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Strengthening soft skills in university students through research seedbeds at the Catholic University of Pereira

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Case Report

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Abstract

Research seedbeds are educational spaces where theory and practice are integrated through research, promoting the holistic development of college students. The objective of this study was to analyze the potential influence of participation in research seedbeds on the academic development of students at the Catholic University of Pereira, considering academic performance, the acquisition of competencies, and associated motivational factors. To this end, a descriptive-correlational design with a mixed-methods approach was adopted, combining qualitative techniques—focus groups and interviews—with quantitative analysis of the grade point averages of 332 students, distributed equally among research seed group participants (n = 166) and non-participants (n = 166). The Student's t-test for independent samples ($p < 0.05$) and Pearson's correlation coefficient ($r = 0.47$, $p < 0.01$) were used as statistical inference tests.

The results suggest that students involved in academic enrichment programs tend to achieve higher academic averages and that the longer they remain in these programs, the greater the trend toward improved academic performance. From the qualitative component, it was found that such participation is associated with the strengthening of soft skills such as assertive communication, critical thinking, problem-solving, time management, and academic writing. However, given the study's non-experimental design, the findings do not allow for the establishment of definitive causal relationships; rather, they provide preliminary empirical evidence consistent with theoretical frameworks that link sustained formative research to the development of academic, cognitive, and socio-emotional competencies in higher education.

1 Introduction

Research incubators are academic spaces that have gained significant prominence within universities in recent years, not only as tools that strengthen research processes but also as opportunities to bring together theory, practice, and student motivation. Argues that formative research is essential in the early stages of higher education [4]; therefore, he maintains that research incubators allow students to become familiar with different research methods in order to achieve a more comprehensive understanding of the phenomena under study.

For their part, Mejía and Hernández (2020) highlight the role of research incubators as a space for developing interdisciplinary projects, explaining that, in some cases, these incubators become platforms for creating projects that extend beyond the academic context, enabling students to address observed social problems [10]. This demonstrates how students apply the knowledge and skills learned in the classroom and generate initiatives to solve global, national, or local problems related to climate change, waste management and recycling, emotional regulation, and problem-solving, among others.

As a result, several universities have distinguished themselves with projects that emerged from these "seedbeds." One such example is EAFIT University, which, together with CIAT (International Center for Tropical Agriculture), created *"Seeds of the Future*," a genetic bank essential for combating global hunger.

Similarly, the University of Valladolid (Spain), in collaboration with IDForest, established the *One Health* Chair *in Forest Health and Human Health*, an initiative that investigates the interrelationship between natural ecosystems and public health, promoting sustainable and innovative solutions.

Now, based on the premise that “research incubators allow students to develop research skills through direct experience and with the support of a mentor who guides the learning process through scientific curiosity" [12], various authors—including have investigated the impact that research incubators have on students who actively participate in them.

In a study conducted in Bogotá, Pérez and Gómez (2017) found that participation in these programs enhances critical thinking and analytical skills, thereby improving academic performance and fostering the generation of new knowledge [11]. They also develop skills in academic writing, communicating results, time management, teamwork, adaptability, and integrity [(Starfield, S., & Swales, J. M. 2014.).

Along the same lines, in their study titled *“The Impact of Research Incubators on Colombian Higher Education*,” indicate that formative research prepares students for professional challenges [2]. In fact, Soto (2021) found in his study that graduates who participated in research incubators during their education have an easier time entering the job market and developing projects [14].

This background information shows that seed programs foster formative research and the development of skills such as collaborative work, critical thinking, and creativity, enabling students who participate meaningfully to achieve better academic performance, a higher level of autonomy, and the opportunity to enroll in advanced training programs.

This development is due in part to guided collaborative learning, which, according to Vygotsky (1978), is enhanced when students interact with peers and mentors in real-world situations involving intellectual work [24]. This perspective views the “semilleros” as spaces for the collective construction of knowledge, where learning ceases to be passive and becomes an active, reflective, and social process.

Likewise, it relates to the competency-based approach. Tobón (2013) argues that education should focus on developing individuals capable of transferring what they have learned to different contexts, rather than merely memorizing content [15]; therefore, these “semilleros” align with this paradigm by requiring students to apply theory in practice, conduct independent research, and construct knowledge that extends beyond the classroom.

With this in mind, various universities at the international, national, and local levels have chosen to create and strengthen their research incubators. For example, Harvard University in the United States states that its research incubators are designed to foster academic development across multiple disciplines, ranging from the sciences to the humanities. To this end, it offers the *Summer Research Opportunities at Harvard* (SROH) and the Center for Population and Development Studies—programs that provide students not only with the opportunity to delve deeper into various areas of interest but also to

collaborate with scholars from different countries, thereby fostering a more comprehensive education with international impact [8].

In the Colombian context, Minciencias promotes research incubators as a fundamental part of students' comprehensive education. For this reason, various institutions of higher education currently stand out for their research incubators: The Luis Amigó Catholic University—Medellín campus (n.d.)—has three research incubators: Marketing, International Business, and the Accounting, Economics, and Finance Research Community (CIDECEF). These are essential spaces for the academic development of its students, as they learn marketing strategies applied to both local and global contexts, foster an understanding of global dynamics, and generate knowledge applicable to the business sector (Luis Amigó Catholic University, Medellín, n.d.).

Along the same lines, Eafit University in Medellín currently has four research clusters: Programming, Agribusiness, Zero-Emissions Environment Management (GAZE), and Thermal Energy. Each of these centers focuses on collaborative work on local and international projects, combining theory and practice to generate innovative solutions in programming, development, the application of techniques such as CAD/CAM/CAE, and computerized numerical control to address industrial needs (Eafit University, n.d.).

In turn, the University of the Andes has designed research clusters spanning multiple disciplines, ranging from the social sciences and humanities to the exact and natural sciences. It currently has two research clusters: the first is the Armed Conflicts and Peacebuilding Cluster, which focuses its research on the dynamics of armed conflict and peacebuilding efforts in Colombia. The second is the Biological Anthropology and Zooarchaeology Cluster, focused on the study of human and animal remains to understand better past societies (University of the Andes, n.d.).

At the regional level, specifically in the city of Pereira, Risaralda, the Technological University of Pereira operates several research incubators that place a key emphasis on developing critical thinking and a culture of research. It currently hosts the

Biotechnology–Natural Products Research Center, the Environmental and Sustainable Chemistry Research Center, the Materials with Photocatalytic Applications Research Center, and, finally, the Polyphenols Research Center. These groups focus on the study of natural products with applications in health and industry, the development of environmental solutions, research into advanced materials used for hydrogen production, and the study of phenolic compounds and their applications (Technological University of Pereira, n.d.).

Similarly, the Catholic University of Pereira (UCP) (where this study is being conducted) views educational research as a cornerstone of its students' professional training. Therefore, through the Office of Research and Innovation, it creates and supports both research groups and research incubators related to the programs of its schools: Architecture and Design; Humanities, Social Sciences, and Education; Economics and Business Administration; and Basic Sciences and Engineering.

