

Inspiring Leadership in the Academic Community - Newton Smart Campus Case Study

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Abstract

The skills of professionals in the future go further than technical issues. Leadership, emotional intelligence, flexibility, communication and adaptability are soft skills highly valued for graduates employability. Although students in engineering programs have some courses on economy, project management, business administration, the development of those soft skills is incipient. That is why universities must create programs to provide the students the opportunities to develop those skills. This paper presents the case of Newton Smart Campus, from Newton University in Brazil, which aims to inspire, articulate and empower the academic community to create solutions to real problems in society by using the campus as a learning and prototyping space.

Introduction

In general terms, Engineering undergrad programs curriculum define the graduate profile of a generalist, critical and conscientious professional with a great analytical capacity, qualified not only to operate industries, equipment and/or projects related to his/her specialty but above all, absorb, adapt and promote technological innovations. Unfolding these elements, a graduate student in Engineering (UFMG, 2019) should:

- Develop a capacity for reasoning, equation, and problem-solving in Engineering, in the various areas of knowledge;
- Be ethical and humanistic;
- Be able to meet the demands of society;
- To have a critical and analytical view of the political, economic, social, environmental and cultural aspects of the problems to be solved.

To meet the graduate profile, the undergraduate courses have technical Engineering disciplines that help to develop the capacity for logical reasoning and problem solving. There is also a content of disciplines of Applied Humanities and Social Sciences, such as Ethics, Law, Business Administration, Entrepreneurship and Project Management. These disciplines attend to the Teaching axis that corresponds to the transmission of knowledge through abstraction and, when possible, the practice of certain subjects, made by a

professor.

Brazilian Constitution, in the 207 article, defines education in a three inseparable pillars approach: Teaching, Research and Outreach.

There are also two pillars inseparable from the Teaching that are Research and Extension, defined by the Ministry of Education through article 207 of the Brazilian Constitution of 1988. Research is the opportunity to apply or develop new concepts from the built bases by the teaching stage. The Outreach is the direct application of the knowledge obtained in the teaching and research stages that help the student to have contact with the chosen profession, either through supervised internships or through projects that attend to the real problems of society, including communities with low human development index - HDI (Brazil, 1988).

In spite of all the existing initiatives in Higher Education Institutions, a core group of skills needed for engineers is still left out from traditional curriculum. In addition to technical skills, an Engineer must develop skills such as leadership, teamwork, conflict resolution, resilience, negotiation, and management.

Hinkle (2007) makes a narrative of the first week of work of a recent graduate as an Engineer. When assisting a chief engineer in the testing of a new product, we can see several activities that correspond to Leadership and Management. Among the technical activities, it was necessary to perform:

- Negotiation with the factory for the delivery of test units;
- Planning of the flow of test units by the engineering laboratory;
- Obtaining external resources to meet your needs quickly;
- Directing technicians with test procedures;
- Estimate time to complete tasks;
- Resolving conflicts and problems that were impeding progress.

The experience in this study shows that technical skills of an engineer were a small percentage of the skills required for the professional to perform. Interpersonal skills, business skills, and leadership and management skills are required in engineering jobs. In addition, as engineers advance in the profession, leadership and competency management become more important, regardless of whether they are in the managerial position or not (Hinkle, 2018).

This scenario challenges Engineering Schools to design solutions, whether they are inside or outside the classroom experiences, to develop soft skills from an early moment in undergrad programs. Therefore, Newton University created and implemented Newton Smart Campus concept and program, an innovative approach that conciliates the student development to local positive impact.

Newton Smart Campus

The intensification of urbanization leads to various aggravating factors in an intensely populous city. Among them, we can mention complications in urban mobility, the increase in waste generation and difficulties of disposal, intense use of finite resources, such as

water and energy. Such background is also found within an University Campus, that concentrates different facilities, commercial areas and high flow of people and vehicles. University Campus are, hence, small-scale cities with challenges to be solved. At the same time, the campus has talented students from different areas capable of exploring, experimenting, testing and implementing creative solutions; all they need is a space and a methodology to help them in that. Newton University design the Smart Campus outreach program to become a living lab for them.

The Smart Campus concept was created in 2015 in collaboration with students from the G-LAB program (Global Entrepreneurship Lab) at the Massachusetts Institute of Technology (MIT). Newton Smart Campus began in 2016 at Newton University and its concept is based on Human, Smart and Sustainable Cities or simply, Smart Cities.

Smart Cities fully aggregate the accessible technological resources and especially integrate citizens in this system, leveraging their role as the main character for this change in the process of social, economic, environmental and technological restructuring (INATEL, 2016). According to Bassi et al. (2016), smart cities provide better efficiency of urban activities and services, as well as their competitiveness, taking into account the current needs together with a vision of the future (Inatel, 2016; Bassi et al., 2016).

