Article

Social Entrepreneurship, Complex Thinking, and Entrepreneurial Self-Efficacy: Correlational Study in a Sample of Mexican Students

José Carlos Vázquez-Parra [1], Patricia Esther Alonso-Galicia [2], Marco Cruz-Sandoval [3,*], Paloma Suárez-Brito [1] and Martina Carlos-Arroyo [1]

[1] Institute for the Future of Education, Tecnologico de Monterrey, Monterrey 64849, Mexico
[2] Institute for the Future of Education, School of Business, Tecnologico de Monterrey, Monterrey 64849, Mexico
[3] Center for the Future of Cities, Tecnologico de Monterrey, Monterrey 64849, Mexico
[*] Correspondence: cruzsandovalmarco@tec.mx

Abstract: This article presents the results of a study conducted on a sample population of students attending a technological university in western Mexico. The development of the entrepreneurial self-efficacy competency was evaluated within a process of ideation of social entrepreneurship projects to develop social entrepreneurship and complex thinking competencies. A multivariate descriptive analysis was implemented to demonstrate possible statistically significant correlations between the competencies of social entrepreneurship, complex thinking, and entrepreneurial self-efficacy. The results confirm the correlations between the competencies of social entrepreneurship, complex thinking, and entrepreneurial self-efficacy, concluding that there is statistically significant information to indicate that the complex thinking competency positively impacts not only the process of generating social entrepreneurship projects but also the scaling of entrepreneurs' perceptions about their capabilities at the time of entrepreneurship. At a practical level, this study presents results that argue for the need to develop complex thinking in students in social entrepreneurship programs, both in universities and in organizations that promote entrepreneurship. It confirms that complex thinking is a valuable competency in the ideation and generation of entrepreneurial proposals.

Keywords: professional education; educational innovation; future of education; complex thinking; higher education

1. Introduction

Nowadays, universities no longer seek to develop just the knowledge of their students, as they also seek to develop students' cognition and promote attitudes and skills, enabling them the implementation of theory into practice (Martínez Casanovas et al. 2022). However, this process is not simple because, despite pedagogical efforts, psychoemotional aspects may influence whether students perceive themselves as truly capable with the skills that they develop. Thus, it is not enough to acquire competencies; it is necessary to strengthen students' conviction that they can transform these into valuable and practical professional skills (Ramos et al. 2021).

Self-efficacy indicates the perception that a person has adequate and sufficient knowledge, attitudes, and skills to execute actions to produce an outcome (Newman et al. 2019) effectively. Although self-efficacy can be appreciated as an attribute of personal perception, it can influence the processes of choice and decision making, becoming a predictor of the direction of the actions that individuals take. Thus, considering the above, it is not enough to adopt pedagogical models to acquire and develop competencies; simultaneously, we must work to help students perceive their self-efficacy (Wardana et al. 2020).

In recent years, studies, such as those of Krueger and Dickson (1994), Sánchez et al. (2005), and Alonso-Galicia et al. (2015), have proposed a natural relationship between

self-efficacy and areas of knowledge, such as entrepreneurship, considering that particular elements of the entrepreneurial process require a high level of conviction about capacity for action. Entrepreneurs usually judge their projects based on their perception of both the environment and their capabilities because, beyond the natural uncertainty of any decision, it is difficult for them to choose to do something that they believe exceeds their abilities (Gielnik et al. 2020).

Thus, entrepreneurship processes must be linked with skills that broaden the vision of the environment to bring reality into view as entrepreneurs develop their projects. Their perception of the environment not only influences the ideation of proposals but also impacts their perception of competency and, thus, their level of entrepreneurial self-efficacy. An incomplete or biased view of wicked problems affects ventures and influences entrepreneurs' perception of their capabilities for decision making and actions (Liu et al. 2019).

Hence, this article presents the results of a study conducted on a sample population of students attending a technological university in western Mexico. The development of the entrepreneurial self-efficacy competency was evaluated within a process of ideation of social entrepreneurship projects to develop social entrepreneurship and complex thinking competencies. Adopting a methodology that correlates the complex thinking competency and social entrepreneurship processes, this study employs a multivariate descriptive statistical analysis to identify how the complex thinking competency applied to an entrepreneurship process can improve students' perception of the environment and problems and, thus, their entrepreneurial self-efficacy skills.

2. Theoretical Framework

2.1. The Relationship between Complex Thinking and Social Entrepreneurship

The competency of complex thinking refers to the knowledge, skills, and attitudes that allow for a comprehensive analysis of phenomena to develop a broad and interconnected vision of all the elements and factors involved (Tobón and Luna-Nemecio 2021). For Morin (1990), complex thinking is a priority in contemporary times, where factors such as globalization, diversity, and uncertainty have become crucial considerations for decision making and problem solving.

From this perspective, complex thinking qualifies as a general competency; i.e., its relevance at the formative and professional level is not limited to a specific discipline or work because it has a transversal impact (Drucker 2021). Critical thinking, problem solving, communication, collaboration, creativity, innovation, intercultural skills, productivity and responsibility, and leadership comprise the complex thinking skills indispensable to decision making in any professional field (Koerber and Osterhaus 2019).

As an integrated competency, complex thinking comprises four sub-competencies or types of thoughts, providing a broad and flexible character (Vázquez-Parra et al. 2022a). These four sub-competencies are systems thinking, critical thinking, scientific thinking, and creative thinking. Systems thinking is a type of reasoning that allows one to analyze problems in an interconnected way, recognizing the elements that comprise them and the dynamics among them (Jaaron and Backhouse 2018). Critical thinking allows for the contextual validity of reasoning and the rethinking of problems beyond existing paradigms (Cui et al. 2021). Scientific thinking allows people to make decisions and solve problems by adopting objective and validated methodologies, adopting tools for reasoning, and formulating and testing hypotheses (Suryansyah et al. 2021). Finally, innovative thinking (also called creative thinking) includes processes that assess reality from different angles and perspectives to generate proposals and solutions that are both original and feasible (Zhou 2021).