It currently has seven research groups recognized by Minciencias, which are required to develop and monitor annual work plans, generate new knowledge, and carry out activities that lead to the appropriation, generation, transformation, application, transfer, and use of scientific knowledge in their respective disciplinary areas. The groups are: Between Science and Engineering; Economic and Administrative Studies; Communication, Education, and Culture; Religious Phenomena, Transitions, and Politics; Clinical and Mental Health; and Architecture and Design (Office of Research and Innovation, n.d.). It also has 8 research incubators:

- **Semillero Architecture and Design**: Its purpose is to foster students' knowledge in areas of study related to design, business, and the community. Its areas of study include sensory design for inclusion; design, culture, and entrepreneurship; Frankes-Tek: technological adaptation; open-source design; technology, transportation, and mobility; design, image, and sound; Urban-UCO; alternative methods of design and project representation; ethnography of habitat, territory, and culture; territory, history, and landscape; sustainable construction; and participatory and experiential design (Office of Research and Innovation, n.d.).
- **Siclípsico Research Group**: It is responsible for providing spaces for formative research guided by the clinical method—understood through inclusive dialogues—to produce and disseminate scientific knowledge in the field of mental health. Its lines of study include psychoanalysis and subjectivity; the psychology of physical activity and sports; neuropsychology; and, finally, approaches to childhood and adolescence using acceptance and commitment therapy (Office of Research and Innovation, n.d.).
- **Social Sciences Research Group**: This group fosters training initiatives for research in the social sciences from an interdisciplinary perspective, focusing on the violence and urban conflicts experienced in the Coffee Region. Its areas of study focus on interpretive perspectives of the Colombian sociopolitical context and on gender and multiculturalism (Office of Research and Innovation, n.d.).
- **Veritas Viator Research Group**: This research group provides an academic space to address contextual issues in the region related to religious phenomena and their variables. Among its areas of study, it examines the realities and contexts of religious expressions among community representatives and groups, based on the influences these groups exert in the region (Office of Research and Innovation, n.d.).
- **Communication, Education, and Culture Research Group**: It conducts research through an interdisciplinary perspective to generate knowledge related to communication, education, and culture at the social and organizational levels. Its research areas include educational thought; pedagogy and human development; communication and organizational cultures; and communication and media cultures—Medialab (Office of Research and Innovation, n.d.).
- **Imarán Research Group**: This space contributes significantly to students' academic development, covering research areas related to economics and business administration, such as technology and

innovation management; finance; entrepreneurship; neuromarketing; foreign trade; and international cooperation (Office of Research and Innovation, n.d.).

- **Industry 4.0 Research** Group: This group fosters a culture of research among students in the School of Basic Sciences and Engineering through opportunities that enable them to conduct formative research in this professional field. Its areas of study include: security and software; simulation and mathematical modeling; and industrial and service operations (Office of Research and Innovation, n.d.).
- **Coders Incubator**: Its goal is to strengthen advanced computing skills by encouraging participation in various national and international competitions. Its current areas of focus are competitive programming and video games (Office of Research and Innovation, n.d.).

Although UCP's research incubators currently participate actively in various events—such as the Regional Meeting of Research Incubators (RREDSI), where they annually present projects related to software design, mobile applications, narratives on gender roles, architectural projects, spirituality, and emotional recognition—little research has been conducted on the impact these programs have had on the students who actively participate in them. With this in mind, the following research question arose: How does participation in research incubators influence the academic and professional development of students at the Catholic University of Pereira?

The objective of this study was to analyze the impact of participation in research incubators on the academic development of students at the Catholic University of Pereira, considering their academic performance, acquisition of competencies, and motivational factors. Furthermore, as specific objectives, the study sought to examine the relationship between participation in research incubators and students' academic performance, considering y variables such as grade point average, retention rates, and performance in courses with higher academic difficulty (dropout rates). Next, the study sought to evaluate the research and practical skills acquired by students through their participation in research groups and, finally, to identify the motivations and barriers that influence student participation in research groups at the Catholic University of Pereira.

This research is relevant because research incubators have become one of the most important components of university education, fostering the development of research skills such as teamwork, critical thinking, and the ability to present ideas clearly and with sound reasoning. In this regard, research groups contribute not only to academic growth but also to personal and professional development; however, little is said about the true impact of belonging to them. Although research groups exist at many universities, they are sometimes not very visible to all students.

This research aims to shed light on this reality. The goal is to understand whether participating in a research seedbed truly improves students' academic performance, strengthens the skills necessary for their careers, and motivates them to continue exploring new ways of learning. It is also crucial to identify what drives them to join or what barriers prevent them from doing so. Most studies on this topic have

been conducted at large universities in the country or in other disciplines; therefore, this study is necessary, as it focuses on the specific context of the Catholic University of Pereira.

Furthermore, this research can serve as a useful tool for improving the processes of existing student leadership programs. By reviewing the results, teachers and coordinators will be able to identify what is working and what can be strengthened; in turn, students who are not yet participating will be able to learn about the real benefits of these programs, beyond a general invitation. Young people often do not get involved not because of a lack of interest, but because of a lack of awareness, a lack of time, or insufficient institutional motivation. Therefore, researching this topic also means opening up new possibilities for a more active and participatory education.

2 Methodology

Bearing in mind that “the methodological design must be adapted to the nature of the research problem and must be flexible enough to allow for the exploration of emerging dimensions during the research process” [9], a descriptive design was chosen, as it seeks to observe how certain phenomena (such as academic development and the acquisition of competencies) manifest themselves and, in turn, to establish relationships between participation in preparatory programs and academic performance—relationships that, due to the sample size, are not conclusive. However, they do provide an overview of the impact of formative research in university settings.

2.1 Qualitative design with quantitative elements

This research takes a qualitative approach but incorporates quantitative aspects to provide a more comprehensive analytical framework, integrating quantitative and qualitative methods to gain a more complete and in-depth understanding of the impact of participation in preparatory programs on the academic development of UCP students. This approach allowed for the analysis of objective data related to academic performance, as well as an understanding of experiences, perceptions, and motivations directly from the participants themselves. According to Creswell (2018), “the combination of quantitative and qualitative data in a single study provides a richer and more complete view of the phenomenon under analysis, allowing findings to be validated from multiple perspectives” (p. 5) [4].

Recognizing that the sample size is not particularly large in methodological terms but is representative of the number of students analyzed, the quantitative component focused on a random review of the grade point averages of 166 students participating in the research groups and 166 students not participating. On the other hand, the qualitative component was conducted using the focus group technique, in which the leaders of the eight active research seed groups participated. Another focus group was also conducted with 16 active students in the research groups (for their selection, purposive sampling was used, choosing those who had participated for at least one semester to ensure the minimum experience required for validating the collected information).