According to Bassi et al. (2015, p.18), in short, a Smart city:

- Generates integration that provides public administration with the necessary and transparent information for better decision-making and budget management;
- It allows a better service for users of services and improves the image of public agencies, thus raising the degree of satisfaction of the inhabitants;
- Optimizes resource allocation and helps reduce unnecessary spending;
- Generates common procedures that increase the efficiency of government;
- Produces performance indicators that help in the measurement, comparison, and improvement of public policies;
- It allows greater involvement of organized civil society and citizens in administration with technological tools that help to monitor public services, pointing out problems, informing and interacting with municipal administration to solve problems.

Extrapolating from the concepts of smart cities, a parallel is usually made between a city and a University Campus. If you want to become a smarter city, a campus should follow the trend. This is where the Smart Campus concept comes in.

Newton Smart Campus proposes to identify real problems of society and the intensification of urbanization and develop solutions to solve these problems, using the campus as a space for prototyping and learning.

The focus is that all activities and projects should fit into the concepts of Human, Smart and Sustainable Cities, committed with the UN's Sustainable Development Goals and Belo Horizonte Agenda 2030, the local government strategic plan.

Among the objectives of the Newton Smart Campus Program, we can highlight:

- Make cities more human, smart and sustainable;

- Meeting the 17 Sustainable Development Goals, in particular: 3; 4; 6; 7; 8; 9; 11; 12 and 17;
- Meeting the Challenges of Belo Horizonte Agenda 2030, in particular: Belo Horizonte as a municipality of very high human development; Resilient and environmentally sustainable city; City in which one lives more, with health, safety, and quality education; Belo Horizonte with transparent, shared and excellent management; Compact, integrated, inclusive and connected city with sustainable mobility;
- Make university *campi* smarter;
- Articulate, empower and inspire the academic community to create solutions to real problems applicable in the urban context, aligning them with the needs of Brazil in the coming decades;
- Encourage leadership from the first graduation periods, giving the responsibility for managing projects from each axis and with that achieve the best solution taking into account effectiveness, lower cost, execution time, impacts and financial return;
- Be a reference in Human, Intelligent and Sustainable Cities in Minas Gerais state.

The main purpose of the program is to enable students to experience market the market challenges by putting into practice the theories acquired during the course. With this, Newton University would place qualified professionals on the market, raising the credibility of the institution.

Methodology

Smart Campus is organized into 10 work axes that correspond to a theme in which a city needs to develop. In each of them, a student is responsible for bringing solutions through the implementation of projects related to the axis. Usually, some projects permeate more than one axis and the students collaborate to develop the projects together. The work axes are divided as follows:

- Information and Communication Technology (ICT) - innovative solutions in Information Technology and Communication, which contribute to providing, improving and expanding communication, information management, quality of life and social inclusion;
- Urbanization - This area aims to study projects that optimize urban complexity, developing solutions for planning, sustainable low-cost construction, analysis and application of modern and ecological technologies for buildings, social management and understanding of urban and rural behaviors;
- Energy - Projects involving the study of intelligent solutions for the generation, distribution, monitoring and supply of energy from alternative sources that do not harm the environment;
- Art, Culture and Education - Projects that aim to promote hybrid and personalized learning, making use of emerging technologies, such as gamification and learning methodologies that involve practice and experimentation;
- Mobility and Security - Development of solutions that improve urban mobility and research for developing multimodal transport that guarantee usability, reduction of traffic and the general safety of users and public patrimony;
- Health and Quality of Life - Projects that assist in the prevention and mitigation of health problems and promote a better quality of life, integrating sports projects,

- health, and social activities;
- Environment - Projects that seek to make the city environmentally intelligent, to optimize and protect the available resources, as well as promoting cultural changes aligned to the tripod's perspective "environment, society, and economy";
 - Industry and Business - Projects that develop solutions in production, processes and innovative industrial technologies, focused on optimization, rationalization, improvement of the quality of productive processes, effectiveness, entrepreneurship and management of the contemporary business ;
 - Newton Tech - Projects aimed at seeking partnerships between companies and industries to provide services and increase the opportunity of internships for students in the academic community;
 - Governance - Responsible for integrating, controlling and directing the efforts of the other axes so that the projects developed achieve the objectives.

The students responsible for each axis is called trainee, effectively trained and empowered to manage projects and teams to implement the projects. They are subordinated to a General Supervisor of the Smart Campus, who is a professional with experience of industry, innovation and project management. The trainees have mentors, professors with a background in the area of study that have a consultant role in the projects. The trainees are responsible for the project teams, volunteer students that engage in specific projects. The number of participants in each team depends on the complexity of the project and is jointly decided with the General Supervisor. Figure 1 shows a interaction workflow between Smart Campus and different stakeholders to conceive a project and Figure 2 represents Smart Campus process Workflow during a project development.