It is possible to appreciate that the general competency and its sub-competencies adhere to the transversal approach mentioned above. Therefore, it is possible to understand why it is a competency that can be easily linked to cognitive processes where the individual must have a broad vision of the environment and its problems, as occurs in social entrepreneurship processes. Although entrepreneurship is usually associated primarily

with business areas, it is not exclusive to this discipline because, in the specific case of social entrepreneurship, it involves cognitive processes, skills, and aptitudes practical for any professional desiring to address environmental problems through innovative solutions that create value and positively impact society (García-González and Ramírez-Montoya 2019).

According to García-González et al. (2020), social entrepreneurship processes are linked to the development of competencies and skills associated with self-control, leadership, social awareness, social value, social innovation, and financial sustainability, which, although has an administrative focus, it is broad enough to also be helpful in decision-making and problem-solving processes, which has led some educational institutions to consider it a general or transversal competency (Tecnologico de Monterrey 2019).

Thus, both competencies, in their ways, can enrich the formative process of any professional because, being skills linked to decision-making and problem-solving processes, they allow individuals to recognize their capacity for action beyond the acquisition of knowledge (García-González and Ramírez-Montoya 2019). Vázquez-Parra et al. (2022b) propose a methodology for developing both competencies as complements by stating that complex thinking is a helpful tool to improve the analysis of the environment and, thus, devise social entrepreneurial projects that are more focused and indeed linked to the reality and social problems experienced by people.

Seeking to complement and transcend that proposal, we consider that, in addition to this correlation, it is possible to include the competency of entrepreneurial self-efficacy since complex thinking not only broadens the vision of the environment and systems but also contributes to adopting valuable methodologies for problem solving, thus improving students' perception of achievement and capacity at the time of entrepreneurship.

2.2. The Entrepreneurial Self-Efficacy Competency

How much can a person be influenced by feelings of self-efficacy when undertaking a project or problem solving? This is a question that essentially motivates studies of entrepreneurial self-efficacy. Since the seminal work of Bandura (1986), the concept of self-efficacy has been studied extensively; it is usually defined as a person's perception of their ability to perform a particular task or action (Bandura and Wood 1989). Furthermore, as a subjective perception, it has been shown to be a more focused, specific concept related to human intention and behavior (Armitage and Conner 2001).

For Bandura (cited by Blackmore et al. 2021), self-efficacy goes beyond a person's knowledge or beliefs about their capabilities. Instead, it is a generative situation allowing for the integration of competencies and skills to achieve a goal. The expectation of efficacy can influence learning processes and a person's decisions or actions, as it modulates the biological reactivity to environmental stimuli (Hoang et al. 2020).

In the field of entrepreneurship, self-efficacy goes beyond being a personal belief that one has about oneself and their capabilities; it becomes a competency that entrepreneurs can develop to predict their ability to succeed when carrying out a new project or facing a possible difficulty (Garaika et al. 2019). The study by Gielnik et al. (2020) shows that self-efficacy is an essential element that entrepreneurs can use in the face of uncertainty, transforming their ability to explore and identify opportunities. Moreover, this self-perception has been linked to enriching learning experiences among entrepreneurs (Adebusuyi et al. 2022). It has even been pointed out that it could be relevant for discovering the skills needed in each stage of the entrepreneurial process (Drnovšek et al. 2010; Kickul et al. 2009).

Self-efficacy is a measure related to the prediction of entrepreneurs' performance, which implies its influence as a moderating variable for different variables of entrepreneurial behavior. The antecedents of self-efficacy include cultural, institutional, formative, and educational factors; work experience; the influence of mentors and role models; and, above all, differences between individuals, such as gender, cognitive styles, and personality (Newman et al. 2019). Since formative processes have been shown to influence entrepreneurial self-efficacy significantly, they can guide various curricular aspects of entrepreneurial training, particularly in developing countries (Adeniyi et al. 2022).

In this sense, the self-efficacy competency allows an individual to integrate their cognitive, attitudinal, and procedural skills when assessing a problem or challenge and making a judgment about their ability to succeed despite the natural uncertainty of the environment. It is considered that the more developed the competency, the higher the precision of its analytical capacity and, therefore, its success rate (Elnadi and Gheith 2021). According to Neneh (2022), a person with a high-level self-efficacy competency has a positive perception of their abilities and how they can process the demands of their environment.

Different scales measure the entrepreneurial self-efficacy competency. The first and most commonly used is the one proposed by De Noble et al. (1999), the entrepreneurial self-efficacy (ESE) scale. It considers an entrepreneur's capacity to develop new products and market opportunities, build an innovative environment, initiate relationships with investors, define the central object of the business, face unexpected changes, and develop essential human resources. Kolvereid and Isaksen (2006) adapted the entrepreneurial self-efficacy scale to be more specific to include the identification of opportunities. This scale measures the self-perception of the ability to carry out actions and gather resources to recognize a potential opportunity for a new company to emerge, improve products or services, create a market niche, satisfy consumers' unmet needs, and create value.

With the above, it is possible to appreciate that, although the analysis of the social entrepreneurship competency may be an essential topic, it may remain incomplete if the next step in the practical implementation is not achieved, which we can measure using the entrepreneurial self-efficacy competency. This study proposes that complex thinking is a viable tool for the joint scaling of social entrepreneurship and entrepreneurial self-efficacy competencies by developing skills to analyze the environment holistically, which is valuable in social entrepreneurship; moreover, it provides broad analytical capabilities of one's problem-solving skills, which is essential for entrepreneurial self-efficacy.

3. Methods

As part of an interdisciplinary research group, we developed a methodology for students to acquire and scale the skills necessary for social entrepreneurship projects at fundamental levels. The proposed educational intervention aims to develop a process of the ideation and development of a social entrepreneurship project at a basic level. Unlike other entrepreneurial programs, this proposal considers the importance of acquiring and scaling up the complex thinking competency and its sub-competencies.

The hypothesis of this intervention is that complex thinking, being a competency that considers the elements and development of transversal knowledge, can be a valuable tool for the ideation, proposal, and prototyping processes of social entrepreneurship projects, i.e., showing a correlation with the competency itself (Vázquez-Parra et al. 2022b). Moreover, as a competency focused on integrative knowledge of the environment for the resolution of complex problems, it is also related to the perception that individuals have about their capabilities, which we can measure with the entrepreneurial self-efficacy competency. Thus, this article proposes analyzing the possible correlations of these three competencies.

To test this hypothesis, we measured these competencies before and after the educational intervention in the sample group, using validated instruments to measure the initial state and the development.

