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E-Mentoring Pilot Program in Academic Internships: Effectiveness in Improving Participants' Competencies

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Abstract: This research is interested in the role that mentoring can play as a strategy for academic and professional support in the academic internships of undergraduate students of a marketing program in a Colombian university, aiming to validate an e-mentoring model to stimulate the acquisition of professional competencies in students of academic internships. Thus, a quantitative approach-related group pre-posttest experimental type study (a pilot study) was carried out to validate the e-mentoring program. The sample consisted of 18 mentees with their respective 18 mentors, who were evaluated in three different phases (pretest mentee, posttest mentees, and posttest mentors). The results showed positive results, especially in four distinctive competencies (project management, problem-solving, autonomous work, and teamwork). On the other hand, the mentors confirmed elements associated with high satisfaction with the e-mentoring program through its design, purpose, the training provided, and the level of professional, logistical, and technological support.

Keywords: e-mentoring; internships; educational practices; competencies; online collaboration

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1. Introduction

Mentoring involves a professional partnership between a less experienced individual (the mentee) and a more experienced individual (the mentor) where the purpose is the mentee's personal and/or professional growth. Although the goals of the mentoring relationship may differ across settings and relationships, almost all partnerships that arise under this modality involve the acquisition of knowledge [1]. While having a mentor is certainly not a new idea, it has resurfaced in recent years in a variety of forms supported by diverse outcomes [2]. Mentoring can occur in a variety of ways, but it almost always has a positive effect on the student, both psychosocially and academically [3]. Given that such benefits can arise from mentoring programs, it is important that such programs are done well.

Higher education in the 21st century cannot be easily separated from technology-based solutions. Technology is increasingly becoming an essential tool for any educator [4,5]. Technological advances and the use of Computer-Mediated Communications (CMC), such as email, chat rooms, blogs, among others, are changing the way mentors and mentees interact [2].

The use of technology in the mentoring process has led to the creation of many terms and definitions, including e-mentoring, telementoring, and online mentoring. Some of these terms highlight the specific technological tools used in the mentoring process [2]. Figure 1 shows the types of e-mentoring identified by Mullen [1].

Types of e-mentoring	Description
Computer-mediated communication only (CMC only)	Mentoring conducted solely through electronic communication
Primarily through computer-mediated communication (CMC-primary)	This type of interaction is complemented by phone calls and even face-to-face interaction
Supplementally through computer-mediated communication (CMC-supplemental)	Refers to traditional mentoring supplemented by some electronic communication

Figure 1. Types of E-mentoring.

In addition, e-mentoring differs from traditional face-to-face mentoring models in its use of electronic communications to build relationships [6]. However, its benefits are similar; thus, Leidenfrost et al. [7] noted that e-mentoring provides mentees with the same informational, psychosocial, and instrumental benefits as those found in face-to-face mentoring models. Moreover, electronic communications allow mentors and mentees to overcome many of the geographic and temporal limitations of face-to-face mentoring, and e-mentoring offers opportunities for many more connections, including among other institutions [8].

Mentoring programs typically aim to exert a positive helping role between mentors and mentees [9–14]. Thus, the literature supports the idea that the e-mentoring model can help to effectively develop the capacity mentees possess to cope with the challenges associated with starting their professional careers [15].

Camacho Lizárraga [16] recognized that the most effective e-mentoring practice in higher education is to create a culture of mentoring throughout the university and at all formative levels. Nevertheless, programs may vary in their effectiveness to meet the unique needs of institutions and organizers.

1.1. E-Mentoring and Competencies

E-mentoring relationships are developmental partnerships through which knowledge, skills, and perspectives are shared to support personal and professional growth [17]. Mentees often seek various types of support from their mentors that involve personal accountability, support, friendship, promotion of personal growth, and constructive feedback on the mentee's progress [13].

The mentor-mentee relationship can also foster a sense of independence and confidence in the mentee [18]. Thus, building a collaborative approach in which mentors engage mentees with solving their own concerns and problems facilitates a supportive environment and provides maximum opportunities for academic success. The recognition of academic success is directly linked to the mastery of professional competencies by students in academic internships [19]. To achieve such recognition, it is important to look for a combination of key skills and knowledge, competencies that the participating students should master.

A competency is a measurable pattern of knowledge, skills, abilities, behaviors, and other characteristics that a learner needs to successfully perform in their job or occupational functions during an academic internship [12,20]. Competencies specify the "how" of performing the job tasks, or what the person needs to do the job successfully.

The relevance of e-mentoring in promoting competencies points to the need to establish structured programs with key ideas such as the one presented here. In this way, it recognizes and outlines the scope and content of the professional competencies that internship students must achieve to be successful in their work environments.

1.2. Internships in the University Context

It can be noted that academic internships are generally part of the curricular or training activities carried out while attending university. The universities are empowered to regulate these types of internships, with an agreement made between the university and the student

to perform activities that achieve specific results. As part of the expansion of work areas provided by each university, the Social Projection Coordinator of each entity manages the processes aimed at the promotion and strengthening of entrepreneurship, seeking the development of the culture of entrepreneurship, and the formation of basic, professional, citizenship and business skills required within the industry [4,6,21].

In an endeavor to explain and interpret reality as a starting point in the transformations aimed at by academic practices in Colombia, the University participating in this study coordinates an academic internship for students in the Marketing program that is carried out in the sixth semester of the course, which is full-time for a duration of 6 months (24 weeks). The student, as an intern, is linked to a company or organization to work as a professional in one or more areas of economics and marketing. The intern is accompanied by a professor-tutor of the University, who is responsible for advising the student's professional performance process, and also serves as a liaison between the internship site and the University.

The company must provide the intern with the necessary resources to develop his or her work properly, and must also assign a manager who is committed to accompanying him or her in the design and execution of his or her work plan. At the end of the internship, the student is evaluated by the tutor and by the immediate supervisor, from which a final grade is issued and reported to the University to formalize the approval—or not—of the internship semester.

1.3. Pilot Program Structure

The e-mentoring pilot program has been conceived and designed to help students in academic practice to recognize the mastery of their professional competencies. As emphasized in the literature, mentoring programs typically aim to exert a positive helping role between mentors and mentees. Overall, mentoring has become a fairly widespread practice to help practitioners establish the expected proficiencies in internship situations [18,19]. Tominaga and Kogo [22] suggest that experienced mentors can provide mentees with guidance and support to learn new pedagogies and socialize into new professional norms. However, proving that this design is effective and allows students to improve their professional practices entails validation through its pilot application, in this case, in a university in Colombia, with students enrolled in a Marketing program.

The expected results provided the guiding parameters for the planning and execution of the pilot mentoring program, as well as its summative evaluation. The intended outcomes of the pilot program are:

- To create and systematically test a model mentoring program for students in academic practice in the Marketing program of a Colombian University, which serves as an effective support to recognize the mastery of professional competencies of mentees and which is scalable and sustainable in the long term.
- Establish a professional support group of graduates belonging to the faculty through the e-mentoring pilot program to foster learning areas of high perpetual need for students in academic practice.