SMART CAMPUS AND STAKEHOLDERS INTERACTION WORKFLOW

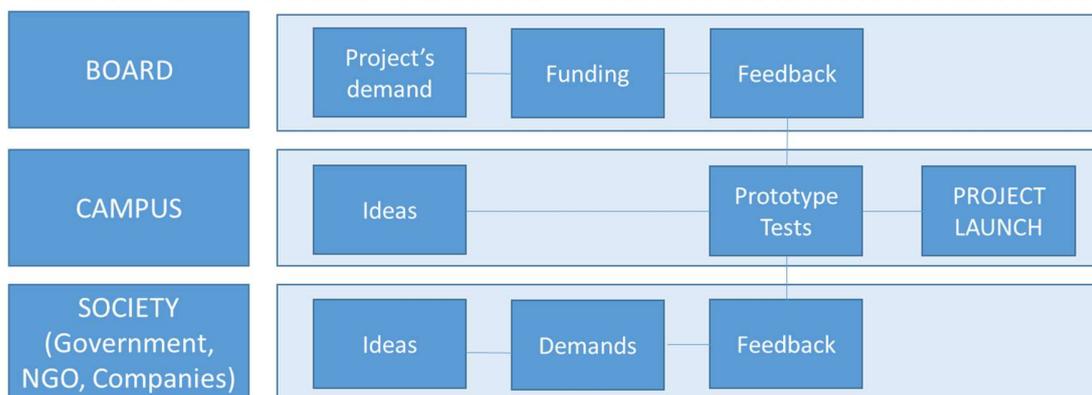


Figure 1 – Iteration Workflow between Smart Campus and stakeholders.

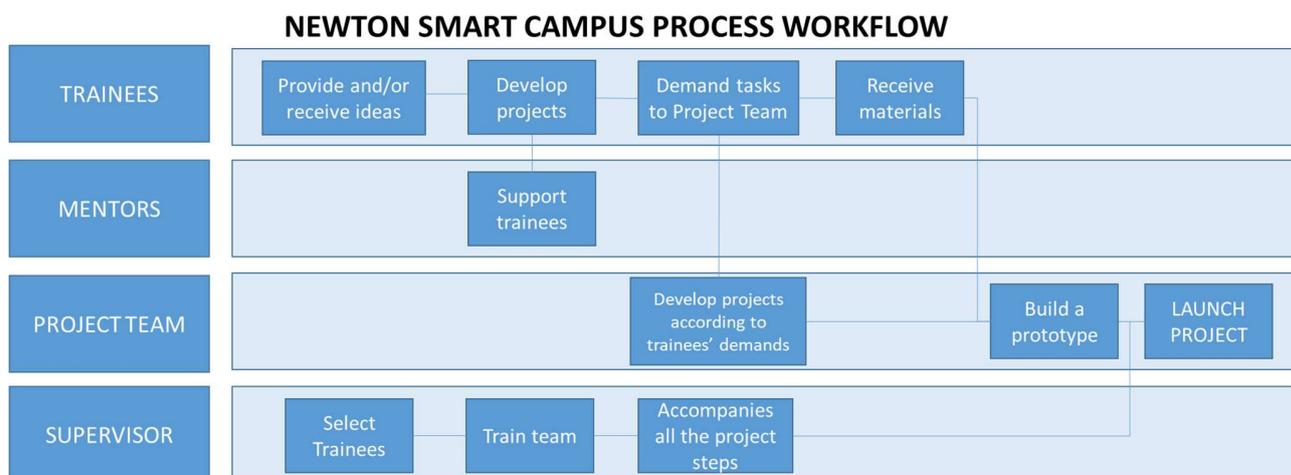


Figure 2 – Process Workflow inside Smart Campus.

All Smart Campus trainees receive training in Organizational Culture, Smart Cities and Project Management. Within the Project Management course, trainees experience themes such as:

- Definition of Projects, Processes, and Programs;
- Stages of a Project;
- Construction of a Project Charter;
- Construction of an Work Breakdown Structure (WBS);
- Construction of a Project Plan;
- Schedule;
- Cost Control;
- Follow-up of Projects;
- Closure of Projects;
- Lessons Learned.

Based on this tool, students can work as Project Managers in their areas under the supervision of the Smart Campus General Supervisor. Projects timeframe are between six months to a year for implementation. The projects scope are aligned with the concepts of Smart Cities and classified as outreach initiatives according to the Brazilian Ministry of Education. The project deliverable is a prototype that represents a real solution for the campus and the cities. The problems addressed in Smart Campus may come from the students themselves, from professors, from the Academic Board and Campus Management.