The implementation process was carried out in three stages:

- Initial diagnosis: This included the implementation of a validated instrument that measured the initial state of the social entrepreneurship, complex thinking, and entrepreneurial self-efficacy competencies.
- Formative activities: This considered the ideation, development, and prototyping processes of a social entrepreneurship project.
- Closing evaluation: This included the implementation of a diagnostic instrument to assess the development of the three competencies once the intervention had been carried out.

The implementation was carried out in June and July 2022 during a summer course in which students from various university careers and campuses throughout Mexico participated. The implementation was online, supported by a facilitator who accompanied the group.

In this exploratory, experimental pilot study, we had a convenience sample (1 class) with 17 students (10 males and 7 females). The implementation was regulated and approved by the interdisciplinary research group R4C because it was an experimental study involving individuals. The Writing Lab of the Institute for the Future of Education of Tecnologico de Monterrey provided technical support. Since this was the first implementation of this methodology, the authorization for implementation was limited to a single experimental group of students. The commitment to expand the sample was encouraged if the results were positive for a repetition of the implementation.

Three validated instruments were used for the diagnosis and evaluation of the competencies of social entrepreneurship, complex thinking, and entrepreneurial self-efficacy:

- Social entrepreneurship: The instrument entitled "Profile of the Social Entrepreneur" (García-González et al. 2020) uses a Likert scale with 24 questions (items) for assessment. This instrument measures four sub-competencies: self-control, leadership, social awareness and value, and social innovation and financial sustainability (see Table 1).
- Complex thinking: The "E-Complexity" instrument aims to measure the students' perception of their mastery level of the reasoning-for-complexity competency and its sub-competencies. It is an instrument that has been validated theoretically and statistically by a team of experts in the field (Castillo-Martínez et al. 2021). The instrument consists of 25 items divided into 4 sub-competencies: systemic thinking, scientific thinking, critical thinking, and innovative thinking. Its implementation is self-applicable, and each item is assessed using a Likert scale (see Table 2).
- Entrepreneurial self-efficacy: The "entrepreneurial self-efficacy (ESE)" instrument developed by Kolvereid and Isaksen (2006) is a scale that measures the self-perception of the ability to carry out actions and gather resources to recognize a potential opportunity for a new company to emerge, improve products or services, create a market niche, satisfy consumers' unmet needs, and create value. It is an instrument with 4 items evaluated using a Likert scale (see Table 3).

It is important to note that the instruments used for this study do not directly measure the development of competencies but rather the students' perception of their level of achievement or performance. For this research, being competent is not a sufficient element, since, if a person does not perceive themselves as such, they will limit their own development. Therefore, we consider that the relevant point to ensure is that individuals have a positive perception of their level of achievement, since this opens up the possibility of exercising their abilities when making decisions with the confidence that they know what they are doing.

Complementarily, the Social Entrepreneur Profile and E-Complexity instruments have already been applied in other associated studies, such as those of Vázquez-Parra et al. (2021), Vázquez-Parra et al. (2022b), and Cruz-Sandoval et al. (2023), demonstrating that they are valid and reliable for the objective they propose. Furthermore, these instruments are part of the SEL4C methodology, which has been validated for the scaling of both competencies and their sub-competencies in a correlated manner (Vázquez-Parra et al. 2023).

Table 1. Entrepreneurial profile instrument items.

Item	Description
1	When I am passionate about something, I do my best to achieve my goals.
2	When I am passionate about my work, I do my best to finish it, even if I face adverse circumstances, lack of time, or distractions.
3	Despite rejection or problems, I always seek to achieve my goals.
4	I am tolerant of ambiguous situations or situations that generate uncertainty.
5	I have the ability to establish a clear goal and the steps to achieve it.
6	I often manage to convince others about my ideas and actions.
7	I master different ways of communicating my ideas: in writing, video, or face-to-face talks.
8	I can delegate activities to my team members according to their profiles.
9	I can identify the strengths and weaknesses of co-workers.
10	I am facilitated to collaborate actively in a team to achieve common goals.
11	I am passionate about working for social causes.
12	I believe that my life's mission is to work for social change and improve people's lives.
13	I am interested in leading an initiative with favorable results for society and the environment.
14	I can identify problems in society or the environment to generate innovative solutions.
15	I am committed to participating in the social aspects of my environment.
16	I believe that economic growth should occur with equal opportunities and equity for all.
17	My actions and behaviors are governed by moral standards based on respect and care for people and nature.
18	I know how to apply strategies to create new ideas or projects.
19	I know how to apply accounting and financial knowledge to develop an enterprise.
20	I have notions about logistics to carry out the management of an organization.
21	I know how to make a budget to achieve a project.
22	I know how to establish evaluation criteria and measure social impact results.
23	I believe that making mistakes offers us new learning opportunities.
24	I know strategies to develop a project, even with scarce resources.

Table 2. E-Complexity instrument items.

Item	Description
1	I can find associations between a project's variables, conditions, and constraints.
2	I identify data from my discipline and other areas contributing to solving problems.
3	I participate in projects that need to be solved using inter/multidisciplinary perspectives.
4	I organize information to solve problems.
5	I enjoy learning different perspectives on a problem.
6	I am inclined to use strategies to understand the parts and whole of a problem.
7	I can identify the essential components of a problem to formulate a research question.
8	I know the structure and formats for research reports used in my area or discipline.
9	I identify the structure of a research article used in my area or discipline.
10	I apply the appropriate analysis methodology to solve a research problem.
11	I design research instruments consistent with the research method used.
12	I formulate and test research hypotheses.
13	I am inclined to use scientific data to analyze research problems.
14	I can critically analyze problems from different perspectives.
15	I identify the rationale for my own and others' judgments to recognize false arguments.
16	I self-evaluate the level of progress and achievement of my goals to make the necessary adjustments.
17	I use reasoning based on scientific knowledge to make judgments about a problem.
18	I make sure to review the ethical guidelines of the projects in which I participate.
19	I appreciate criticism in the development of projects to improve them.
20	I know the criteria to determine a problem.
21	I can identify variables from various disciplines that can help answer questions.
22	I apply innovative solutions to diverse problems.
23	I solve problems by interpreting data from different disciplines.
24	I analyze research problems contextually to create solutions.
25	I tend to evaluate the solutions to a problem with a critical and innovative sense.