This e-mentoring process aims to facilitate the adaptation to the employability process of internship students in the Marketing program and to provide the necessary information, advice, and guidance on different academic and labor needs that are essential for their academic internship. Figure 2 describes the e-mentoring framework as an effective tool for professional and personal development, serving as a hub for knowledge exchange and skills development.

Structure	Definition
Objective	Ensure that the application of the pilot program to a group of participants from the university of application will make it possible to recognize its functionality and success in future editions of the program
Modality	Virtual, emphasizing an interpersonal relationship between a mentor and mentee
Participants	Mentees, mentors, program coordinator, program supervisor
Schedule	An academic semester 2019-1
Administrative support	• Program coordinator: This individual articulates the pilot mentoring program, has constant communication with the participants and ensures that all academic and technical processes related to the program are complied with • Program Supervisor: This individual is a member of the university community, chosen by the director of the Marketing program, whose function is to validate and protect the information acquired from the students
Technical Support	Participants need constant access to the Internet, social networking sites, e-mail sites, and other technical resources. The technology must be appropriate to the type of program planned and the participants
Communication tools	WhatsApp, Google Forms, email, Skype, Zoom
Learning and coaching support	Participants receive training so that expectations are clearly delineated and understood by both parties. Mentee training is coordinated with mentor training. The program supervisor needs to know the parameters of the relationship, what is expected of the mentee and the mechanics of the e-mentoring relationship with the mentor
Evaluation	Pre-test and post-test forms, bi-weekly feedback forms and program satisfaction forms are sent out

Figure 2. E-mentoring program framework.

The importance of this framework is that the development of competencies and skills with an e-mentoring process can help to highlight unique attributes in each individual and foster the attention, concentration, and clarity necessary to determine which skills and competencies are relevant to become more specialized and become a professional in any field [20–24]

Likewise, to recognize previously acquired competencies and identify key learning needs, training resources, and the additional skills necessary for adequate professional development. Thus, the e-mentoring process helps the students to assume their professional roles and responsibilities and guides them to self-evaluate themselves [25–27]. With this application, a series of results are expected for the e-mentoring pilot program to validate its effectiveness.

This e-mentoring program focuses on the relationship between peers (mentees) and mentors (alumni) based on a formal model, coordinated and supported by a program coordinator. The internship student participating in this program is assigned a mentor. The mentees are monitored, assessing their improvement in competencies, taking an interest in possible difficulties and helping them to resolve their difficulties, guiding them in the design of their training, and planning their training and curricular itinerary together.

Finally, it is essential to recognize that higher education institutions are increasingly using mentoring as a strategy to create or reinforce the cultural aspects of the institution. Thus, if mentoring is valid to generate organizational changes, it is also fully adequate to foster the culture of innovation in our institutions. Facilitating an innovative e-mentoring program like the one proposed in this pilot program maximizes learning and also greatly strengthens the connection between participants [22,24]. This innovative proposal goes beyond adding something new to the programs that already exist, rather it is about changing and recognizing the competencies of students in academic practices, to generate value in the participants who are part of the program and to whom this experience is directed [19].

This pilot e-mentoring program seeks to adapt new contexts and channels that, essentially, meet the latest primary needs of each generation that coexists in our educational institutions. In addition, it will incorporate a flexible approach to meet the differing requirements of the institutions that may apply to the program. However, there are certain essential issues in the pilot e-mentoring program proposal that remain at its core [1,6,7]:

- The willingness to learn.
- The willingness to share knowledge.
- Personal commitment to support.
- Open-mindedness.
- Determination to achieve a learning or development goal.

2. Methods

The methodology used was fundamentally aimed at validating the pilot program with the students in the academic internship and recognizing if it fulfilled a supportive function, which was translated to the effectiveness of the program. Based on the aforementioned objective and hypotheses, we selected a quantitative approach for a group pre-posttest experimental-type methodological design [28]. This related-group pretest-posttest design helped us to determine the effect of a treatment or intervention on a given sample.

In this sense, it was intended from the design of the research and with the results that were reached, to answer a series of research questions:

- To what extent was the pilot program implemented?
- To what extent did the project achieve its goals and objectives?
- To what extent can the work and achievements of the program be considered scalable and sustainable? That is, in what ways and to what degree is the work of the program likely to survive beyond the scale and time of external support to the pilot program?

The purpose of the research was to test the work strategy and identify the main influencing components (it is not a case study). The treatment is the program, a mentoring program that was intended to be replicated in different contexts, therefore, validated instruments were needed with a reference population, and validated instruments could only be applied if we worked with quantitative statistics. However, we initially wanted to work with a mixed-method approach, as this would allow us to include the potential of qualitative research. In this case, we found that few participants responded to the qualitative instruments (monitoring and observation forms), so we changed the nature of the study due to the lack of data. Since we worked with a small sample, we integrated all the statistical analyses that favored the study, such as nonparametric tests and effect size. To highlight the effect size, as it is a statistic that solves the problems of small samples and also very large samples, this statistic showed the degree to which the phenomenon is replicated in the population and, therefore, allowed us to determine whether the program could be replicated in other contexts. If only a qualitative methodology was used, the relevance of this treatment in a specific context could be analyzed, but replication in other contexts could not be integrated because the results could be extrapolated.

2.1. Objectives and Hypothesis

The above questions were the working basis for the research objectives and hypotheses. Consequently, the program evaluation objective was delimited in validating an e-mentoring model to stimulate the acquisition of professional competencies in academic internship students. This objective was encompassed in the working hypothesis defined as the inclusion of students of academic internship to an e-mentoring program will mean an improvement in the acquisition of professional competencies in the labor field.

2.2. Participant Sample

In the study, the two main participant groups were the mentees and mentors. Regarding the *mentees*, the participating sample was made up of 18 students in the academic

internship semester (the sixth semester) of the Marketing program at a Colombian University who were invited to participate in the e-mentoring pilot program. However, it is important to note that the mentees were not the only ones who participated in the pilot program. Rather, the study sample was made up of the entire population of students who participated in an academic internship in the sixth semester. Therefore, the study sample and the total internship population coincided (N = n = 18) avoiding self-selection bias, since this sample is the one that will serve to verify the improvement in competencies that the pilot program entails.

It should be noted that the selection of the sample was configured over three terms that allowed the full participation of all academic internship students in the Marketing program in the first semester of 2019:

- *Term 1. Communication and invitation to fifth-semester students to participate in the pilot program and go out for academic practice commencing January 2019:* the first contact with the study population (27 students applied for internship) developed during September and October 2018 (pre-planning of the program), whereby the program was presented via email communication sent by the University coordinator of academic internships, which outlined the e-mentoring program that would be implemented the following semester and invited students to participate in it.
- *Term 2. The population that applied for academic practice:* at the end of November 2018, the University academic internship coordinator sent a communication to the organizer of the e-mentoring pilot program advising that the Academic Council of the University had issued a document with the number of students from the Marketing program that would go out to academic practice in January 2019. Ultimately, the population was reduced from 27 students to 18 with the loss of thematic cores, semester deferral, and complete withdrawal from the institution. Thus, the possible working target population was 18 students.
- *Term 3. Participation in the program:* after learning that the number of students registered and enrolled for practice in January 2019 was 18 students, the University academic internship coordinator, together with the Marketing program management, proposed to the coordinator of the pilot program that it be made mandatory and an integral part of the semester curriculum (commencing January 2019) as a university student social service. Thus, the entire student population participated in the e-mentoring pilot program.