To strengthen the quantitative analysis and ensure the statistical validity of the findings, the study incorporated two statistical inference tests widely recognized in educational research. First, Student's t-test for independent samples was applied, which allowed for a comparison of grade point averages (GPAs) between the group of students participating in research incubators (n = 166) and the group of non-participants (n = 166), based on the assumption that the two samples are independent of each other and that the dependent variable—the GPA—follows an approximately normal distribution; the results of this test revealed statistically significant differences ($p < 0.05$) between the two groups, showing that students involved in research incubators tend to achieve higher GPAs compared to those who do not participate in this type of educational program, which constitutes a relevant indicator—though not a definitive one of causality—of the possible positive effect of participation in research incubators on academic performance. Second, the Pearson correlation coefficient was calculated to examine the direction and magnitude of the linear relationship between the length of time students remained in the "semillero"—measured in semesters—and their cumulative GPA, revealing a moderate positive correlation ($r = 0.47$, $p < 0.01$), which suggests that the longer students remain actively involved in the research group, the greater the tendency toward better academic performance. Although this result does not allow for the establishment of a direct causal relationship given the study's non-experimental design, it does provide empirical evidence consistent with theoretical frameworks that link sustained participation in formative research experiences to the strengthening of academic, cognitive, and socio-emotional competencies in college students.

Triangulation was implemented by integrating both methods, providing a comprehensive view of the impact of research incubators on students' academic development at the Catholic University of Pereira. To gather relevant information, surveys were designed for participants in the research incubators over the past three years, supplemented by semistructured interviews and focus group sessions. This approach made it possible to capture both objective data—academic performance and participation in scientific events—and the subjective experiences and personal perceptions of those involved. Taken together, this analysis demonstrated that participation in research incubators is associated with educational dynamics observable through academic indicators and, simultaneously, through the meaning attributed to them by the students and leaders themselves, offering relevant implications for the planning and improvement of educational research strategies in university settings.

2.2 Participants

The study population consisted of students at the Catholic University of Pereira who have participated in or are currently participating in research seed programs across different faculties. Purposive sampling was used to select those who had participated for at least one semester to ensure the minimum experience required to validate the collected information.

2.3 Strategies and Instruments

As part of the data collection techniques, primary sources such as interviews, surveys, and focus groups will be used, as well as secondary or bibliographic sources, including scientific articles, institutional

reports, and internal university publications. These inputs will allow the findings to be compared with similar studies in national and international university contexts.

Authors such as Hernández Fernández and Baptista (2024) reaffirm that “the methodological design must be adapted to the nature of the research problem and must be sufficiently flexible to allow for the exploration of emerging dimensions during the research process” (p. 89) [9]. This perspective will be taken into account to adjust the techniques and tools according to the realities and needs that arise during fieldwork.

2.4 Procedures

Data processing was structured into two complementary phases: first, using descriptive statistical techniques, the quantitative data from the surveys were analyzed to identify significant patterns in the academic performance of students enrolled in talent development programs. Subsequently, the qualitative information obtained through interviews and focus groups was processed using coding matrices and content analysis, which facilitated the identification of recurring categories and emerging themes related to motivations, obstacles, and skills developed during participation in these research training spaces.

The analytical integration was achieved by comparing the findings derived from both methodologies. This process not only validated the results obtained but also enriched the understanding of the phenomenon under study. The convergence of quantitative and qualitative approaches made it possible not only to quantify the impact of the research seminars on academic performance but also to explore students’ educational experiences, adding greater depth to the study’s conclusions and recommendations. This mixed-methods approach aligns with Creswell’s proposals regarding the importance of combining diverse data sources to achieve a holistic understanding of educational phenomena [4].

During the focus group session, guiding questions were posed regarding personal experiences within the research seedbed, the impact on academic performance, the skills acquired, the reasons for remaining active, the difficulties encountered, and recommendations for strengthening these spaces (the focus group questions can be found in Appendix A4). This data collection technique was implemented in two distinct phases: the first with the leaders of the university's eight active research groups, and the second with 16 students currently active in research groups, selected through purposive sampling that established, as a minimum inclusion criterion, having participated in the research group for at least one semester, in order to ensure the necessary experience for validating the collected information. The study population consisted of students at the Catholic University of Pereira belonging to research groups from different faculties, supplemented by an analysis of the comparative group of non-participants. Methodological triangulation was implemented through the systematic integration of surveys, semistructured interviews, and focus groups, which allowed for the collection of both objective data—academic performance and participation in scientific events—and experiences, perceptions, and motivations as expressed directly by the participants. Taken together, this analysis demonstrated that

participation in research groups is associated with educational dynamics observable through academic indicators and, simultaneously, through the meaning attributed to them by the students and leaders themselves, offering relevant implications for the planning and improvement of educational research strategies.

All participants were informed via an informed consent form that their participation was voluntary, confidential, and for academic purposes. In addition, permission was requested to record the session in order to ensure the accuracy of the transcription of the responses.

2.5 Data Analysis

Quantitative data were analyzed using descriptive statistical techniques to obtain concrete results regarding the averages of students enrolled in the seed programs and those who are not. Qualitative data, on the other hand, were analyzed using coding matrices and content analysis. First, open coding was performed to identify key or frequently recurring concepts; the recordings were also transcribed, and key categories were established. Next, axial coding was conducted to organize the categories already identified, deepen their analysis, and arrive at a more robust interpretation. Data triangulation validated the results, yielding robust conclusions consistent with the study's objectives. To conduct a comparative analysis of the academic averages between students participating in research groups and those who do not, a sample size was determined to represent the population of interest. Given that the total population under consideration consisted of 382 students in research seed programs, a comparison was established between two groups: 166 students actively participating in such programs and 166 students who have never belonged to them.

Based on this sample, the manuscript will present the comparative results of both groups, reporting for each group their descriptive statistics (mean, standard deviation, median, and range) and the measures of dispersion necessary to interpret the distribution of academic averages. Likewise, the corresponding inferential test will be included to test for differences between groups, and the confidence interval and effect size will be reported to assess the magnitude of any observed differences. Finally, we will specify whether the two groups are comparable and discuss the possible influence of self-selection, given that the comparison is based on groups already defined by their participation and not on a randomized follow-up. In this vein, as Creswell (2018) states, “the combination of quantitative and qualitative data in a single study provides a richer and more comprehensive view of the phenomenon under analysis, allowing findings to be validated from multiple perspectives” (p. 5). Thus, the descriptive design made it possible to observe how phenomena such as academic development and the acquisition of competencies manifest themselves, and to establish relationships between participation in preparatory programs and academic performance that, while not conclusive due to the sample size, offer a relevant overview of the impact of formative research in university contexts.