Table 3. Items of the entrepreneurial self-efficacy instrument.

Item	Description
1	I feel capable of recognizing the potential of an idea or opportunity for the emergence of a new enterprise.
2	I feel able to discover new ways to improve existing products or services.
3	I feel able to identify new potential growth areas and profitable market niches for a product or service.
4	I feel able to create products or services for unmet consumer needs.

Regarding data processing, we performed a multivariate descriptive statistical analysis using R (R Core Team 2017) and Rstudio (RStudio Team 2022) computational software. The analysis was mainly based on the analysis of arithmetic means, standard deviations, violin plots, boxplots (also known as box-and-whisker plots), and a correlation analysis. Arithmetic means were obtained to determine the behavior of a variable for which there was a large set of data. Likewise, the standard deviation was calculated to determine the dispersion of the data around the mean. The violin plot allows for the exploration and visualization of the data (Hintze and Nelson 1998). This diagram synergistically combines the boxplot and the smoothed histogram (i.e., density plot) in a single visualization that reveals the internal structure of the data. In particular, the violin plot provides insight into clusters in the data; the peaks, valleys, bumps in the distribution; and probability density (Hintze and Nelson 1998). In this sense, the boxplot diagram allows us to know four main characteristics of the data: its center, dispersion, symmetry, and outliers from its visualization in quartiles (Williamson 1989). Finally, a correlation analysis was used to obtain the direct relationship between the different competencies (i.e., social entrepreneurship, complex thinking, and self-efficacy) using the coefficient of self-determination (R^2) with a 95% confidence interval. It should be noted that this analysis was carried out to determine the associations between competencies, and it was not intended to obtain coefficients of determination for prediction purposes.

4. Results

The overall arithmetic mean was calculated for each item assessing the perception of each sub-competency of social entrepreneurship and the perception of the overall competency (see Table 4). The results show that, due to the proposed educational intervention process, the means of the students' perception of each sub-competency and the social entrepreneurship competency increased. For the overall competency, the intervention improved the perception of social entrepreneurship by 6% (the mean increased from 4.2 to 4.5). The intervention increased students' perception by 10% at the sub-competency level, primarily regarding social and financial innovation (the mean increased from 3.87 to 4.26). Similarly, it is essential to mention that the educational intervention allowed us to decrease the dispersion of our data, i.e., the standard deviations in the closing evaluations of all sub-competencies, except for self-control. However, Table 4 shows that the intervention increased the perception of the social entrepreneurship competency more so in men than in women. That is, men experienced an increase of about 9%, while women experienced an increase of 5% from the initial assessment to the closing diagnosis.

Table 4. Results of the social entrepreneurship competency and its sub-competencies (Initial to Final).

		Men		Women		Total	
Application	Concept	Mean	SD	Mean	SD	Mean	SD
Initial	Self-control	4.47	0.64	4.64	0.66	4.54	0.66
Final	Self-control	4.47	0.65	4.78	0.70	4.6	0.70
Initial	Social awareness and social value	3.87	0.88	4.77	0.88	4.26	0.88
Final	Social awareness and social value	4.33	0.67	4.73	0.71	4.50	0.71
Initial	Social innovation and financial sustainability	3.84	1.09	3.91	1.09	3.87	1.09
Final	Social innovation and financial sustainability	4.34	0.71	4.16	0.74	4.26	0.74
Initial	Leadership	4.25	0.76	4.28	0.76	4.27	0.76
Final	Leadership	4.53	0.65	4.50	0.70	4.52	0.70
Initial	Social entrepreneurship	4.06	0.91	4.30	0.91	4.20	0.91
Final	Social entrepreneurship	4.41	0.71	4.51	0.73	4.45	0.73

Figure 1 shows a violin plot of the perception of the social entrepreneurship competency in the initial assessment and the final diagnosis after the educational intervention. Figure 1 shows an increase in the mean value of the perception of the social entrepreneurship competency. However, the dispersion of the students' perception was observed to be smaller in the closing diagnosis than in the initial evaluation of the competency. Similarly, from the distribution of our data, we observed that the probability of students perceiving themselves as competent in social entrepreneurship improved after the educational intervention.
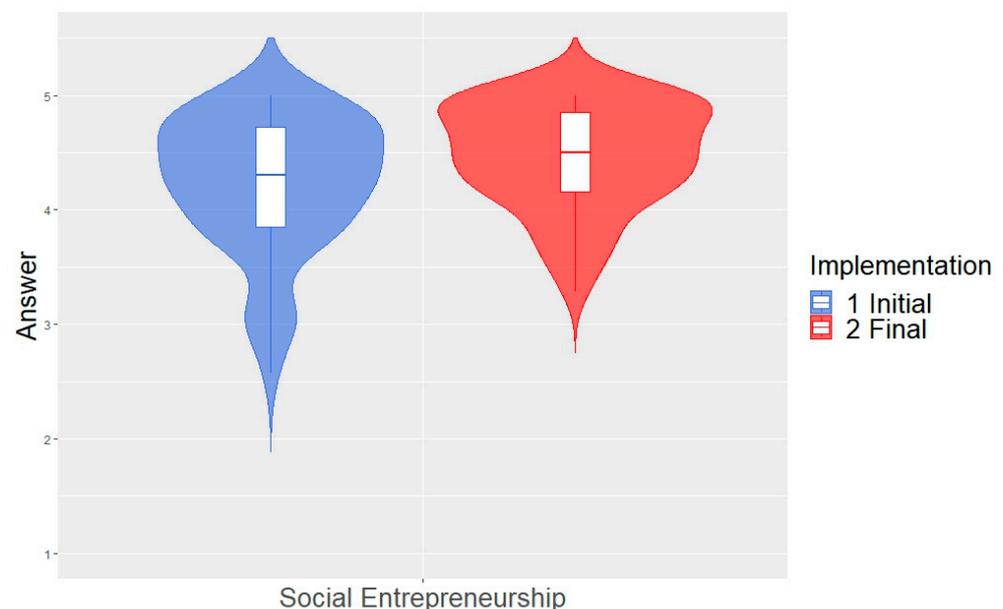
Figure 1. Social entrepreneurship competency results (Initial–Final).