Recognizing that the sample was equal to the population, we could determine that "the statistics obtained in the sample correspond, represent, without systematic error, the parameters of the population", Argibay [29] (p. 14). Clarifying this, the measures that we obtained from the sample are called statistics, and in this case, taking all the components of the population, to calculate these measures would be the parameters. Therefore, we have taken the measurements of all the components that make up the study, and we have obtained the values of the parameters by means of the statistics obtained from the sample.

Regarding the 18 students (mentees) participating in the program, the sample was fairly equitable by gender, although the proportion of men was slightly higher, 10 males (56%) compared to 8 females (44%).

The second target group for the development of the program was the *mentors*. They were the graduate students of the faculty of Economic Sciences which administers the Marketing program. A total of 126 potential candidates were selected from the university database. A response rate of 36% was obtained (46 responses of interest in voluntary participation). A mentoring participation database was created with information regarding the characteristics and interests of the potential mentors gathered from the emails received from them. An email invitation to participate in the program was sent to graduates, only 18 candidates were selected who met the necessary characteristics to participate as mentors in the program to coincide with the same number of mentees. Figure 3 shows several appropriate characteristics that determined inclusion in the study.

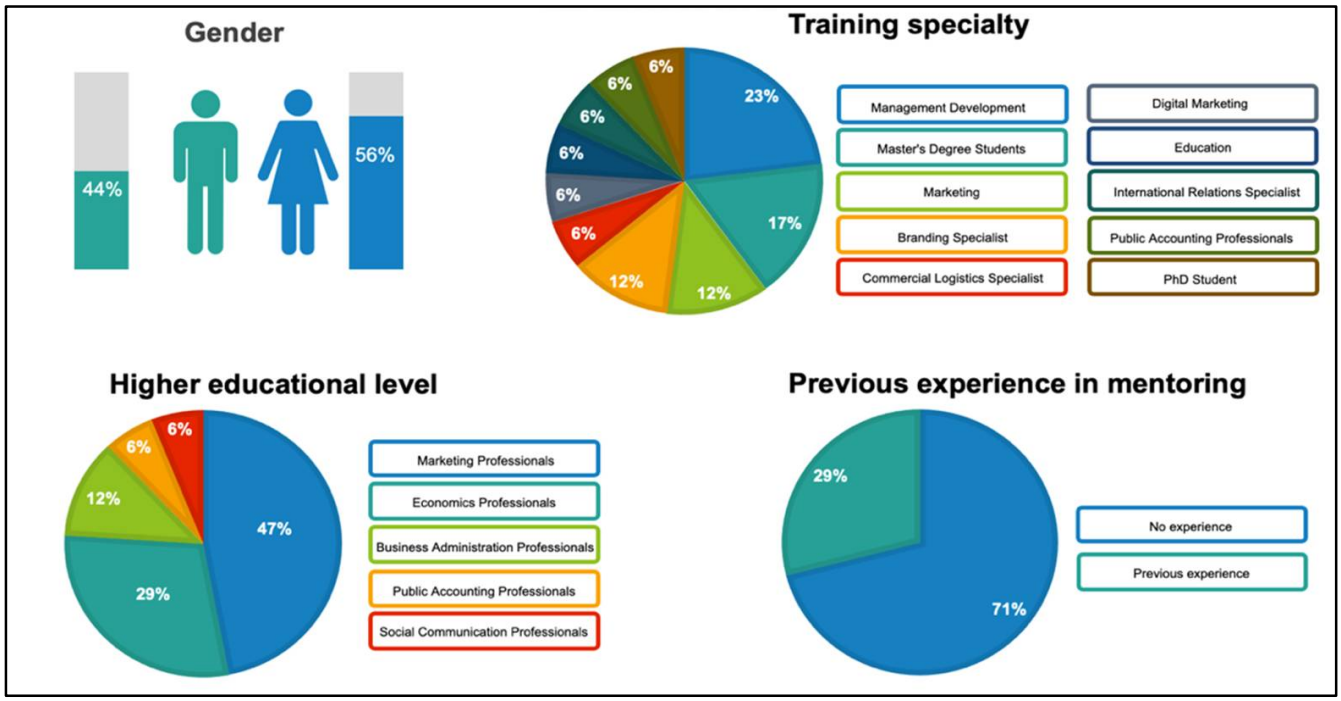

Figure 3. Mentor characteristics.

2.3. Variables and Instruments for Data Collection

In relation to the objective of the study, the independent variable was defined as the design of the e-mentoring pilot program itself. The dependent variable was recognized as the level of mastery of professional competencies by students in the University Marketing program academic internship (self-assessed and/or observed).

The collection of the information was carried out with the use of the competency assessment rubric, which was designed and applied to the students to demonstrate what they have learned, in addition to facilitating a self-review and a competency mastery review by mentors for their mentees. The rubric helped participants understand both the holistic nature and/or the specific analysis of the expected mastery and the expected level of learning, to make decisions about their current level of learning to inform review and improvement [30].

The rubric contained four essential features: the competencies selected, the criteria that must be recognized by the mentees to complete the task (indicators of each competency), the levels of competency mastery (the rating scales), and the scoring [19,20,31–34]. Criteria were used to determine the level at which the students' work meets expectations. The levels of mastery gave learners a clear idea of what they must do to demonstrate a certain level of understanding and competence. Figure 4 shows a summary of the elements that made up the rubric.

COMPETENCY	INDICATORS (Competency indicators identify specific aspects of a competency that are transferable between subject areas or contexts)
Project management	1. Establish priorities of objectives and tasks 2. Work in a systematic and orderly manner 3. Ability to search for information 4. Ability to apply and use information
Problem-solving	1. Identification of the problem and analysis of its causes 2. Application of an effective procedure to solve the problem 3. Identification of conflicts and analysis of the problem 4. Decision making and action plan.
Application of critical, logical and creative thinking	1. Establishes concrete objectives for the situation at hand 2. Adequately processes the information and elaborates a coherent plan to solve the situation 3. Ability to generate original solutions 4. Ability to express, transmit and implement original ideas
Autonomous work	1. Undertake ambitious projects involving decisions 2. Orientation towards innovation and technological research 3. Make decisions considering ethical aspects 4. Ability to perform good economic, social and environmental management
Learning to learn	1. Identifies the most significant elements, groups them into related categories and establishes dependency relationships 2. Expresses conclusions and presents the information using the most appropriate technique 3. Integrates knowledge from different subjects to understand the problem or system of study 4. Synthesizes the scientific-technological foundations of the problem and compares the different possible solutions according to the dynamics or possible solution of the problem
Effective communication	1. Expresses their ideas in a structured and clear way 2. Illustrate their ideas by integrating examples, analogies, metaphors and other resources appropriately 3. Responds to questions to defend their ideas 4. Encourages the participation of their listeners and asks constructive questions to achieve dialogue and thus improve the communication of their ideas
Teamwork	1. Ability to lead 2. Personal contribution and willingness to work 3. Involvement and integration in the team

LEVEL (Used to measure the ability to demonstrate a competency)	LIKERT SCALE			
Basic: *The mentee has a common knowledge or understanding of basic concepts and techniques.*	1	2	3	4
Intermediate: *The mentee has the level of experience gained in a classroom and/or experimental setting. It is expected that he/she will need assistance in performing this skill*	1	2	3	4
Advanced: *The mentee is able to successfully complete the tasks of this competency as requested. Occasional expert assistance may be required from time to time, but is generally able to perform the skill independently*	1	2	3	4

Figure 4. Definitions of the rubric and competency level indicators.