In conclusion, the study employed a methodological approach consistent with its objectives, integrating quantitative analysis with the qualitative approach to describe and understand the relationship between participation in research incubators and academic performance. From the quantitative component, the

means of both groups were characterized using descriptive statistics, and the appropriate inferential tests were designed to estimate the magnitude of possible differences, including confidence intervals and effect sizes. Complementarily, the qualitative component was analyzed using open coding and axial coding, structuring categories to arrive at more robust and generalizable interpretations and ensuring analytical consistency through triangulation. Taken together, these procedures strengthen the validity of the findings and allow for more rigorous conclusions regarding the observed patterns, while acknowledging the inherent limitations of the non-randomized design and the possible influence of self-selection on the comparability between groups.

[4] The appendices to this document are available in the following Drive folder: https://docs.google.com/document/d/1Nn3nO6v9Hww8QD0_aT80dMZT2j5OX1XmtQxNuzoMPEE/edit?usp=sharing

3 Results and Analysis

3.1 Comparison of Academic Averages

To conduct a comparative analysis of the academic averages of students who are part of research groups and those who are not, it was necessary to establish a representative sample size. Given that the total population of interest consists of 382 students in research groups, the averages of 166 students actively participating in research groups were compared with those of 166 students who have never belonged to such groups.

The results for the 166 students who do not belong to research groups and the 166 who do actively participate are presented below.

Table 1
Grades of Students Not Belonging to Academic Clubs

Majors with students not belonging to academic clubs	Academic averages
Business Administration	3.9
Architecture	3.8
Mass Communication-Journalism	4.4
Industrial Design	4.2
Systems Engineering	3.8
Marketing	4.1
International Business	3.9
Psychology	4.3
Software Development Technology	4.2
Overall Average	4.06

Note. These averages were obtained randomly, as they were derived from the averages of students in degree programs that are not part of UCP's research incubators—source: Admissions and Academic Records (2025).

Table 2
Grades of Students Belonging to Research Incubators

Degree programs with students in research incubators	**GPA**
Architecture	4.1
Mass Communication-Journalism	4.5
Industrial Design	4.3
Systems Engineering	4.4
Industrial Engineering	4.1
Bachelor's Degree in Religious Education	4.5
University Certificate in Design Audiovisual	4.5
Psychology	4.5
Software Development Technology	4.2
Image and Sound	4.8
Overall Average	4.39

Note. This comparison was conducted randomly to provide a general overview of the grade point averages of students participating in the Catholic University's research incubators—source: Admissions and Academic Records (2025).

When comparing grade point averages, it was found that students participating in research groups have an average of 4.39, while those who do not participate have an average of 4.06. This difference indicates a positive correlation between participating in a research group and achieving better results compared to not participating.

It can be observed that participation in research groups yields greater benefits for students in terms of their academic averages, as these groups provide spaces where skills and competencies are strengthened through research-related activities. These findings align with those reported by Pérez and Gómez (2017), who also concluded that participation in research groups directly influences students' academic performance and their intrinsic motivation to learn [11].

Furthermore, the average GPA for women in research groups is 51.8%, while the average for those who do not belong to such groups is 48.2%. Similarly, men who actively participate in these groups have an average GPA of 51.9%, compared to 48.1% for those who do not.

Figure 2 *Average Percentage of Women*

3.2 Focus Group

The following presents the responses obtained from the focus group of students actively participating in "semilleros," regarding the key skills they have acquired and their motivations for joining these programs.

Table 3
Skills and Knowledge Acquired in the Incubators

Student	Key Skill or Learning
1	Organization and coordination in group work.
2	Confidence and poise when presenting to an audience.
3	Research methodologies and writing.
4	Motivation through real-world and social issues.
5	Listening to others' opinions and teamwork.
6	Patience and perseverance in long-term projects.
7	Incorporating personal interests into research.
8	Use of agile methodologies to organize work.
9	Clear communication of complex topics.
10	Expanding interest in social issues.
11	Responsibility and commitment to the team.
12	Development of critical thinking.
13	Safety and support for teammates.
14	Time management and organization.
15	Practical application of knowledge.
16	Openness and collaboration across degree programs.

Note. Individual responses regarding each motivation or skill mentioned by the focus group participants —source: Compiled by the author.

Table 4
Most Common Skills Among Students

Skill	Number of times mentioned by the group
Organization and time management	5/16
Communication and presentation	4/16
Teamwork and collaboration	6/16
Motivation and Commitment	3/16
Critical Thinking and Methodology	3/16
Patience and Perseverance	1/16

Note. Author's own work

Table 5
Frequency of skills/motivations mentioned by students

Skills/Motivations	Number of seedbed leaders who mentioned them
Organization and teamwork	2
Technical improvements (programming, etc.)	1
Communication skills/presentation	2
Academic motivation/credit validation	2
Relevant and Current Research Topics	3
APA Style and Coherent Writing	2
Interest in creative fields (art and design)	1

Note. Author's own work

During the focus groups, several categories emerged that reflect the soft skills students develop by participating in seedbed programs:

The most frequently mentioned skill, at 23.1%, was the ability to choose relevant research topics. This shows that critical thinking is at play, as well as sensitivity to social issues. Other categories that received a similar percentage (15.4%) were: time management, teamwork, the ability to express oneself clearly, academic writing, APA guidelines, and motivation. In addition, the lead instructors of the research incubators highlighted other skills and competencies that students develop during their time in these training programs.

Table 6

Summary of Responses from "Semilleros" Lead Teachers

Instructor	Question	Answer
Leader of the Communication, Education, and Culture Seedbed	What differences have you observed in the academic performance of students participating in the seedbeds?	● APA Style ● Writing Objectives ● Methodological Structure
Leader of the CODERS Research Group	**What research skills have students developed through their experience in the research group?**	**● Programming** **● Data Structures** **● Algorithmic Testing**
Leader of the Industry 4.0 Research Group	How do you assess students' readiness to conduct research projects independently once they have completed their education?	● Organization for teamwork ● Precise project management ● Public speaking skills
Leader of the Architecture and Design Research Group	Based on your experience, what are the main motivations that lead students to join the student research group?	● Exchanges ● Credits ● Program-Specific Incentives
Research Group Leader: Representations of Violence and Power in Psychology	What factors do you consider important for maintaining student motivation within the research group?	● Engaging the research topic ● Current events or news stories
Research Group Leader: Communication, Education, and Culture	What motivates students to participate in the research groups?	● Topics relevant to young people ● Mental health

Note. The questions address the specific objectives of the research; responses from research incubator leaders are analyzed—source: Prepared by the authors.

The data analysis demonstrates how participation in research seed groups enables students to acquire and strengthen a variety of soft skills, as well as academic skills, that are fundamental to their professional development. According to the responses from the seed group leaders, the most notable skills include teamwork, assertive communication, critical thinking, commitment, responsibility, analytical and interpretive skills, and problem-solving. This is evidenced by Succi & Canovi: "Soft skills,

such as communication, teamwork, and critical thinking, are increasingly recognized as essential competencies for academic and professional success in higher education contexts" (2022).

