managing financial and economic resources essential for creating business projects, as well as human resources like forming a team. In this area, the competency associated with “Motivation and Perseverance” stands out with the highest average (M=4.47), while the competency “Financial and Economic Education” has the lowest average (M=3.94).

Table 7. Spearman correlation analysis – Entrepreneurial competencies, Entrepreneurial Self-efficacy, and Entrepreneurial Intention.

			Entrepreneurial Self-efficacy	*Entrepreneurial Intention*
Area 1: Ideas & Opportunities	*Identify opportunities*	CC	.515**	.417**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
	Creativity	CC	.347**	.268**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
	Vision	CC	.353**	.302**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
	Evaluate ideas	CC	.487**	.221**
		Sig. (two-tailed)	<.001	0.003
		N	175	175
	Ethical and sustainable thinking	CC	.294**	.253**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
Area 2: Resources	*Self-awareness and self-confidence*	CC	.331**	0.127
		Sig. (two-tailed)	<.001	0.093
		N	175	175
	Motivation and perseverance	CC	.231**	.301**
		Sig. (two-tailed)	0.002	<.001
		N	175	175
	Mobilize resources	CC	.541**	.330**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
	Financial and economic education	CC	.644**	.331**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
	Engage other people	CC	.331**	.292**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
Area 3: Taking action	*Take the initiative*	CC	.471**	.335**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
	Planning and management	CC	.310**	.149*
		Sig. (two-tailed)	<.001	0.049
		N	175	175
	Handle uncertainty. ambiguity. and risk	CC	.399**	.244**
		Sig. (two-tailed)	<.001	0.001
		N	175	175
	Work with other people	CC	.349**	.307**
		Sig. (two-tailed)	<.001	<.001
		N	175	175
	Learn from experience	CC	.408**	.333**
		Sig. (two-tailed)	<.001	<.001
		N	175	175

** The correlation is significant at the 0.01 level (two-tailed).

When an opportunity has been identified, and resources are well-managed, one is in a position to "Take Action." This area focuses on the capacity to act and materialize opportunities. In this regard, this dimension includes the competency with the highest average, "Learn from Experience" (M=4.75), which indicates a perception of an intermediate to advanced level of development.

All of these competencies are in line with Ajzen's theory of perceived control [8]. This theory suggests that the belief in having control over resources can greatly influence taking action, such as pursuing entrepreneurship. Therefore, these competencies are crucial in developing the intention to become an entrepreneur.

According to the study, engineering students showed moderate entrepreneurial competence. To boost these competencies and enhance entrepreneurial intention, it is necessary to establish action strategies that align with Ajzen's theory of perceived control [8]. Previous studies have suggested that one way to achieve this is through innovative entrepreneurship education methodologies [10], [11].

Now, we can delve into the "Entrepreneurial Project". Table 3 provides a descriptive analysis of the sub-dimensions of the "Entrepreneurial Project," which include "entrepreneurial self-efficacy" and "entrepreneurial intention." "Entrepreneurial self-efficacy" reflects students' confidence in their ability to start and manage successful businesses. This self-efficacy, as indicated by [8], [9], is a critical component for the development of "entrepreneurial intention," which corresponds to the students' inclination to create and develop companies. According to [16], intention is a key indicator of future entrepreneurial actions. These dimensions resulted in averages that indicate a perception of moderate development of the same (4/6 according to the scale of Table 1). These engineering students' moderate entrepreneurial self-efficacy and intention provide opportunities for educational improvements.

Based on the study's results, there was a strong and positive correlation between the students' perceived competence in "Ideas & Opportunities," "Resources," and "Taking Action." This finding supports the studies [8] and [7], which emphasize the importance and interrelationship of each entrepreneurial competence to strengthen the entrepreneurial ecosystem. The study also found statistically significant correlations between entrepreneurial competencies, "entrepreneurial self-efficacy," and "entrepreneurial intention." These findings reinforce the idea that students' confidence in their entrepreneurial abilities is intrinsically linked to their perception of competence development in this area, which has been highlighted by other authors such as [6], [13], [14], [19].

It is worth mentioning that in this particular study, there is a significant and positive correlation ($\rho = 0.605$, $p < 0.001$) between "Resources" and "Entrepreneurial Self-Efficacy." This indicates that the capacity to manage resources is a crucial factor in predicting the confidence of engineering students in entrepreneurship.

Regarding the "motivation" dimension, Table 5 presents how various types of personal motivation, including the desire for personal success, novelty, independence, and self-

fulfillment, are moderately correlated with entrepreneurial intention. This is in direct alignment with other studies where personal motivation has been identified as an influential factor in entrepreneurial intention [4], [7]. Students with high personal motivation are more likely to develop strong entrepreneurial intentions and start ventures, as motivation is a central and unique element that gives meaning to learning and determines the achievement of goals.

A notable correlation was found between the desire for self-employment and "entrepreneurial intention" among the participants ($\rho = 0.700$, $p < 0.001$), which is displayed in Table 6. This correlation is particularly significant within the context of the studied educational program, where students receive technical training alongside entrepreneurial skills. According to various experts [4], [16], entrepreneurial intention is a key predictor of future entrepreneurial behaviors, such as starting new businesses. Therefore, the strong preference for self-employment among engineering students indicates a significant potential for future entrepreneurial endeavors and economic growth for society as a whole [1].

Finally, Table 7 highlighted the correlations between the perception of developing specific competencies such as "Identifying opportunities," "Evaluating ideas," and "Mobilizing resources," among others, in relation to entrepreneurial self-efficacy. This observation aligns with previous studies [15], [16], emphasizing these competencies' significance in bolstering students' confidence in their entrepreneurial capabilities. This, coupled with the correlation found between entrepreneurial self-efficacy and entrepreneurial intention, has multiple implications and could highlight the importance of integrating these competencies into engineering education programs to encourage entrepreneurial intention among students [8], [10], [13], thereby enabling them to meet current market challenges and contribute significantly to economic and social development.

Conclusions

This study delves into the relationship between entrepreneurial intention and the development of entrepreneurial competencies in engineering students. It highlights the crucial interdependence of these components within the educational context of engineering. The findings reveal a significant correlation between "entrepreneurial competencies" and "entrepreneurial self-efficacy," as well as "entrepreneurial intention," emphasizing the importance of nurturing both dimensions to foster an effective entrepreneurial mindset among future engineers.

The study suggests that higher education institutions and educational policymakers should take an active role in recognizing and nurturing the essential elements for developing entrepreneurial intention. This includes creating and/or strengthening an educational ecosystem that actively supports entrepreneurship. This ecosystem should provide resources, mentorship, networking opportunities, and access to practical knowledge. Such an ecosystem would enable students to apply and develop their entrepreneurial competencies in real-world contexts, which would contribute to the individual growth of future entrepreneurs. Additionally, it would help generate solutions from the academic field that contribute to the economic and social progress of the country.

In conclusion, this study not only confirms the interrelation between entrepreneurial intention and competencies in the context of engineering education but also highlights the crucial role of comprehensive and applied entrepreneurial education in shaping future engineers prepared to take on business challenges. The way forward underscores the need for future research to explore how various teaching approaches directly impact entrepreneurial intention and skill development in engineering students. Longitudinal studies that track the evolution of entrepreneurial attitudes and competencies over time could provide valuable insights for enhancing the entrepreneurial education programs provided by higher education institutions.

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