2.4. Data Analysis

The statistical analyses carried out to test the hypothesis formulated on the competency efficacy obtained by the students in the e-mentoring pilot program are presented below. Prior to choosing the most suitable type of contrast test (parametric or non-parametric), an exploratory study of the variables was applied in both processes (pretest and posttest), and the assumption of normality of the distribution of the operationalized variables was studied at each level of measurement using the Kolmogorov-Smirnova and Shapiro-Wilk tests [35].

Data on the students' proficiency level were obtained in the pretest phase, then the program was implemented, and finally, the self-perception test of proficiency level was administered again to the students at the end of the tutoring program. To corroborate or refute the study hypothesis, the Wilcoxon W test (pretest-posttest) was performed. This test was used to establish the effectiveness of the program. However, along with this test, the r test for sample size was added to provide further support for the results obtained.

After obtaining the above data, the perception of the student-mentor analysis was established, i.e., the differences before and after the program in each group were verified. Taking into account that the mentors were matched without prior knowledge of the conditions of mastery of the mentees' competencies, only the comparison with the post-test process, in which they were participants, was taken as a basis. In this way, it was intended to check whether the mentors' rate was higher or lower than that of the mentees. To corroborate or refute the study hypothesis, at this point, the Mann-Whitney U test (posttest mentees) and the "r" for effect size had been performed.

In addition, this was complemented with the calculation of the Spearman's correlation between the groups to assess whether the degree of agreement between the two variables was strong and positive (the closer the values were to 1, the stronger and more

positive). This phase was supported by the following hypothesis: Mentors perceive the competencies of the mentees at the same levels of acquisition at which the mentees claimed to have developed.

This hypothesis was operationalized in the working hypothesis defined as: To verify that there are no statistically significant differences (n.s 0.05) between the competencies perceived by the mentee and mentor, and to verify that the relationship between the two is positive. For this purpose, we worked with both descriptive and inferential analyses supported by the data analysis program SPSS v. 25 (license acquired by the University of Salamanca). Figure 5 shows more clearly the different techniques of statistical data analysis performed.

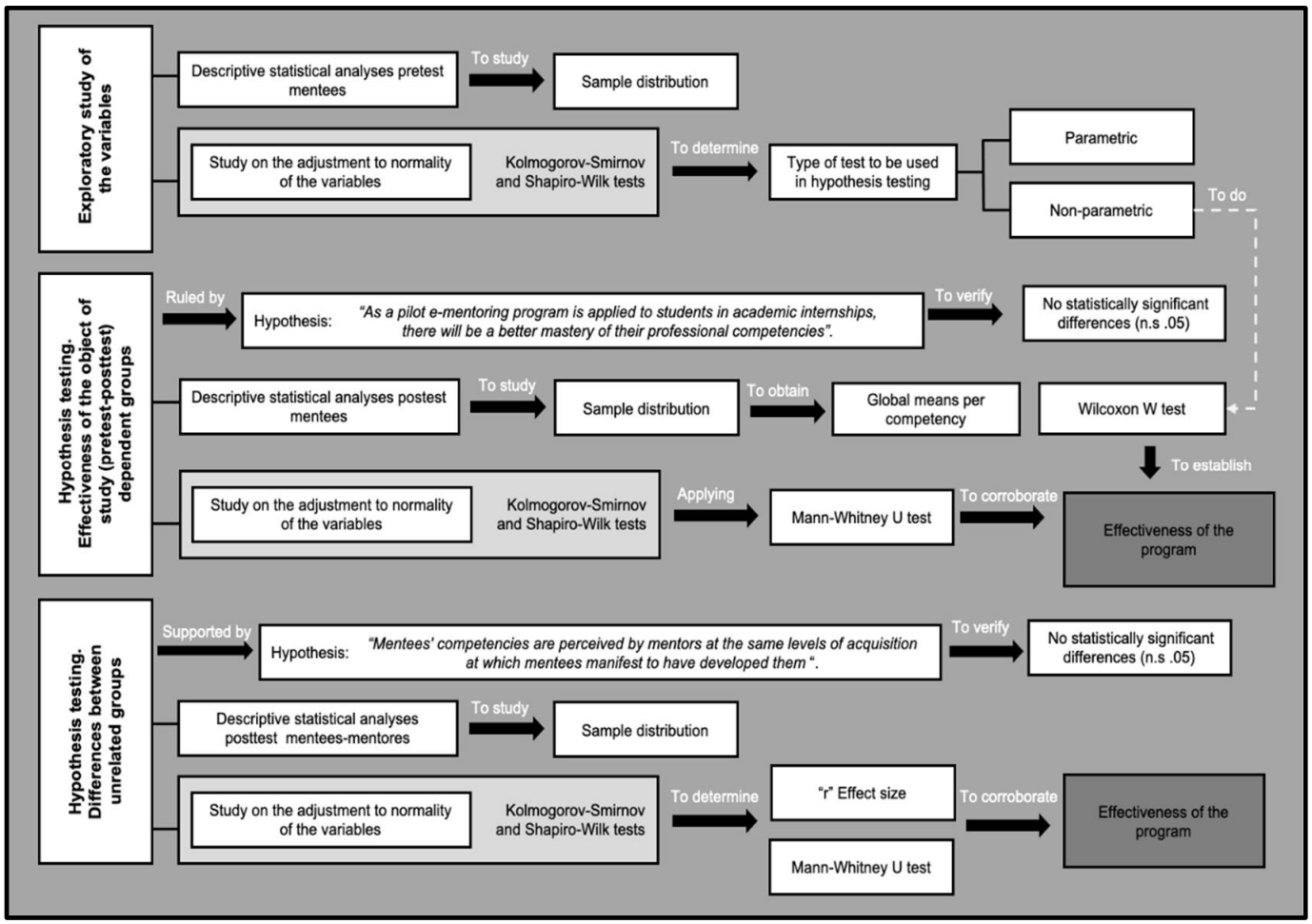

Figure 5. Data analysis performed.

3. Results

The analysis of the quantitative information collected in the pretest was studied using basic descriptive statistics such as the means and standard deviation for each indicator per competency at the different competency levels. This information allowed us to know how the group was positioned at the beginning of the e-mentoring program in order to subsequently check if there had been any changes (Figure 6).