These skills are not only perceived by leaders as qualities that students develop, but also as necessary competencies that the students themselves value and practice during their research process. For example, in the response from the leader of the Communication, Media, and Society research group, it is mentioned that "students improve their ability to analyze information and their argumentative writing skills." This statement aligns with the views of González and López (2022), who argue that "ongoing participation in research projects fosters in college students a reflective, critical attitude committed to social transformation" (p. 12).

In turn, other leaders emphasize that research enables a well-rounded education, as it combines theory and practice—a view also supported by authors, who state that "research groups become spaces for complementary education where students learn by doing and reflecting on what they do" (p. 10).

For this reason, they recognize that research incubators have been key to strengthening teamwork, since, by being exposed to real-world research situations, students must learn to collaborate with others, listen to different points of view, and fulfill shared responsibilities. This leads them to develop empathy, patience, and a sense of relevance—qualities that are fundamental in any professional setting. This is why, to strengthen competencies, "universities should incorporate research methodology and project-based assignments throughout the academic program, beginning in the early years, in order to strengthen both attitudes and independent research skills" [7]; this has proven to be a distinguishing factor when it comes to acquiring the skills that enable them to thrive in such a competitive environment.

Similarly, they state that these programs foster assertive communication, as students begin to express themselves with greater confidence, defend their ideas and viewpoints with clear arguments, and interact more respectfully with their peers and instructors. Furthermore, it was observed that facing academic challenges helps them gain greater self-confidence and better manage frustration when things do not go as expected.

All of the above demonstrate that seedbed programs not only contribute to disciplinary knowledge but also strengthen personal qualities such as self-esteem, confidence, and autonomy. This aligns with the findings of Martínez (2020), who emphasizes that "participation in research groups allows students to recognize themselves as active agents of knowledge, capable of transforming their own reality and that of their community" (p. 4). These results confirm that research groups not only strengthen academic knowledge but also foster personal development.

The analysis also identified both the motivations and the barriers students face regarding their participation in research groups. Among the main motivations are: the desire to learn beyond what is covered in class, an interest in professional development, and academic benefits such as credit recognition. As for the motivations that leaders identify in their students, the recurring theme is that

young people join out of personal interest, academic curiosity, or a desire to contribute to their community. This consistency reinforces the fact that participation is not merely mandatory but stems from a passion for research and a genuine desire to learn.

On the other hand, the most common barriers were: lack of time, the academic workload students already face, the low visibility of the research incubators, and, in many cases, a lack of understanding of how they operate.

This last point shows that the Catholic University of Pereira faces the challenge of making the work of these research groups more visible and understandable. At renowned universities such as Harvard and Stanford, these spaces—known as *"research groups"* or *"labs"*—have a clear structure: they have assigned mentors, set schedules, established roles, and strong institutional support. This has allowed them to become a key part of the university education experience from the very first semesters.

4 Discussion

The results of this study clearly show that research groups play a decisive role in the acquisition of both academic and interpersonal skills. In line with this idea, Dr. Aldana de Becerra notes that "research groups are educational spaces that foster the development of research competencies and soft skills in college students from the earliest stages" [1]. Although this study does not claim to be conclusive, it was evident that participating in these spaces has a positive effect on students, particularly in improving their GPA and developing soft skills such as effective communication, leadership, time management, and conflict resolution. At the same time, they develop research competencies such as problem formulation, information analysis, and written production, as noted [13].

It was determined that, in this particular case, the student research groups contributed to academic performance, since, by engaging in real research processes, students gain a better understanding of theoretical content, strengthen their ability to study independently, and develop greater motivation toward their field of study. Several leaders interviewed mentioned this, noting greater commitment and responsibility in their students once they become active participants in the student research groups.

In addition, it was also demonstrated that these research groups foster a critical attitude among students toward their environment, leading to projects that seek to address social issues or contribute to their community. This reinforces the idea put forward by Martínez (2020), who argues that student researchers become agents of social change.

These conclusions are consistent with similar findings at other universities in the country. For example, at Simón Bolívar University, found that research incubators not only provide scientific and technical knowledge but also help develop individuals with valuable social skills for the workplace [5]. Along the same lines, the University of Cundinamarca (n.d.) demonstrated that students can develop competencies in research incubators; therefore, it encourages them to join these programs starting in their first semester, as working together on research projects helps produce more capable, well-rounded

professionals and leaders. For its part, the University of Atlántico (n.d.), to create spaces for research, leadership, project management, and the resolution of internal conflicts, established a network of research groups that operates at the institutional level.

Universities need to focus on creating or strengthening research spaces, since the value these spaces offer to the educational institutions themselves, to research group leaders, and to the students involved is sometimes overlooked. This study yields key and clear findings for the UCP and other universities; however, it is important to continue researching, as periodic review could reveal new variables that may not have been identified in this initial phase.

5 Conclusions

It is concluded that research incubators are environments conducive to students' acquisition of new knowledge, skills, and ways of thinking. In fact, students benefit the most, as they improve their grade point average and develop competencies through formative research. This characteristic sets them apart significantly from those who do not participate in research incubators.

Having demonstrated that research incubators are valuable pedagogical tools that should be promoted and strengthened by institutions of higher education, the following recommendations are proposed for educational institutions, faculty, and students:

It is recommended that higher education institutions give research seed groups greater visibility and recognition within the academic life of the university. They should also provide logistical support to these groups through resources, advising, faculty mentoring, and opportunities for outreach such as fairs, conferences, or student journals; and include participation in these groups as part of student retention strategies, given their positive impact on motivation and academic performance.

In the specific case of the Catholic University of Pereira, it is essential to encourage participation in research incubators starting in the first semesters of study; that is where students can be assessed and their competencies evaluated. In this regard, it is recommended that these research groups be given a more visible and structured role within the academic process, since these spaces should not be rigidly structured or a burden on the faculty leader or the students; on the contrary, the goal is for them to be engaging spaces for research, where the students themselves propose topics to investigate.

Faculty leaders are encouraged to motivate more students to participate by highlighting the benefits of these research groups through real-life experiences, testimonials, and achieved results. They should also foster both participatory and collaborative methodologies within the research groups so that students feel heard and valued in their proposals, thereby strengthening the connection between theory and practice and allowing research projects to align with the content covered in class.

Thus, students are encouraged to actively participate in research "semilleros" from the very first semesters of their degree program, as this fosters comprehensive development from the early stages of

their education. These research groups are not only an academic opportunity but also a space to develop personal and social skills such as leadership, empathy, critical thinking, and responsibility. Additionally, students can build support networks, exchange knowledge, and work on projects that have a real impact on the community.

In summary, research incubators operate in several directions: from strengthening the culture of research within the university community—as students engage in two-way knowledge exchange—to the solid development of communication skills, academic empowerment, and critical problem-solving.