Concerning the competency of complex thinking, the educational intervention caused an increase in the perception of the development of this competency (Table 5). That is, the perception increased by about 6%, from a mean of 4.31 to a mean of 4.56. The educational intervention significantly impacted scientific thinking at the sub-competency level for the ideation and development of a social enterprise. This sub-competency increased by about 10%, from a mean of 4.16 to 4.57. Moreover, Table 5 shows that the educational intervention increased the perception of complex thinking in women more so than in men. Women experienced a 7% increase in their perception of their mastery of complex thinking, while men experienced an increase of about 5% (women's mean increased from 4.33 to 4.62, and men's mean increased from 4.29 to 4.52).

Table 5. Results of the complex thinking competency and its sub-competencies (Initial–Final).

Application	Concept	Men		Women		Total	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Initial	Scientific Thinking	4.12	0.81	4.22	0.89	4.16	0.84
Final	Scientific Thinking	4.44	0.61	4.73	0.44	4.57	0.56
Initial	Critical Thinking	4.24	0.75	4.42	0.73	4.32	0.74
Final	Critical Thinking	4.46	0.84	4.69	0.51	4.56	0.72
Initial	Innovative Thinking	4.33	0.58	4.21	0.75	4.28	0.66
Final	Innovative Thinking	4.59	0.49	4.45	0.63	4.53	0.53
Initial	Systemic Thinking	4.51	0.66	4.47	0.63	4.50	0.74
Final	Systemic Thinking	4.59	0.56	4.61	0.53	4.6	0.55
Initial	Complex Thinking	4.29	0.72	4.33	0.76	4.31	0.74
Final	Complex Thinking	4.52	0.64	4.62	0.54	4.56	0.6

Figure 2 shows a violin plot of the perception of the complex thinking competency at the beginning of the assessment and at the end of the diagnosis once the educational intervention was implemented. Figure 2 shows that the perception of the complex thinking competency increased due to the educational intervention. Likewise, through the distribution, we can observe that the probability of increasing perception values in complex thinking is higher due to the educational intervention. Likewise, we can observe in the final diagnosis that there is less dispersion in the data as a result of removing outliers.
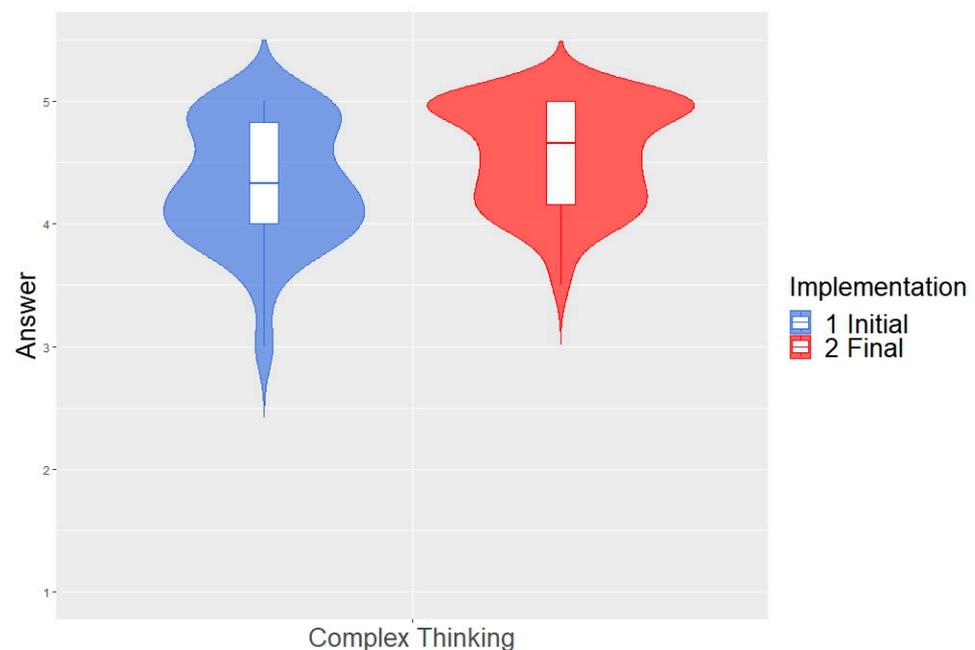

Figure 2. Results of the complex thinking competency (Initial–Final).

Table 6 shows the correlation between the perception of the social entrepreneurship competency and complex thinking. The results in Table 6 show an increase in the coefficient of determination (R^2) from 0.55 to 0.75 after the educational intervention. Although the coefficient of determination is not very close to 1, we must mention that we are not evaluating the predictive ability of the coefficient. In other words, the coefficient of determination obtained and the association between both variables with a reliability level of 95% (p value < 0.05) indicate a correlation between these two competencies.

Table 6. Correlation of development of social entrepreneurship and complex thinking competencies (Initial–Final).

Implementation	R^2	p
Initial	0.55	0.02
Final	0.75	0.00

Figure 3 shows the fit of a linear regression model with a color-coded 95% confidence interval concerning the initial assessment and the final diagnosis. It shows the correlation between the perception of social entrepreneurship competencies and complex thinking. In other words, as a result of the educational intervention, students increased their perception of their social entrepreneurship competency, and, at the same time, they perceived themselves as more competent in complex thinking.
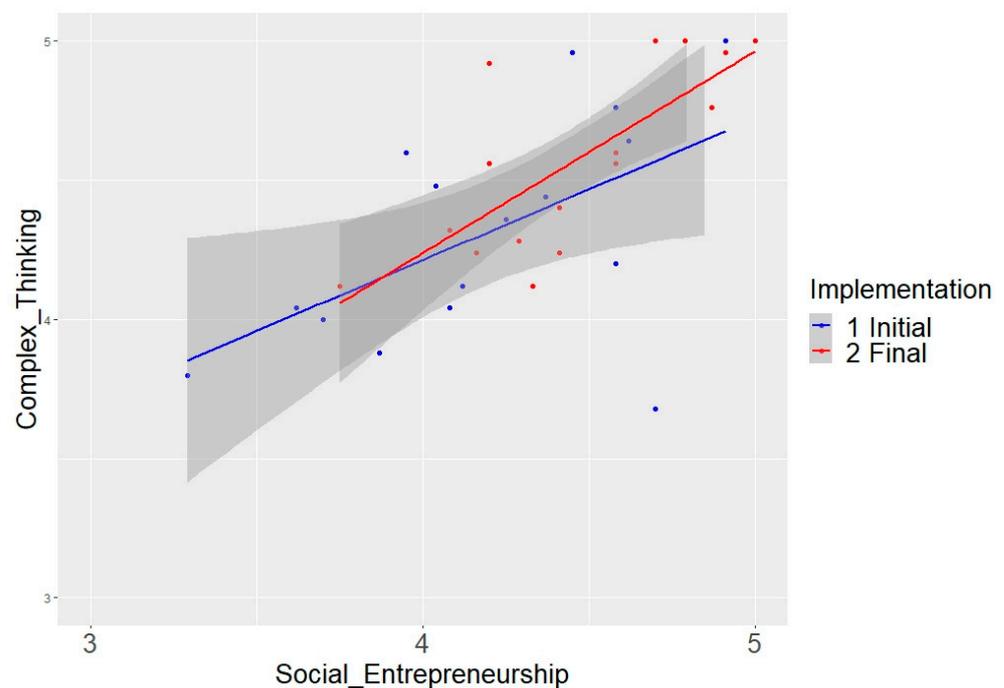
Figure 3. Results showing the positive correlation between social entrepreneurship and complex thinking competencies (Initial–Final).