Competency	Indicator	Competency level	Pretest Mentees $\bar{X}$	Pretest Mentees S_x	Posttest Mentees $\bar{X}$	Posttest Mentees S_x	Posttest Mentors $\bar{X}$	Posttest Mentors S_x
Project management	Prioritization of objectives and tasks.	Low	2.41	0.52	2.55	0.03	2.69	0.05
		Medium	1.55	0.78	3.11	0.07	3.11	0.07
		High	1.88	0.32	3.05	0.03	3.19	0.05
	Work in a systematic and orderly manner.	Low	1.66	0.56	1.66	0.09	1.58	0.07
		Medium	2.13	0.47	3.19	0.05	3.36	0.07
		High	2.30	0.25	2.94	0.03	3.00	0.07
	Ability to search for information.	Low	2.50	0.70	1.72	0.10	1.94	0.15
		Medium	2.27	0.46	3.00	0.09	3.22	0.10
		High	2.77	0.42	3.05	0.05	3.22	0.10
	Ability to apply and use information.	Low	2.00	0.00	1.94	0.05	2.00	0.11
		Medium	2.00	0.00	1.88	0.07	2.00	0.11
		High	3.05	0.23	3.27	0.10	3.33	0.11
Problem-solving	Identification of the problem and analysis of its causes.	Low	2.50	0.61	1.94	0.05	2.00	0.11
		Medium	2.44	0.70	3.00	0.09	3.00	0.10
		High	2.88	0.32	3.05	0.05	3.38	0.11
	Application of an effective procedure to solve the problem.	Low	1.44	0.51	1.33	0.11	1.61	0.11
		Medium	2.27	0.82	3.05	0.05	3.55	0.12
		High	3.16	0.51	3.33	0.11	3.5	0.12
	Conflict identification and problem analysis.	Low	1.83	0.29	1.75	0.06	1.38	0.07
		Medium	2.97	0.11	3.25	0.10	3.38	0.09
		High	3.30	0.42	3.36	0.09	3.55	0.07
	Decision making and action plan.	Low	1.88	0.21	1.66	0.11	1.66	0.07
		Medium	3.08	0.25	3.22	0.08	3.41	0.07
		High	3.11	0.21	3.41	0.12	3.25	0.06
Application of critical, logical and creative thinking	Sets specific objectives for the situation at hand; identifies and assesses the information needed to achieve those objectives.	Low	1.58	0.30	1.36	0.06	1.61	0.07
		Medium	2.97	0.11	3.02	0.02	2.91	0.06
		High	3.00	0.38	3.22	0.09	3.08	0.04
	Adequately processes information and develops a coherent plan to resolve the situation.	Low	2.44	0.16	2.27	0.06	2.5	0.08
		Medium	2.97	0.11	3.35	0.10	3.36	0.09
		High	3.00	0.00	3.27	0.10	3.13	0.05
	Ability to generate original solutions.	Low	2.50	0.00	2.52	0.04	2.5	0.08
		Medium	2.91	0.19	3.16	0.09	3.11	0.05
		High	2.83	0.24	3.38	0.06	3.27	0.06
	Ability to express, convey and implement original ideas.	Low	2.16	0.29	2.00	0.29	2.00	0.11
		Medium	2.91	0.19	3.00	0.09	3.00	0.09
		High	2.97	0.11	3.22	0.09	3.00	0.10
Autonomous work	Undertake ambitious projects that involve decisions.	Low	2.00	0.00	1.75	0.10	1.91	0.04
		Medium	2.91	0.19	3.19	0.10	3.02	0.02
		High	2.69	0.30	3.33	0.11	3.11	0.05
	Orientation towards innovation and technological research.	Low	1.94	0.29	1.75	0.10	1.97	0.0
		Medium	2.91	0.25	3.11	0.07	3.00	0.09
		High	2.58	0.30	3.00	0.07	2.55	0.03
	Makes decisions considering ethical aspects.	Low	2.83	0.38	2.94	0.05	3.00	0.02
		Medium	3.00	0.00	3.16	0.09	3.00	0.10
		High	2.77	0.42	2.94	0.05	2.83	0.09
	Ability to perform good economic, social and environmental management.	Low	2.61	0.69	2.77	0.12	2.88	0.07
		Medium	2.83	0.38	2.94	0.055	3	0.02
		High	3.00	0.00	3	0.09	3	0.10
Learning to learn	Identifies the most significant elements, groups them into related categories and establishes dependency relationships.	Low	3.00	0.00	3.22	0.08	3.11	0.05
		Medium	3.00	0.00	3.30	0.10	3.27	0.08
		High	3.08	0.19	3.33	0.11	3.05	0.03
	Expresses conclusions and presents information using the most appropriate technique.	Low	2.05	0.23	1.94	0.08	2.05	0.03
		Medium	3.00	0.24	3.22	0.08	3.08	0.04
		High	3.02	0.11	3.25	0.08	3.05	0.03
	Integrates knowledge from different subjects to understand the problem or system under study.	Low	2.80	0.25	2.69	0.05	2.5	0.08
		Medium	3.02	0.11	3.27	0.09	3.13	0.05
		High	2.91	0.25	3.33	0.10	3.11	0.05
	Synthesizes the scientific-technological foundations of the problem and compares the different possible solutions according to the dynamics or possible solution of the problem.	Low	2.44	0.48	2.58	0.09	2.5	0.08
		Medium	2.83	0.29	3.00	0.02	3.00	0.02
		High	2.86	0.28	2.97	0.04	2.94	0.03
Effective communication	Expresses ideas in a structured and clear manner.	Low	1.97	0.11	1.72	0.10	1.88	0.05
		Medium	3.02	0.11	3.27	0.10	3.00	0.05
		High	3.00	0.00	3.19	0.07	3.00	0.02
	Interpret ideas by integrating examples, analogies, metaphors and other resources appropriately.	Low	2.25	0.25	1.94	0.09	1.88	0.06
		Medium	3.00	0.00	3.27	0.09	3.02	0.02
		High	3.00	0.00	3.16	0.05	3.25	0.06
	Responds to questions posed to defend their ideas.	Low	1.97	0.11	1.61	0.11	2.00	0.11
		Medium	2.47	0.36	2.61	0.05	2.69	0.05
		High	3.05	0.16	3.30	0.08	3.11	0.05
	Encourage participation of his/her listeners and asks constructive questions to achieve dialogue and thus improve the communication of his ideas.	Low	3.00	0.00	3.13	0.06	3.00	0.02
		Medium	2.97	0.11	3.16	0.08	3.02	0.02
		High	3.00	0.00	3.22	0.09	3.00	0.02
Teamwork	Ability to lead.	Low	3.05	0.23	3.22	0.10	3.00	0.09
		Medium	3.05	0.23	3.38	0.11	3.00	0.06
		High	2.94	0.41	3.27	0.10	3.11	0.07
	Personal contribution and willingness to work.	Low	2.38	0.32	2.02	0.07	2.00	0.08
		Medium	3.02	0.11	3.19	0.08	3.00	0.07
		High	3.00	0.17	3.16	0.09	3.05	0.03
	Involvement and integration in the team.	Low	1.75	0.30	1.5	0.11	1.88	0.06
		Medium	3.08	0.19	3.44	0.08	3.13	0.05
		High	3.55	0.16	3.69	0.05	3.33	0.05

Figure 6. Exploratory for the basic statistics of the variable in the pretest and posttest.