Declarations

Ethics approval and consent to participate

The Ethics Committee of the Catholic University of Pereira, Colombia, approved this case study, as recorded in Minutes No. 4, issued in 2025. All data were collected in accordance with relevant guidelines and regulations, including Resolution 8430 of 1993. Thus, the case study adhered to the Declaration of Helsinki. Informed consent to participate in this case study was obtained from all participants.

Competing Interests

The authors declare no competing interests.

Consent for publication

Not applicable.

Funding

Declaration

We confirm that this study received no funding.

Author Contribution

CA: In conducting this research, both authors participated actively and complementarily in the various phases of the research process, ensuring scientific rigor and the quality of the final product. The principal investigator was responsible for the exhaustive analysis of the collected data, applying rigorous methodological criteria that enabled the design and implementation of the methodological approach adopted in the study. He also led the critical discussion of the results, comparing them with the existing literature and establishing the necessary connections for proper interpretation of the findings, which

were systematized and presented in a manner consistent with the research objectives.YV: The co-investigator played a fundamental role in the data collection phase, ensuring proper application of the instruments and procedures defined for obtaining the data necessary for the study. Similarly, he constructed and drafted the theoretical framework, appropriately integrating the conceptual references and research background that underpin the research problem. Furthermore, he contributed significantly to formulating the conclusions, synthesizing the main findings in relation to the proposed objectives and the study's theoretical and practical implications.

Data Availability

All data supporting the findings of this study are available within the article and its supplementary information. The indicators, variables, and statistical analyses presented in the tables and figures have been duly referenced according to the sources consulted, and those without explicit citation constitute the authors' own work, derived directly from the fieldwork and the processing of information collected during the research. Should additional information be required, it may be requested from the corresponding author upon reasonable request.

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29. Contributions In conducting this research. both authors participated actively and complementarily in the various phases of the research process, ensuring scientific rigor and the quality of the final product. The principal investigator was responsible for the exhaustive analysis of the collected data, applying rigorous methodological criteria that enabled the design and implementation of the methodological approach adopted in the study. He also led the critical discussion of the results, comparing them with the existing literature and establishing the necessary connections for proper interpretation of the findings, which were systematized and presented in a manner consistent with the research objectives.
30. The co-investigator played. a fundamental role in the data collection phase, ensuring proper application of the instruments and procedures defined for obtaining the data necessary for the study. Similarly, he constructed and drafted the theoretical framework, appropriately integrating the conceptual references and research background that underpin the research problem. Furthermore, he contributed significantly to formulating the conclusions, synthesizing the main findings in relation to the proposed objectives and the study's theoretical and practical implications.

Footnotes

1. Research seedbeds are student groups led by a faculty researcher, whose role is to help students develop their research skills through projects and training programs.