Regarding the perception of the entrepreneurial self-efficacy competency (Table 7), we observe an increase in the mean values in three of the four items after the educational intervention. Moreover, the data dispersion decreases due to the reduction in the standard deviation values. The increase of about 7% in item 1 from the proposed educational intervention stands out, where the mean increases from 4.15 to 4.43.

Table 7. Entrepreneurial self-efficacy competency results (Initial–Final).

		Initial		Final	
Item	**Concept**	**Mean**	**SD**	**Mean**	**SD**
1	I feel capable of recognizing the potential of an idea or opportunity to enable the emergence of a new enterprise.	4.15	0.68	4.43	0.62
2	I feel capable of discovering new ways to improve existing products or services.	4.53	0.77	4.50	0.51
3	I feel able to identify new potential growth areas and profitable market niches for a product or service.	4.15	0.55	4.37	0.50
4	I feel capable of creating products or services for unmet consumer needs.	4.38	0.65	4.56	0.51
5	Self-efficacy.	4.21	0.73	4.46	0.53

Figure 4 shows violin plots concerning the perception of the self-efficacy competency in the initial assessment and the final diagnosis after the educational intervention was carried out. The bimodal behavior observed in the violin graph corresponds to the small number of students in the sample. However, the graph shows an increase in the mean values and a greater probability of increasing the perception of self-efficacy after implementing the educational intervention.
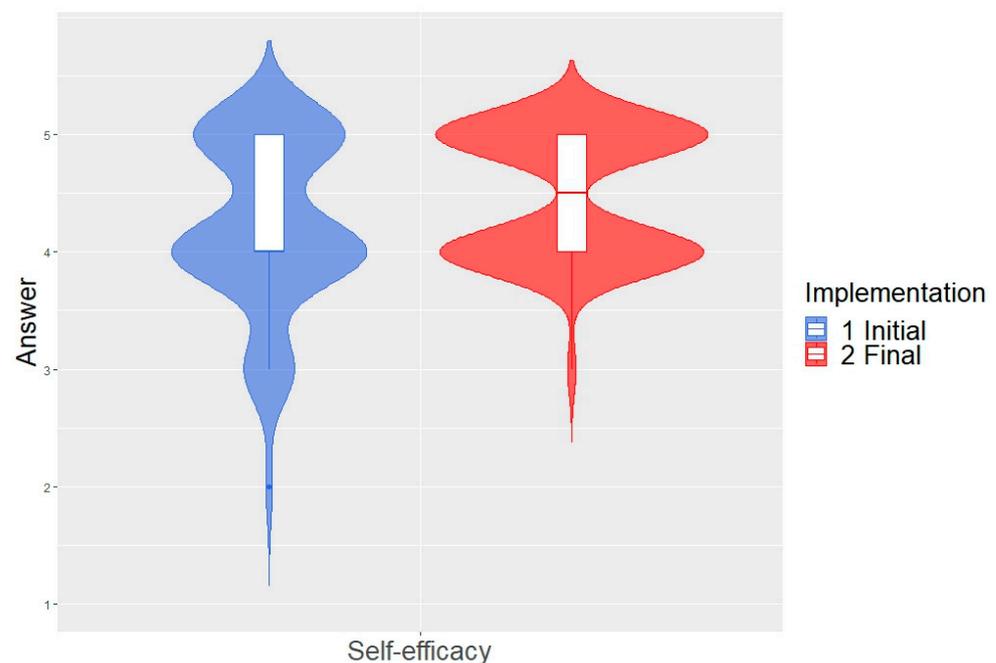
Figure 4. Entrepreneurial self-efficacy competency results (Initial–Final).

Table 8 shows a correlation matrix between the perception of the development of social entrepreneurship, complex thinking, and entrepreneurial self-efficacy competencies in the initial evaluation and the final diagnosis after the social entrepreneurship educational intervention was implemented. Similarly, the matrix shows the coefficients of determination of (R^2) using a linear model with a confidence interval of 95% (p value < 0.05). The results show that the correlation between variables increased among the competencies after the educational intervention was implemented.

Table 8. Correlation of development of social entrepreneurship, complex thinking, and entrepreneurial self-efficacy competencies (Initial–Final). Coefficient of determination.

