

# Student Projects in the Integral Formation of Engineering Students

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**Abstract**– The growth of the Project Management Program (PGP) at the School of Engineering is analyzed in terms of enrolled population, achievements, and financial support from 2012 to 2019. The data is extracted from internal records and documents from the School of Engineering's Wellbeing Office and a qualitative perspective from the program coordinator at the School of Engineering is provided during this period. The results show a significant expansion of PGP in terms of funding and students enrolled in the program, which has allowed them to develop soft skills, leadership, teamwork, and project management knowledge. In general, the study highlights the success and importance of the student group program at the National University of Colombia's School of Engineering in Bogotá and its positive impact on student development.

The PGP program was created in 2010 with Agreement 007 of 2010 from the Higher University Council (CSU) [1], and Resolution 003 of 2010 from the University Wellbeing Council "Regulating student programs of the Integral Companion Area of the University Wellbeing System at the Universidad Nacional de Colombia" [2]. Student groups arise as a need to develop teamwork, leadership, and project management in graduates of the Universidad Nacional de Colombia. Starting from 2018, the University Wellbeing Council structured, organized, and standardized the program through Agreement 020 of 2018 making a series of changes aimed at long-term growth. Student projects are defined in Agreement 020 of 2018, guide of the Project Management Program of the Integral Companion Area of the University Wellbeing System of the Universidad Nacional de Colombia as "initiatives proposed and developed by student work groups that respond to the institutional goals and principles and established guidelines" [3]. These projects provide students with a unique opportunity to apply their skills and knowledge while contributing to the university's mission and vision. The work aims to showcase the growth of the student group program in the Engineering Faculty by associating characteristics such as financial support and remarkable achievements between 2012 and 2019. Concluding with a qualitative analysis from the perspective of the program promoter in the faculty. This growth review of the program is conducted using records and internal documents from the Well-Being Direction of the Engineering Faculty.

**Keywords**-- Student Project, Project Management, University Well-being, Project-Based Learning, Targeted Population".

## I. GROWTH REVIEW

In 2010, the program was created and managed by student assistants in each faculty. At the Engineering Faculty, this meant that projects would not have constant guidance as the student's involvement was partial and academic responsibilities prevented their exclusive dedication to the advancement and development of the program. Starting in 2013, this responsibility was linked and assigned to a professional affiliated with the Wellbeing Direction of the Engineering Faculty, allowing for personalized and easily accessible advice to help students resolve administrative and technical project formulation concerns. This change is quickly reflected in the number of approved groups and the number of enrolled students."

TABLE I  
Enrolled students from 2012-I to 2013-I

Enrolled students from 2012-I to 2013-I	
Semester	Students Number
2012 - I	65
2012 - II	35
2013 - I	107

Considering these results, a set of strategies were initiated to increase the enrolled population and the number of supported groups. Comprehensive trainings were conducted for the members and efforts were made to ensure that the lifecycle of the groups was not dependent on the academic cycle of the coordinator, so that if the coordinator finished their studies, the group could continue to work on their projects, as this was a significant issue for the groups in the faculty. Another activity that contributed to the growth of student groups was participation in events organized by the Director, allowing other colleagues from the faculty to become aware of the group offerings and the possibility of proposing their own initiatives.

The student groups have a requirement to present a report on their activities and results. Until the end of the first semester of 2013, the presentation was made by the group coordinator in a private room for PGP administrators.

**Digital Object Identifier:** (only for full papers, inserted by LACCEI).  
**ISSN, ISBN:** (to be inserted by LACCEI).  
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Starting in 2014, the presentations were made during the induction week, with the group presenting their activities to the new admissions of each curriculum program and the PGP administrators. In this way, new admissions were introduced to the Project Management Program, the groups affiliated with their faculty, and the way to join or propose a new group.

Although this initiative improved the socialization and enrollment of new members to the groups, it did not dynamically show what they were doing and the possibility of the admitted to experience, the activities of the group. Consequently, in 2017, a proposal was made to rethink the socialization space and create a fair during the induction week in which groups have an appropriate space for displaying all activities they develop, so that admitted students travel through these spaces interacting with each of the groups, establishing contact and the recording of data of students interested in them.

TABLE II  
Enrolled students from 2013-I to 2018-II

Enrolled students from 2013-I to 2018-II	
Semester	Students Number
2013 - I	107
2013 - II	104
2014 - I	171
2014 - II	92
2015 - I	276
2015 - II	212
2016 - I	257
2016 - II	240
2017 - I	268
2017 - II	525
2018 - I	445
2018 - II	277

In 2017, a socialization process was carried out with the members of the student groups to evaluate, propose and review the draft administrative act that planned to create guidelines and standardization of the Project Management Program for all faculties at Bogotá Campus.

In 2018, University Welfare Council issued Agreement 20, which took effect from the 2019 call. Its main modifications included the standardization of the evaluation process for approval of student projects through a “preCABU” council, creation of a course on Student project management, an annual project period, and an increase in work lines.

The creation of the course aims to ensure that, as a requirement for submitting to the call and receiving financial

support for the development of activities, students acquire knowledge in project management through seven (7) virtual teaching units in which they learn about the characteristics, life cycle, formulation, planning, indicators, and evaluation of a project. With this course, students can formulate a project, considering the scope and risks associated with the proposed objectives.

The work lines correspond to the themes on which they can present projects. Before the agreement, the work lines were academic projection, aesthetic, and cultural expression, recreational and sports activities, editorial and communicative, social, and educational inclusion, and promotion of health. After Agreement 20 of 2018, two more lines were added: Environmental and Biodiversity Care, and Human Rights, Peace, and Coexistence, in order to better organize and encompass each of the focuses of the projects.