Figures

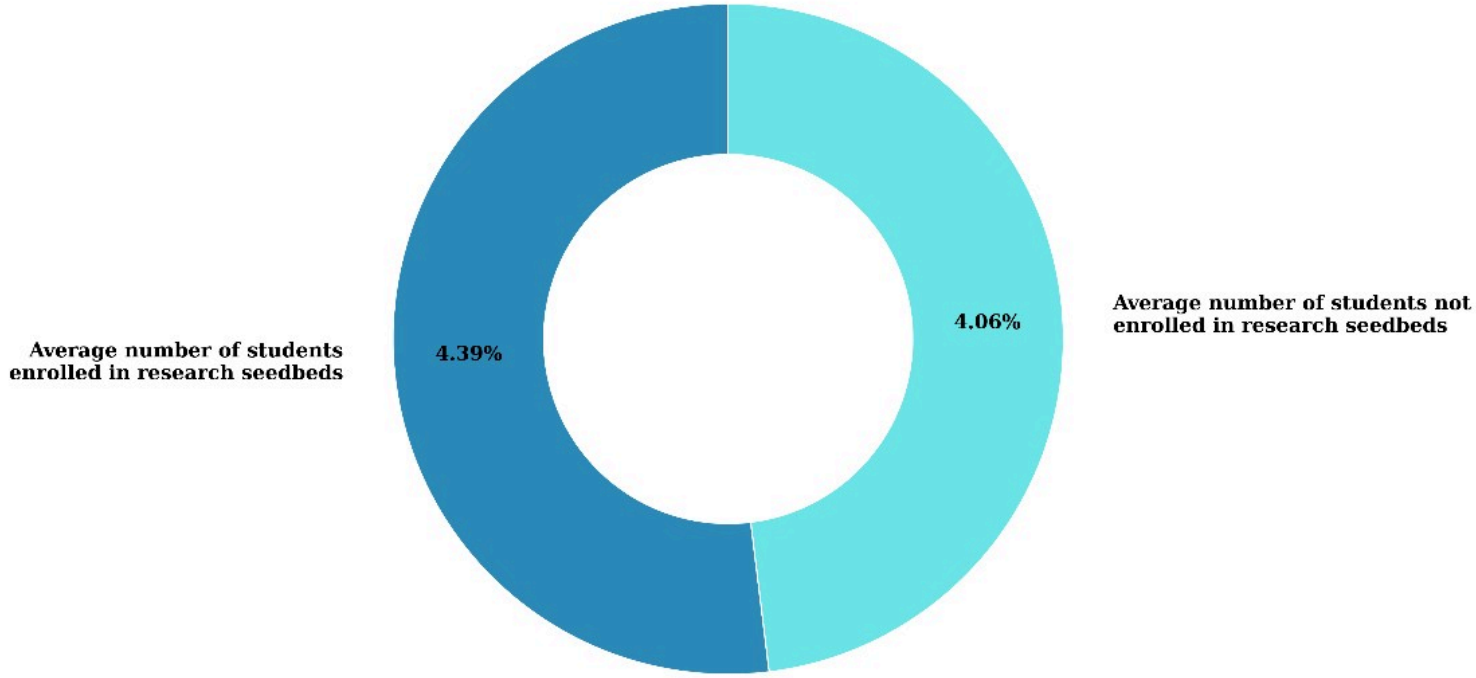


Figure 1

Average Grades

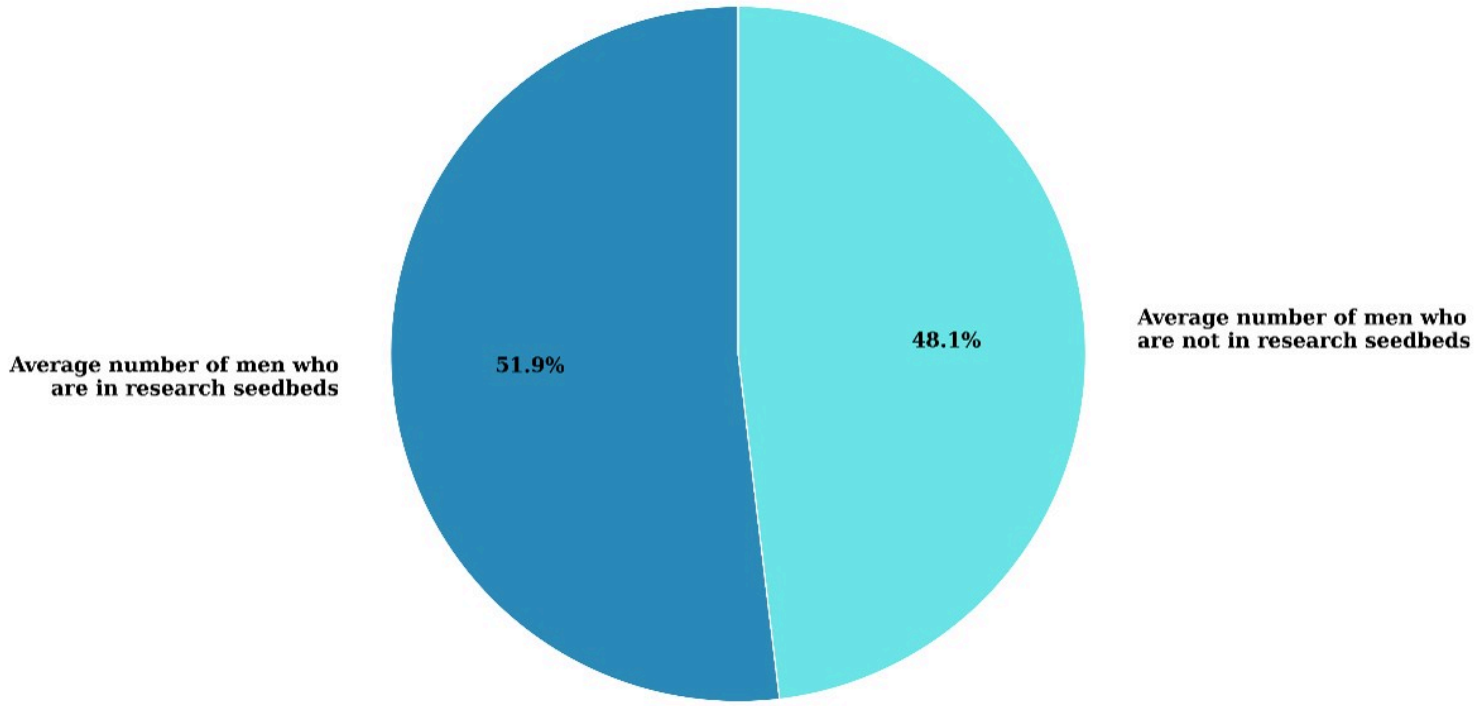


Figure 2

Average Percentageof Women

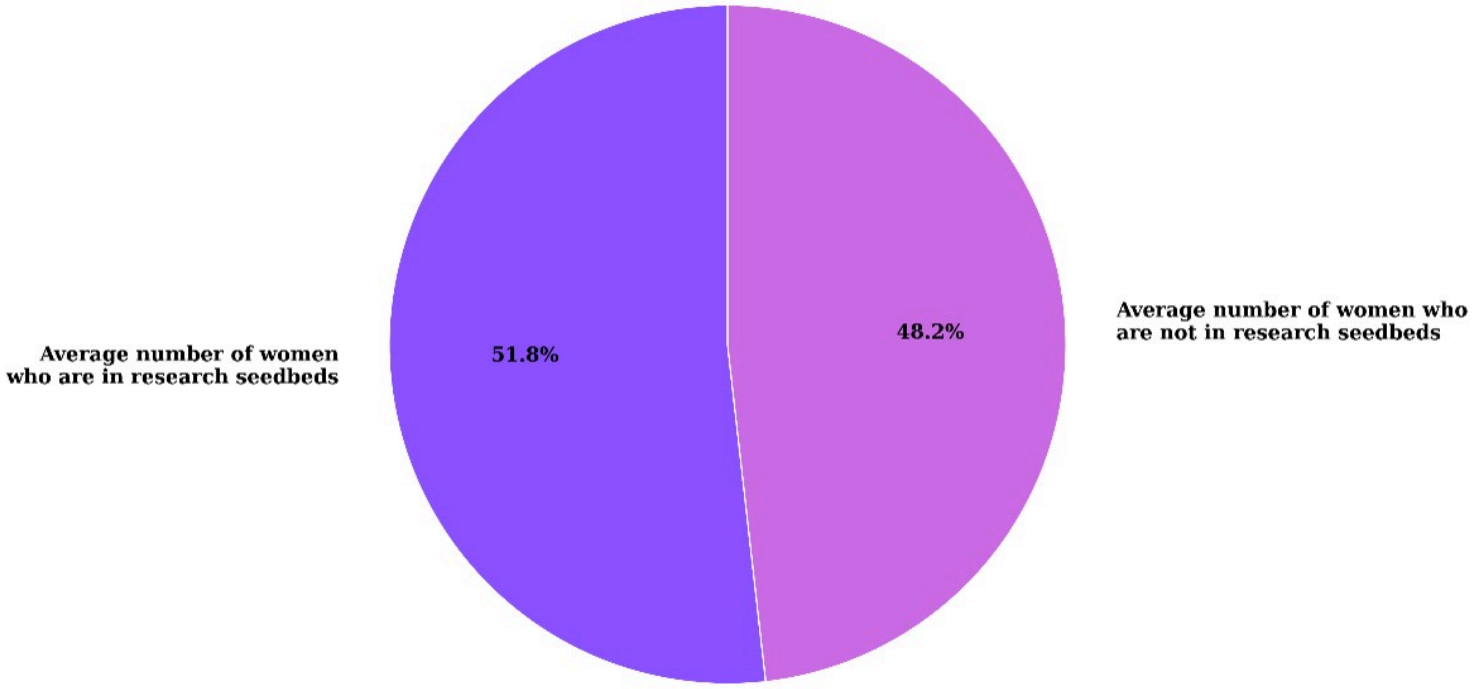


Figure 3

Average percentages of men