Initial Diagnosis			
	Soc. Entrep.	**Complex Thinking**	**Efficacy**
Soc. Entrep.	1.00	0.55	0.43
Complex Thinking	0.55	1.00	0.49
Self Efficacy	0.43	0.49	1.00
Final Diagnosis			
	Soc. Entrep.	**Complex Thinking**	**Self-Efficacy**
Soc. Entrep.	1.00	0.75	0.52
Complex Thinking	0.75	1.00	0.55
Self Efficacy	0.52	0.55	1.00

Finally, Figures 5–7 shows the fit of the linear regression model with a color-coded 95% confidence interval for the initial assessment and the final diagnosis by pairs of competencies. A-C shows a positive correlation between sub-competencies, which increased after the educational intervention of the ideation and development of a social enterprise.
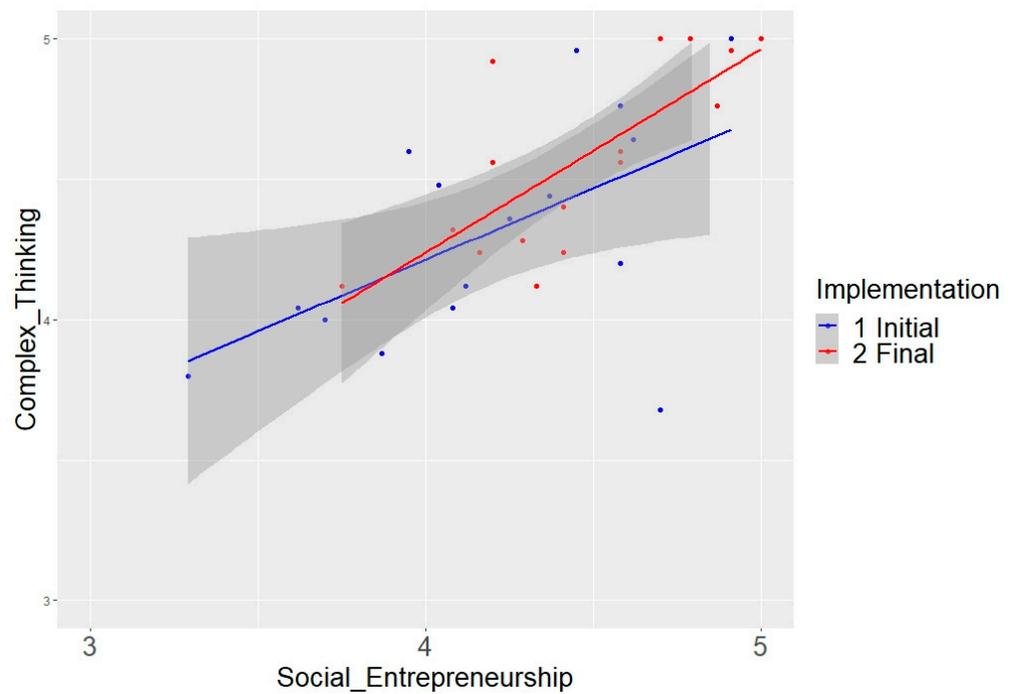
Figure 5. Correlation results of social entrepreneurship and complex thinking competencies.
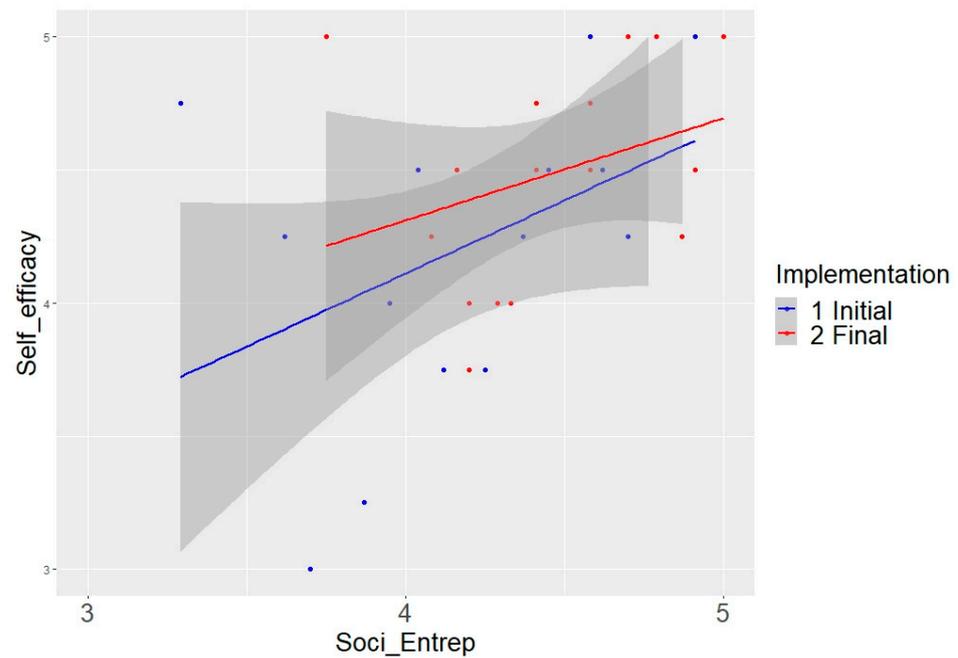
Figure 6. Correlation results of social entrepreneurship and self-efficacy competencies.
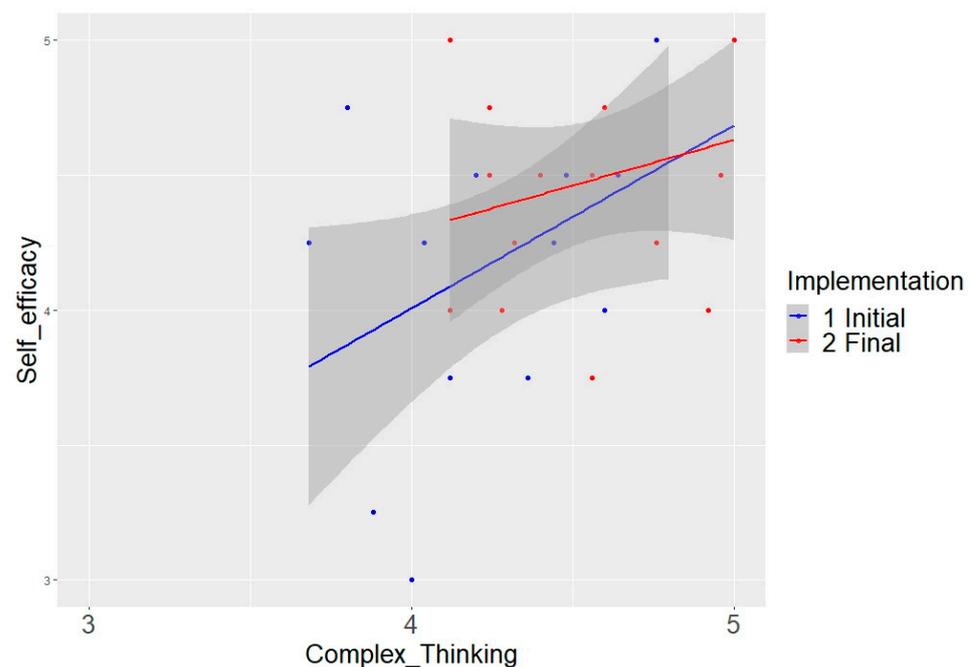
Figure 7. Correlation results of self-efficacy and complex thinking competencies.