3.1. Study of the Sample

Regarding the quantitative findings in the pretest in relation to the *project management competency*, it was recognized that the level of mastery was low 72.69% with respect to the percentage of attribution (the answers were among the scale options < 3), a clear example was the indicator prioritization of objectives and tasks, where the value of the means in all its levels of mastery constituted values less than 2.5, possibly due to the lack of knowledge of the priorities of students in their practice site, or given by the inexperience in the same. On the other hand, the standard deviation was relatively small, and the distribution of responses among the 18 mentees appeared to be more symmetrical.

Regarding the *problem-solving competency*, the competency levels of the four indicators showed very similar values at the medium level, possibly due to the fact that students

in practice recognized that they had the ability to solve real problems in their practice processes and emphasized medium-high levels of ability to make their decisions.

The results of the competency *application of critical, logical, and creative thinking*, determined that the competency levels were very similar according to the values of the mean as the statistic of central tendency recognized and registered that the levels of dispersion showed the respective standard deviations were greatly reduced for each indicator and at each level.

In the descriptive analysis of the *autonomous work competency*, there was a very low recognition by students of the competency indicator known as entrepreneurship in ambitious projects, which involved essential decisions reflected in their learning and self-assessment.

The *learning to learn competency* showed that students identified themselves as having a medium level of competence in relation to the basic requirements and skills that were necessary to master this competency. On the basis of the different indicators of this competency, students believed they performed moderately effective management of learning their practice and the work patterns assigned in it and, in particular, of the indicator expressing their conclusions and presenting information using the most appropriate technique; this assumes that students possess the ability to critically reflect on the purposes and objectives of their learning.

The descriptive statistics found in the *competency of communicating ideas effectively* revealed that the students in the pretest considered that their level was low in understanding the differences in the ways of communicating through interactions with others and structuring their ideas. It is possible that the low level found in the students' self-assessment was due to the recognition of a lack of communication or learned poor communication, and it is even possible that students could present clear and logical information that was poorly communicated. This was reflected in the low levels responding to the indicator, effectively handling verbal and nonverbal communication, which was probably established by the lack of experience at the work level.

In *teamwork competency* in the academic internship environment, it is important to understand that each member contributed to the overall success of the organization. The results indicated that 61.11 % showed an average mastery of appreciation of the three indicators of this competency.

Reviewing the data previously presented, it was decided to carry out a more concise exploration of the normality of the sample, with the purpose of corroborating or not the differences found. Thus, the Kolmogorov-Smirnov and Shapiro-Wilk (K-S) tests were performed to determine the normality of the group. The hypotheses of the K-S test were:

Hypotheses 0 (H0). *The distribution of the variable conforms to a normal distribution (sig* $\geq$ *0.05).*

Hypotheses 1 (H1). *The distribution of the variable does NOT conform to a normal distribution (sig < 0.05).*

Since the significance was less than 0.05 in all dimensions of the variable, both in the Kolmogorov-Smirnov and Shapiro-Wilk tests, the null hypothesis of fit to normality was not accepted. Thus, the non-normality assumption was accepted; therefore, non-parametric tests were implemented and it was concluded that the scores of the distribution variables did not fit the normal distribution.

3.2. Effectiveness of the Objective of the Study (Pre-Posttest)

After obtaining the results of the pretest, and once the participants finished the e-mentoring program, they answered, once again, the evaluation questionnaire on professional competencies, configured in different domains. The questionnaire applied was the same as the pretest phase. However, on this occasion, the mentors answered the questionnaire, as did the mentees, to verify the existence of similarities between the final competency perception of both groups.

The analysis of the data for this new test was carried out in the same way as for the pretest, applying the normality tests for the samples and then comparing the pretest-

posttest results for the mentee group by means of a nonparametric test, given the lack of adjustment to the normality of the group in both the pretest and the posttest. The basic statistics for students and mentors in the post-test are shown in Figure 6.

In relation to these data, analyzing the mean and standard deviation in pretest and posttest, contrasted with those acquired in the pretest by the mentees, it was indicated that there was a variation in favor of the application of the pilot program since the overall mean per competency had increased while highlighting a smaller dispersion among the subjects (Figure 6), consequently, it had become more homogeneous.

Within the results of the means, 88% coincided with the data obtained in the posttest of mentees and the posttest of mentors, recognizing that in both cases, the distribution had the same values on one side as on the other. Allowing to grant the contrast between the results of mentees and mentors for the post-test phase. Once the descriptive statistics had been determined, the normality of the sample was studied to establish the parametric or nonparametric analyses to be performed for the hypothesis testing. Likewise, the study of the adjustment to normality was based on the Kolmogorov-Smirnov and Shapiro-Wilk tests. Therefore, it was again determined as a Kolmogorov-Smirnov and Shapiro-Wilk test hypothesis:

Hypotheses 0 (H0). *The distribution of the variable conforms to a normal distribution for the group of mentors and mentees (sig* $\geq$ *0.05).*

Hypotheses 1 (H1). *The distribution of the variable does NOT conform to a normal distribution for the group of mentors and mentees (sig* $<$ *0.05).*

Since the values of the significance levels were less than 0.05 (<0.05), the hypothesis of normality was rejected and it was concluded that the scores of the distribution variables did not conform to the normal distribution, therefore, in the same way as was recognized in the pretest, the use of nonparametric tests was clarified for all the hypothesis contrasts to be performed.

According to the results obtained in the analyses previously mentioned in the post-test study, it was decided that:

- The nonparametric Wilcoxon W test would be applied, for the contrast of means. This test would be applied for the results of the variables in the related groups (mentees) since the study of normality had shown that in both cases, the sample did not conform to normality.
- We would work with the Mann-Whitney U test, a non-parametric test for non-related samples due to lack of adjustment to normality, which we would apply for the contrast of hypotheses with the variables of the two independent groups (mentees and mentors) in the data obtained in the post-test.

In relation to these data, analyzing the mean and median in pretest and posttest, contrasted with those acquired in the pretest by the mentees, which seemed to indicate that there was a variation in favor of the application of the pilot program since the overall mean per competency had increased while highlighting a smaller dispersion among the subjects (Table 1), consequently, it had been homogenized.

Table 1. Hypothesis tests of the group mentees in the pre-posttest in global competencies. (Wilcoxon signed-rank test).

Competency	Pretest		Posttest		Wilcoxon Signed-Rank Test		
	Global Mean by Competency	Median by Competency	Global Mean by Competency	Median by Competency	Z	*p*	R
Project management	2.22	2.23	2.62	2.60	−6.51	0	1.53
Problem-solving	2.58	2.63	2.70	2.58	−2.32	0.02	0.54
Critical, logical and creative thinking	2.69	2.71	2.81	2.75	−4.15	0	0.98
Autonomous work	2.68	2.75	2.83	2.83	−3.96	0	0.93
Learning to learn	2.84	2.88	3.01	2.83	−5.25	0	1.23
Effective communication	2.73	2.69	2.80	2.73	−2.24	0.03	0.53
Teamwork	2.87	2.89	2.99	2.83	−2.78	0.01	0.66

A variation in favor of the application of the e-mentoring program was recognized since the difference between the global averages had increased for each competency, presenting a recognition of appreciation or competency mastery by the participants, likewise, the difference between the dispersion among the subjects was minimal, generating, as a result, a homogenization.