The creation of the training course requirement for Project Management caused a slight decrease in the target population for 2019, as students who did not pass the course could not be part of the project. However, a later socialization was carried out for explaining to students who had submitted proposals and it was a great learning experience for the following years.

## II. FINANCIAL SUPPORT

Since 2012, new groups have had up to \$1,000,000 COP to execute them for one (1) semester with the possibility of extensions. Groups that had already participated satisfactorily in the call had up to 3,000,000 COP. Thanks to this groups’ increase, a budgetary effort was also necessary to meet the requests. This changed with CBU Agreement 020 of 2018, in which they are all considered new projects with an independent lifecycle with the possibility of requesting support of up to 4,000,000 COP.

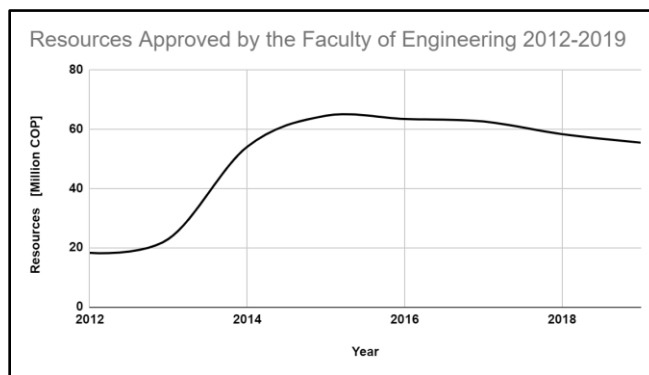


Fig. 1 Resources Approved by the Faculty of Engineering 2012-2019

As shown in Figure 1, during the early years of the implementation of growth’s strategies of the PGP program at the Engineering Faculty, while the targeted population

increased by a value close to five (5) times, the approved resource for project execution only tripled. The final decrease is caused by the same phenomenon mentioned in the previous section in which some projects in 2019 did not meet the project management course requirement.

### III. SIGNIFICANT ACCOMPLISHMENTS OF STUDENT PROJECTS

Some of the most significant projects developed by students are listed below.

In 2015, the GIDA student project managed to contact Engineer Jackelynn Silva-Martinez for a conference for its members and to the people who make up the academic community and other productive sectors.

In 2016, the Chem E Car student project won the Chem E Car competition at PROCESA in Latin America and went on to represent the region at the Chem E Car event in San Francisco, United States, where they placed fifth.

In 2017, the PROTOS student project created a prototype of an upper limb exoskeleton, which is useful in the medical rehabilitation processes of patients with little or no mobility.

In 2018, one of the members of the GIDA student project, thanks to the skills acquired within the student Project, was able to participate in a project in the Utah desert in the United States at the Mars Desert Research Station - MDRS.

In 2018, the UN Búhos American Football project managed to place some players on the national team, achieving two sub-championships of the Andean Cup in the Colombian National League.

In 2019, the McQUN student project won the First National Electric Traction Vehicle Competition in Medellín, Colombia, and the referees project called AAFIN succeeded in having some of its members become professional referees in lower leagues in Colombia.

The CEIMTUN RAS student project created the UNrobot space, where students from high schools and universities are invited to compete in sumo and mini-sumo competitions. In 2021, the UNrobot project won first prize in the RoboCup Virtual Manipulation Challenge, a remote robotics competition where the goal was to program a manipulator robot to sort bottles and cans in a simulated environment [4]. Likewise, the UNRobot project was nominated for the RAS Chapter of the Year award, which is an award given by the IEEE Robotics & Automation Society (RAS) to the best student chapter(s) of the year. Together with the RAS chapter of the Rajiv Gandhi Institute of Technology in India, they were chosen as the award winners. The official award presentation was held in May 2022 at the ICRA (International Conference on Robotics and Automation), which is the annual conference organized by RAS.

### IV. FINAL ANALYSIS

It is evidenced within the members and graduates who were and are part of a student project that the main learning is leadership.

In specific subjects to each curriculum program during the Project Management, projects are generally academic and structured with objectives conditioned by the course's scope without involving monetary resources. PGP enables the development of skills in team management, budgeting, quotation, as well as administration and procurement of public resources.

Student projects provide the opportunity to put what has been learned in the classroom into practice without the pressure of a grade, allowing them making mistakes without being penalized or singled out, and instead taking the error to achieve a goal. In a completely healthy environment, students interact with their peers, and the most important aspect of the process is the acquisition of knowledge and development of soft skills.

After examining the graduated professionals who went through the Programa de Gestión de Proyectos during their university period, they early found their main interesting career field. This allows them to select an academic and/or professional path in which they specialize through postgraduate studies and growth opportunities in different countries, since there is a confirmed experience and motivation for what they want to accomplish. In the long run, these professionals are proactive, committed, and passionate about the work they perform in academia or industry.

Networks of support are created among students and staff, the closeness between peers allows student to formulate their concerns without fear of being singled out, and the proximity to the support professional in the program, allows them to obtain support and knowledge on how to resolve a conflict, thus generating closer relationships with the various support areas in University Wellness.

Two projects cannot be the same. For instance, a project whose goal is the creation of a Human Traction Vehicle, -HTV-, although there may be two other projects proposing the construction of an HTV, they will always be different because the human, economic and even the methodology for the construction of that HTV is always different. Each project is unique and original.

It has been evidenced that the members of student projects generate knowledge appropriation through the achievement of goals, this is seen when a project is called to participate internationally at a congress, and the project achieves a remarkable position, the member of that project is motivated and sees themselves as a holistic professional, avoiding any reason for dropout.

It provides the opportunity for the student community to actively participate in the construction of the University, this is achieved by allowing any student to become involved in a student project and learn any skill or competence from scratch.

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