5. Discussion

As seen in the results, it can be validated that the three competencies showed improvements in their means and standard deviation, which allows us to appreciate a greater concentration of positive results in the sample after the proposed educational intervention.

Specifically, Table 4 and Figure 1 show the development of the social entrepreneurship competency; this increased from a mean of 4.20 (Initial) to 4.45 (Final) and reduced the standard deviation from 0.91 (Initial) to 0.73 (Final), which indicates a higher mean of positive results. Regarding the participants' gender, although women had the best mean improvement (Initial: 4.30; Final: 4.51), men showed the most significant development (Initial: 4.06; Final: 4.41), indicating that the intervention impacted them more. These

results could be considered the most obvious of this study since the intervention was focused primarily on developing a social entrepreneurship project, and a certain level of impact was expected.

As the second point, Table 5 shows that the complex thinking competency also had considerable upward scaling in both its mean (Initial: 4.31; Final: 4.56) and the reduction in its standard deviation, which can be seen in Figure 2. This result could be considered the study's first finding, primarily because the intervention was not focused on developing this competency; however, the positive results were statistically significant in the general competency and all its sub-competencies.

Considering the above and giving more validity to this finding, we analyzed the correlation between both variables (social entrepreneurship and complex thinking); this can be seen in Figure 3, which shows a positive correlation after the intervention with a coefficient of determination (R^2) of 0.75 (Table 6). Thus, it is possible to point out that the development of social entrepreneurship and complex thinking competencies are positively correlated, with their complementarity in line with that in the study conducted by Vázquez-Parra et al. (2022b).

With these results, Table 7 and Figure 4 show the behavior of the entrepreneurial self-efficacy competency in general and in each item. Like the previous competencies, there was an improvement in its mean (Initial: 4.21; Final: 4.46) and a reduction in its standard deviation (Initial: 0.73; Final: 0.53). These results show that the participants in the experimental group not only perceived themselves as more skillful when making a social entrepreneurship proposal but also as more capable of putting this proposal into practice.

Although these results suggest a relationship between the development of the three competencies, we decided to perform correlation analysis to verify the validity and statistical significance. As shown in Table 8, the correlation between the social entrepreneurship and complex thinking competencies was confirmed with a final coefficient of determination (R^2) of 0.75. However, when including the entrepreneurial self-efficacy competency, the correlation, although it managed to be statistically significant (+0.50), lacked predictive power, both with the complex thinking competency (0.55) and with the social entrepreneurship competency (0.52). These data, rather than being limiting, show the need to extend the study to a larger population, with the idea that sample size affects the results. Even so, as shown in Figures 5–7, it is possible to visualize a correlation between the three competencies; however, in the case of entrepreneurial self-efficacy, the results lack predictive power.

In conclusion, the present study yields two findings. First, the results confirm the correlation between the social entrepreneurship competency and complex thinking, in line with the results of previous studies, such as those of Cruz-Sandoval et al. (2023), which confirm a statistically significant correlation between both competencies.

However, there is a second finding that sheds light on the hypothesis motivating this study, which proposed a possible correlation between complex thinking and the competencies of social entrepreneurship and entrepreneurial self-efficacy. This, although verified to a limited extent, is in line with the results of current studies, such as those of Al-Qadasi et al. (2023), Saoula et al. (2023), and Bian et al. (2023).

These results indicate that the complex thinking competency not only positively impacts the process of generating social entrepreneurship projects but also, due to its transversal characteristics, influences the scaling of entrepreneurs' perception of their capabilities at the time of entrepreneurship. Thus, the three competencies show a valid complementary correlation for improving social entrepreneurship programs.

6. Conclusions and Limitations

There is no doubt that the objective of any university training process should go beyond simply acquiring knowledge to involve processes where the knowledge translates into valuable problem-solving skills that meet the needs of professional life. This is crucial in the training of new entrepreneurs because it would be useless to devise a project that

cannot materialize. Thus, the competencies related to entrepreneurship should include practical skills for tasks, including comprehensive knowledge of the environment, the identification of roles within the system, innovative spirit, and problem-solving methodologies as valuable and necessary competencies.

Therefore, the study on which this article is based aims to provide statistically significant arguments that validate the correlation between the competencies of social entrepreneurship, entrepreneurial self-efficacy, and complex thinking, considering that these are three skills that, when developed together, are relevant for generating social entrepreneurship. From the results, it is possible to appreciate that there is indeed a positive correlation between the three competencies, which argues for and encourages the consideration of their joint training in social entrepreneurship programs.

The major limitation of these results is the small sample population in which the implementation was carried out. However, as mentioned in the Methodology Section, this was in response to an ethical consideration of the committee assessing the relevance of this experimental study. Even so, it is essential to point out that, based on these positive results, we already have the authorization to extend the present study, considering the possibility of intervening in a considerably more significant population, which could help to verify the coefficients of determination (R^2) that turned out to be low.

Although the results presented here are part of a pilot test, they are academically valuable because they elevate the need to develop lines of analyses of the interaction among competencies in the processes of university professionalization, employing correlated evaluations that do not isolate competencies but visualize them as skills that are developed collaboratively in working life.

At a practical level, these results invite social entrepreneurship education programs to consider the relevance of working on complex thinking in their students as a valuable complementary element in their ideation and generation of entrepreneurial proposals.

The originality of this text is that, so far, no clear relationship has been established between people's abilities to cope with complex environments and how the perception of one's ability can trigger actions and mobilize resources to exploit an entrepreneurial opportunity, particularly in environments of uncertainty. If the reasoning-for-complexity competency can be considered a predictor of behavior and professional performance, measuring self-efficacy among entrepreneurs in training would have the potential to shape motivation and aptitudes.

In conclusion, although the results presented are on a small scale, they are considered to set a precedent that should be documented for more extensive future studies that could have more significant results.

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