The project management competency identified a significant improvement possibly linked to the appropriate recognition of the competency dimensions. Both knowledge and performance skills were organized around the new conditions of academic internship in the project management knowledge areas. It was important to emphasize that from the application of the pilot program, the emphasis on this competency allowed mentees to recognize new achievements, actions, and the impact of project management in their practical process [36].

The problem-solving competency consisted of using logic, as well as the imagination to make sense of a situation and arrive at an intelligent solution. In fact, the domain improvements recognized in Figure 6, show that students should connect the improvements obtained in the practice of their problem-solving competency with other skills, such as analytical skills, innovative and creative thinking, adaptability, and initiative to recognize a real change in their competency domain [37].

The learning to learn competency was notably recognized with the greatest improvement after participating in the e-mentoring program. Mentees had the possibility of consciously recognizing their self-learning process and identifying available opportunities and the ability to overcome obstacles to successful learning. Recognizing that individual improvement and understanding by students of this competence meant obtaining, processing, and assimilating new knowledge and skills, as well as seeking and making use of guidance, in this case, acquired by the e-mentoring program [32,34].

Perceived improvements in *the competency of communicating ideas effectively* in the posttest were not as high as the rest of the competencies. It was recognized that to communicate effectively, it was not enough to have well-organized ideas. It was essential to adapt the key elements of communication into internship processes [38].

The teamwork competency was related to an enhanced ability to work effectively in the context of the academic internship and asserted that mentees must attend to both the work climate within their group and the process by which they performed their tasks in practice [32,39]. Although mentees may acquire many of the skills through informal social interactions in their internship, a slight positive mastery gained in this competency was noted, possibly because mentees were able to improve their teamwork skills, as well learning to regularly accept feedback on how they were doing through comments by their mentors and/or reflective group discussions and/or peer evaluation and self-reflection.

Considering the results achieved by analyzing the mean and median established differences between pretest and posttest, a specific test needed to be applied to affirm whether there were indeed significant differences between pretest and posttest. Therefore, as indicated in the previous paragraphs, a hypothesis test was carried out using the Wilcoxon

rank test (nonparametric test). The results that are shown in Table 1 allowed us to affirm that after the application of the e-mentoring program, mentees acknowledged significant changes in the competency domains of all the competencies evaluated, especially in project management, critical, logical, and creative thinking and learning, as supported by a higher value in the significance of the effect size. The results obtained in each competency, with the nonparametric Wilcoxon W test, indicated the existence of a change of improvement compared to the pretest results for a significant set of the competency dimensions, except for the competency indicators shown in Table 2.

Table 2. Competency indicators where no improvement was noted using Wilcoxon (W) Test.

Competency	Indicator	Competence Level of Consideration	Effect Size
Project management	Establish priorities of objectives and tasks.	Low	Low
	Work in a systematic and orderly manner.	Low	Low
	Ability to apply and use information.	Low	Low
Problem-solving	Application of an effective procedure to solve the problem.	Low & High	Low
	Identification of conflicts and analysis of the problem.	Low & High	Low
Application of critical, logical, and creative thinking	Establishes concrete objectives for the situation at hand; identifies and assesses the information needed to achieve those objectives.	Medio	Low
	Ability to generate original solutions.	Low	Low
Autonomous work	Ability to perform good economic, social, and environmental management.	Low & Medium High	Low Null
	Expresses conclusions and presents information using the most appropriate technique.	Low	Low
Learning to learn	Synthesizes the scientific-technological foundations of the problem and compares the different possible solutions according to the dynamics or possible solution of the problem.	Low	Low

It was evident that the sample size, defined as small, may influence the results. Therefore, the effect size was studied using the r statistic. It was then found that the effect based on correlation was small (r = 10 ^ <30) in the competency indicators shown in Table 3. For the rest of the competency indicators, the effect size was medium when r = 30 ^ <50, and the effect size was large when r was greater than 0.50.

Table 3. Hypothesis contrast for posttest global competency mentee/mentor. Mann-Whitney test.

Competency	U	*p*	r
Project management	74.00	0.005	−0.377
Problem-solving	87.50	0.018	0.474
Application of critical, logical, and creative thinking	137.50	0.422	0.015
Autonomous work	87.00	0.014	−0.099
Learning to learn	120.00	0.179	−0.057
Effective communication	105.00	0.061	−0.183
Teamwork	97.50	0.037	−0.272

However, despite the data obtained by indicators, it should be remembered that the competencies, in general, did show improvements after the mentoring process, as shown in Table 1.

Thus, a variation in favor of the application of the pilot program was recognized, since the difference between the global averages had increased for each competency, presenting a recognition of appreciation or competency mastery by the participants. Likewise, the

difference between the dispersion among the subjects was minimal (Table 3), generating, as a result, a homogenization.

3.3. Differences between Unrelated Groups

The mean values for each indicator and competency level between mentees and mentors were very similar. The findings (Table 1) acknowledged that both mentees' self-evaluations and mentors' evaluations, after participating in the pilot program, supported the applied measurement model.

The descriptive structure indicated sufficient evidence that in all seven competencies, mentee and mentor participants were similar. More than 70 % of the standard deviation results showed that the results were minimally dispersed, assuming an accurate representation of the true population means that the results were representative of a stable population.

After recognizing the means given by the mentors in each competency, differentiated by the indicators and domains, and having compared them with the mentees' self-assessments, it was noted that the differences between one and the other were minimal, and it is necessary to support this assertion with the appropriate statistical tests.

In this case, it is important to point out that a non-parametric test was performed for unrelated groups according to the statistical tests and supported by the small sample size. The test performed was the Mann-Whitney U test and the effect size was used to corroborate whether the mentee-mentor scores were similar, an aspect that would reduce negative elements, such as the social desirability generated by the mentees in the different competencies analyzed. In this sense, we were looking for no significant differences between the two groups in each global competency. Table 3 presents the information related to the hypothesis testing carried out for the global competencies at the mentor-mentee post-test level, which clarified the idea expressed above.

As previously stated, the mentors were matched without prior knowledge of the conditions for mastery of the mentees' competencies. The hypothesis test for the competencies between mentor-mentee indicated that only in three of the seven competencies, there were no significant differences. In this case, it seems that the scores given by the mentors differed significantly in the competencies of *project management*, *problem-solving*, *autonomous work,* and *teamwork*. However, these data were insufficient to prove that there was a trend in the ratings given by mentors and mentees considering Cohen's [40] proposal in which r values of 0.1, 0.3, and 0.5 represent small, medium, and large effect sizes, respectively. Thus, with the results obtained, we found that there was no agreement between mentee and mentor scores, except for the *problem-solving competency*, which was medium-high. For the rest of the competencies, it was nonexistent, as already denoted in the analysis developed in the descriptive by the indicators.