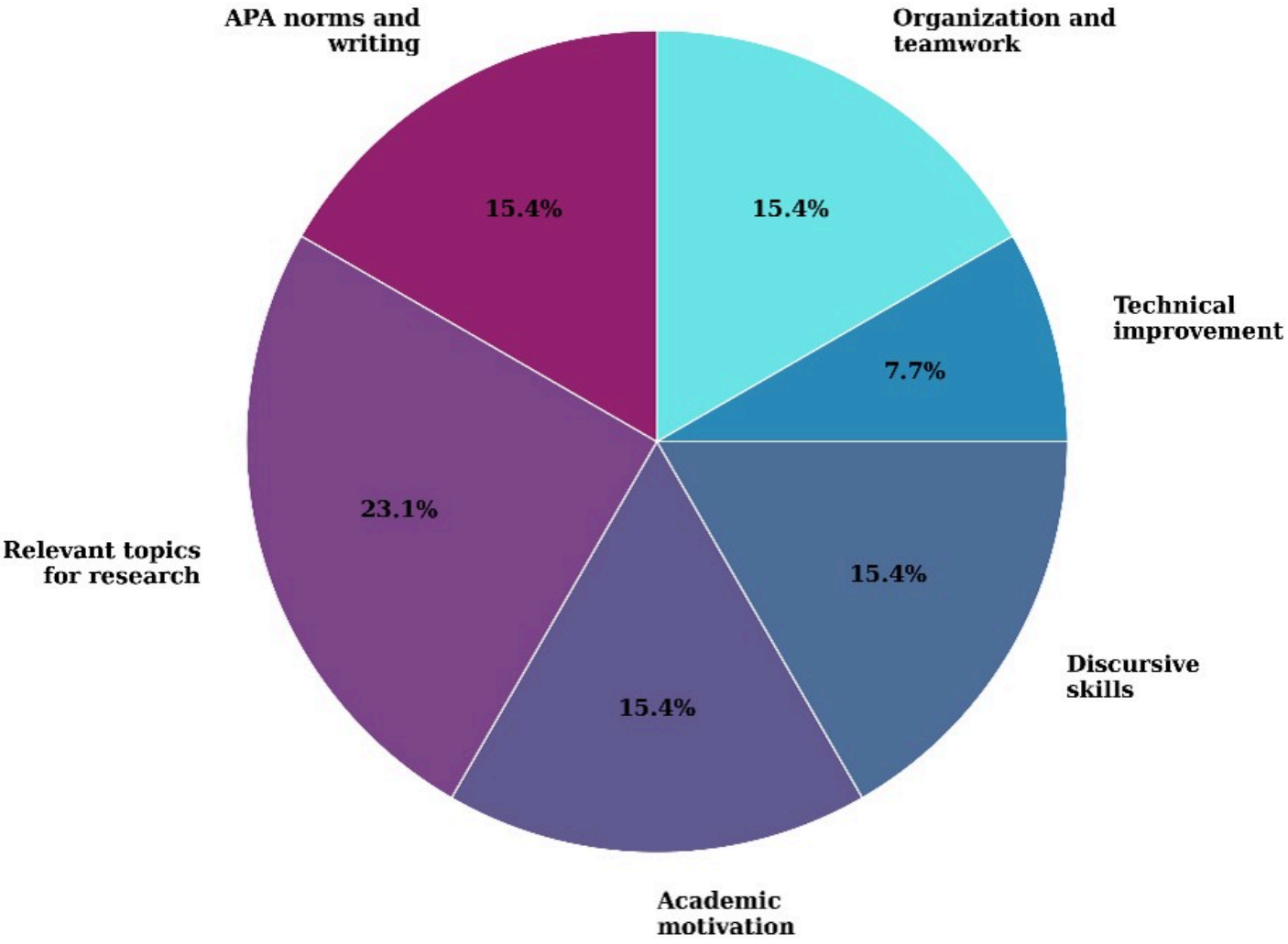


Figure 4

Percentages of soft skills most frequently mentioned by students

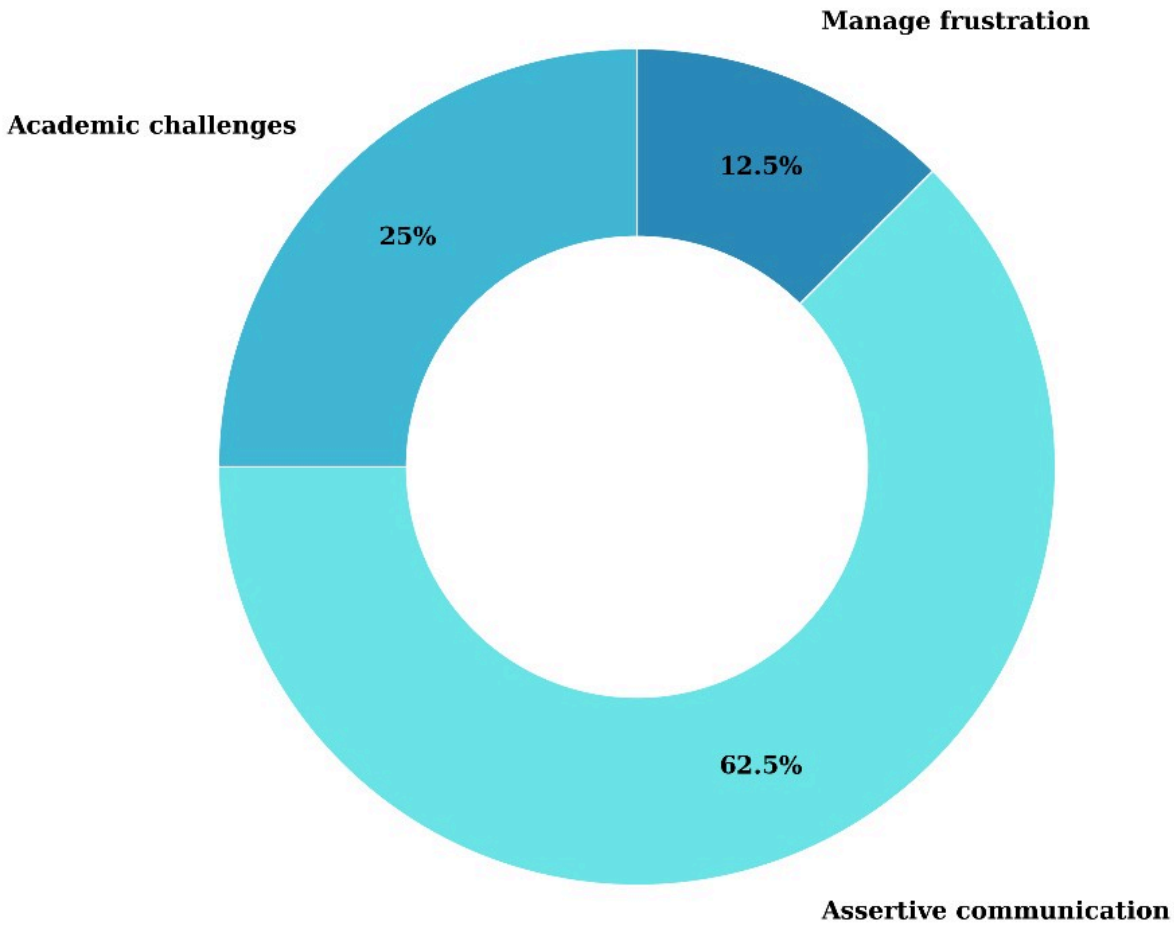


Figure 5

Soft skills developed in the preparatory programs according to teachers



Figure 6

Motivations and Barriers