To evaluate the performance of the projects, Newton Smart Campus established quality indicators as percentage of project realization (for projects in progress) and the number of projects completed at the end of the academic term. In addition, trainees have personal goals such as the number of formalized partners and the number of projects appearances in the media. To achieve the objectives, trainees must develop skills beyond the techniques that are obtained in their graduation, such as negotiation, conflict resolution, leadership, and management, as projects directly impact stakeholders such as Rector's Office, Academic Directorate, Campus Management, Course Coordinators, Students, Professors and Employees and also sectors such as Purchasing, Finance, Legal,

Infrastructure and Laboratories. Because of this great interaction, many projects may be postponed or discontinued. This is why stakeholder engagement in the project is required from the outset of the project design and foreseeing all risks and responses to them.

Results

Since the implementation, Smart Campus has delivered more than 90 projects to make the campus and society better.

Here are some projects worth mentioning:

- Reduced flow rate of faucets - elaboration of flow reducer made from a 3D printer and installation on faucets on campus, promoting a 50% efficiency in reducing water consumption (see Figure 3);
- Recycling of plastics, paper, used oil, electronics, and batteries;
- Liter of Light – development of autonomous energy poles through photovoltaic cells to supply lighting deficiencies on campus (see Figure 4);
- Shared Rides – program to encourage the use of shared rides among students within the Campus;
- Development of Project Management methodologies – models, procedures and routines for better planning, execution, monitoring and controlling of projects according to Project Management best practices;
- Educate and Experiment – elaboration of practices of chemistry and physics to help the students of Elementary Education to arouse the curiosity by such subjects;
- Smart Parking / Resizing Parking Places – a conceptual project that aims to optimize parking spaces on campus, being monitored by sensors and allowing the user greater control of the number of parking lot available;
- Mechanical prostheses – development of 3D printed mechanical prostheses that assists a person with physical impairment in an upper limb, giving the same autonomy to use small objects;
- Elaboration of online Smart Cities course for the entire academic community;
- Smart Talk – a podcast channel available on SoundCloud with a discussion about Smart Cities and Sustainability (see Figure 5);
- Parklets – create living spaces for students and the campus community;
- Promotion of book fairs, in which students can bring old books and exchange for others in an accessible way (see Figure 6);
- Actions with community – partnerships with NGO like Bike Anjo (see Figure 7) and vulnerable community (see Figure 8) to make our cities human, intelligent and sustainable.



Figure 3 – Flow reducers manufactured in the prototyping laboratory and explanatory booklet for installation on the taps.



Figure 4 – Liter of Light Prototype, from an international NGO that aims to install autonomous posts at a low cost.



Figure 5 – Instagram campaign about Smart Talk, a podcast channel related to Smart Cities and Sustainability.



Figure 6 – Book Fair promoted to all academic community.



Figure 7 – Partnership with NGO Bike Anjo, which teaches adult people how to ride a bike.



Figure 8 – Qualification course in Basic Informatics, promoted to Morro das Pedras community.

The expected results for the next few years are that the projects have greater complexity and impact society more comprehensively, elaborating projects on topics such as BIM (Building Information Model), Machine Learning, Big Data, Internet of Things and Industry 4.0.

Testimonials

From the participating trainees, the development of all these projects positively affected to become engineers and architects with negotiation, leadership and management skills. The following are some spontaneous testimonials of former Newton Smart Campus trainees:

"Smart Campus was the cradle of my empowerment. The tipping point, where I was challenged day after day. Through training, interviews, and projects I was shaped to win" – Adriana Nascimento, Chemical Engineering graduate, former trainee ICT axis.

"Being a trainee is an opportunity to live the academic life more actively, and thus grow alongside people who seek the same ideal and leave together that are capable of providing significant changes." – Fernanda Rocha, graduated in Architecture and Urbanism, former trainee Mobility and Safety axis.

"Smart Campus meant more to me than I imagined. Throughout the entire period, I was challenged and empowered to think outside the box, managing projects and volunteer team." – Juliana Lima, Bachelor of Chemical Engineering, former trainee Education axis, current Management Consultant.

"The Smart Campus is a hands-on experience, there I could carry out the prototyping of a parking automation project. Besides, I gained experience, networking, and visibility." – Lucas Henrique, graduated in Control and Automation Engineering, former trainee ICT axis, current Startup Founder.

"The experiences I had in the Smart Campus can not be described briefly, they were very intense. The message I want to leave is that nothing will come easily. You will have to give yourself body and soul in your projects, I have learned that complaining will not change the situation and that all the values of Smart Campus will make a lot of sense in the end." – Martha Jardim, graduated in Electrical Engineering, former trainee Energy axis

Conclusion

The skills of a professional in Engineering transcend Calculus, Transport Phenomena, Electric Machines, among others. Although the curriculum addresses courses of applied human and social sciences, social skills are learned in a better way by practicing.

Smart Campus Newton is an initiative to make early learners gain Project Manager responsibilities, develop negotiation skills, leadership and resilience, having greater employability in the market and more success in their professional path.

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