After these results, the conclusion was that the mentor's evaluations for the mentee were medium-high in each indicator and competency, however, in many cases, there was a lack of consistency between mentors and mentees, which did not allow us to see a positive trend in the evaluation made by the pairs, except in the case of the *problem-solving competency.*

4. Discussion

The information analyzed allowed linking the key elements of this project, including the concepts, skills, and curriculum of an e-mentoring program used in the academic internship of undergraduate students in a university in Colombia. This study facilitated the examination of the quality of the work of each of the components of the e-mentoring program, which allowed the researcher to recognize the application process in a university context of academic internships during the first academic semester of 2019. This first part of the pilot study research allowed obtaining feedback from the participants (mentors and mentees) to make improvements to the e-mentoring program during the process and, therefore, improve the initial design through continuous review. The pilot study represents a fundamental phase of the research process. The objective of this first study is to validate

an e-mentoring model to stimulate the acquisition of professional competencies in academic internship students.

Mentoring seeks to build individual strengths, therefore, the philosophy of the program is dedicated to empowering participants to acquire professional competencies; this aspect is reflected in all elements designed for the pilot program, including its objectives; program materials and communications; orientation and training; and the interactions between program participants, program coordinator, mentors, and mentees [5]. Thus, the mentoring program is developed with the same objective as programs of this same nature, which, are delimited in playing a positive role in the initiation and retention of students in learning processes at the higher education level [9,19,32,41].

Regarding the goals set for the e-mentoring pilot program, it is noteworthy how Shields and Murray [42] state that a well-defined vision of mentoring could serve as a guiding mechanism for future professional development efforts at the higher education level; in other words, short and long-term goals need to be established. Therefore, in the *e-mentoring pilot program*, it has been deemed essential to differentiate between short-term and long-term goals for both mentors and mentees. In turn, to ensure that the vision was in line with the institution itself, the program coordination used the information from the program needs assessment to set realistic goals in both studies that reflected the academic and professional purpose of the program. Once the goals were set, measurable objectives were formulated so that the program could be evaluated.

Furthermore, after the evaluation of the pilot program, it is noted how, although each pair (mentor-mentee) had a different reason for participating in the program, they all agreed on the overall purpose, which was to enrich the mentees' support experience in their semesters of an academic internship through an e-mentoring program, to develop and/or master their professional competencies. In terms of the participant recruitment structure, it was found that matching mentors and mentees is not a straightforward process [43]. Rivera-Mata et al. [42] state that matching is often one of the most difficult aspects of a program. Participants bring diverse skills, backgrounds, learning styles, and needs. This statement could be verified in the research since, in the pilot study, given that the mentors were already graduate students from the university where the programs were conducted, it was a complex task to recruit them to become mentors.

5. Conclusions

5.1. Theoretical Implications

The particular results between the competencies by both participant groups in the pilot revealed positive results, especially in four distinctive competencies (project management, problem-solving, autonomous work, and teamwork), showing in each one, progressive improvement of their strength and quality, and it established improvements between the connection of the participants. These data are insufficient to prove that there is a trend in the ratings given by mentors and mentees, we found that there is no agreement between mentee and mentor scores, except for the problem-solving competency [32].

5.2. Practical Implications

The rubrics and satisfaction surveys provided data that allowed each component of the structured e-mentoring model to be monitored as it was being implemented, to allow necessary revisions to be made or recommendations to be noted for a future study [4,6]. The data collected helped the researcher to implement changes to the program while it was underway and to make necessary improvements [17,19].

These results reveal the heterogeneity of the relationships created within the e-mentoring program [44]. This framework underscores our efforts in designing a program not only to better serve the needs of the participants, but to create a more collaborative and shared space for discussion, reflection, and goal setting.

Regarding the results in the satisfaction survey, a statistically significant high satisfaction of mentees having a mentor available, a supportive coordinator, and a constant level of

communication was identified, supported with similarities found in other studies [11,20,45]. While characteristics such as matching and program length were not statistically significant predictors of high satisfaction.

When considering a training and academic support process through an e-mentoring program, it is important to consider that it will not be effective on its own, rather, we want to integrate this type of resource in a learning process, thus it must be aware of its own challenges, because if they are not taken into account, the results may not be as expected. In this regard, three fundamental aspects stand out:

- Correct communication of the mentoring program: it is necessary to offer direct guidance and reliable information to increase the acceptance, commitment, and efficiency of the participants [46].
- Creating the most appropriate mentor-mentee matches: Matching should be done in a methodical way to maximize the development process and the compatibility of the pairs according to the objectives of the mentoring process [47].
- Demonstrating the success of the e-mentoring program: It is necessary to track and report on the success of the program using and implementing specific tools conveniently for participants and stakeholders [48].

The results of satisfaction by mentors confirm elements associated with high program satisfaction, which are supported by program design, program purpose, adequate training, level of professional and technological support.

Additionally, support for our satisfaction hypotheses shows the importance of support, training, and trust in creating these types of bonds with our participants and alerting us to what elements of the program are being well received, and where attention needs to be focused to make participants more satisfied in the future.

The advantages of this e-mentoring process are not only for the mentees, the mentors and the university institutions also benefit from the process. Table 4 shows some benefits of the e-mentoring proposal for each of the entities involved.

Table 4. Advantages of the e-mentoring program.

Mentee	• The e-mentoring pilot program offers the mentee opportunities for recognition and career enhancement and overall growth [6,11,46]. • Addressing short-term needs [4,11,16,46,47]. • Helps improve academic and practical skills and abilities [4,26,46,48]. • Provides a greater sense of well-being and confidence for the mentee [2,4,18,36,46]. • Improved interpersonal relationships and communication with others. • Preparation for real life [4,6,11,18,22,44]. • Optimization and development of learning potential [2,4,8–11,41]. • Vocational service [5,24,25,27].
Mentor	• Acquires new skills in leadership and teaching other individuals [4,27,32,42]. • Provides high levels of satisfaction, self-awareness, and loyalty [9,10,32,42]. • Prepares the mentor for new challenges in the future, in case he/she has to lead and communicate with his/her work team [5,10,34,43].
University Institution	• Improves and promotes learning [1,3,8,21,22]. • Decreases the number of conflicts, since it is the students themselves who increase morale and motivation in others [21,22,47]. • Prevention of the risk of student desertion [1,4,22,34].

Finally, as possible applications of the research, the e-mentoring program is an effective solution not only to transmit the values of the institution and its culture, but it can also be used as a tool to accompany and accelerate the adaptation processes of individuals who acquire new responsibilities, and even as a tool to empower various groups by accelerating the development of skills that are important for future success.

5.3. Research Limitations

The present study represents the first attempt to quantitatively summarize the results associated with mentoring in the three main areas of research: professional competencies, academic internships, and higher education. One limitation has been the small number of participants, but as a first attempt, the results achieved offer significant differences towards the benefits associated with mentoring, the relationships created, the matching process, and the recognition of the participants' competency mastery, thus laying the groundwork for future work in these areas and providing a precedent for future research. Another limitation has been the lack of collaboration provided by the university entity with the logistics and implementation of the pilot program. The positive findings suggest that although the effect sizes have been small, it is worth continuing this research to help us further understand the dynamics and processes associated with mentoring in academic practices at different levels associated with higher education.

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