

## **A PBL Collaborative and Cumulative Dynamics Towards Urban Sustainable Environments**

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### **ABSTRACT**

*Erasmus+ CityLab Program at Universidad de Belgrano School of Architecture and Urban Planning, has focused on urban structure as generator of dynamic and transformable spaces, through a local case located at Juan B. Justo Avenue corridor, Buenos Aires, Argentina.*

*The CityLab project motivated students to experience an integrative 3-year Problem-Based Learning process, related to Morphology Communication and Digital Media, Urban and Territorial Planning, Final Degree Project, as well as integration with School of Public Relations.*

*More than 75 students participated in this international programme to explore, diagnose and re-think city scale, as well as to discover, build and apply technological tools. Land use and mobility regulations were introduced with the participation of stakeholders and external experts in different stages from diagnosis to final project validation.*

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*Student's and teacher's staff contribution to the academic final conference "PBL for Sustainable Cities"- September 2018, Bogotá, produced a motivating socialization in collaboration with local partners.*

**Keywords:** Problem Based Learning, Sustainability, Collaboration, Urbanism, CityLab.

## INTRODUCTION

The Erasmus+ Citylab Program pedagogical module introduced current problem analysis solved by architecture students in an institutional context at UB. In the last years, traditional teaching practices based on content repetition with static transmission of knowledge from professors to students, decreased their academic interest and motivation to learn and manage a new language, connecting theory and technology.

As educators, we find ourselves in a deep discussion to unblock rigid structures of knowledge to moderate the progressive educational phases at university. To provide an answer to such problems, we found it necessary to propose and verify, if more flexible educational models promoted discussion and debate towards traditional methodology, with proven results.

PBL was defined into our local case, as a system of strategies where students and teachers shared their efforts to arise different approaches to urban real situations. We justified this challenge, prioritizing the importance of competencies such as teamwork, autonomy diagnosis and master planning to reach integrative solutions. Other skills introduced in the process were critical dialogues with stakeholders and the use of technology for contextual analysis.

Our School of Architecture and Urban Planning has a solid experience in motivating students to adopt different software to build 3D models, make simulations, analyse urban variables, and publish academic results towards community outside our campus. At diagnosis initial stage, we focused in augmented reality tools, analysis through video representations and GIS (Geographic Information Systems), which allowed an innovative experience in further planning phases and generative morphology processes. This transformation also meant a renewal of traditional tech-teaching towards student self-management. We stimulated intuitive urban recognition before providing students a formal urban knowledge, who reached a faster and deeper detection of degraded areas, critical places, and approach of urban interventions.

Given a metropolitan macro area of influence, the students determined their specific zone of interest with autonomy and analysed urban regulations to understand its land use complexity, mass transport infrastructure and social impact. Their common challenge was to define and

propose sustainable solutions. Our architectural perspective for planning interventions in public space considered hybrid spaces from physical to digital concepts, offering valuable experiences increased by virtual information to enrich traditional data collection and representation.

At this point, agreements between government and academy drove us to consider external social referents to enrich our discipline with new concepts and notions for re-thinking the city, as well as constructing new projective tools. Project leaders visited our classes in different pre-defined instances to encourage students into team-collaborative work for decision making, analysis, reflection, and interdisciplinarity in our architectural syllabus (Morphology, Urbanism and Project Design). External advisors participated into work methodology, and the participation of Public Relations discipline optimized communication processes. Active collaboration with local stakeholders was included as a cross stages strategy.

### **CASE DEVELOPMENT AND ANALYTICAL TOOLS**

PBL project was defined into stages organized according to an urban morphology analysis sequence, geo-referenced definition of data and project practices, to formulate sustainable solutions to urban problems. This organization fits with architecture academic plan timeline. The stated order reflects each module starting point for the student, who learned urban morphology at the beginning of their third academic year while urban planning extended from the third to the fourth academic year. Students finally solve their master plan at project development, being the last step to obtain their degree. Cross to these subjects, the intervention of Public Relations added trans-discipline. (Fig.1) Resumes the sequence from 2016 to 2018, according to architecture syllabus involved in City Lab programme, where G1 to G3 represents each group of students, starting the process to PBL experience per semester. This strategy was shared by different teams across Erasmus + City Lab Programme and in the last stage we could finally verify the cumulative learning results regarding final Master Plans on Project Development.

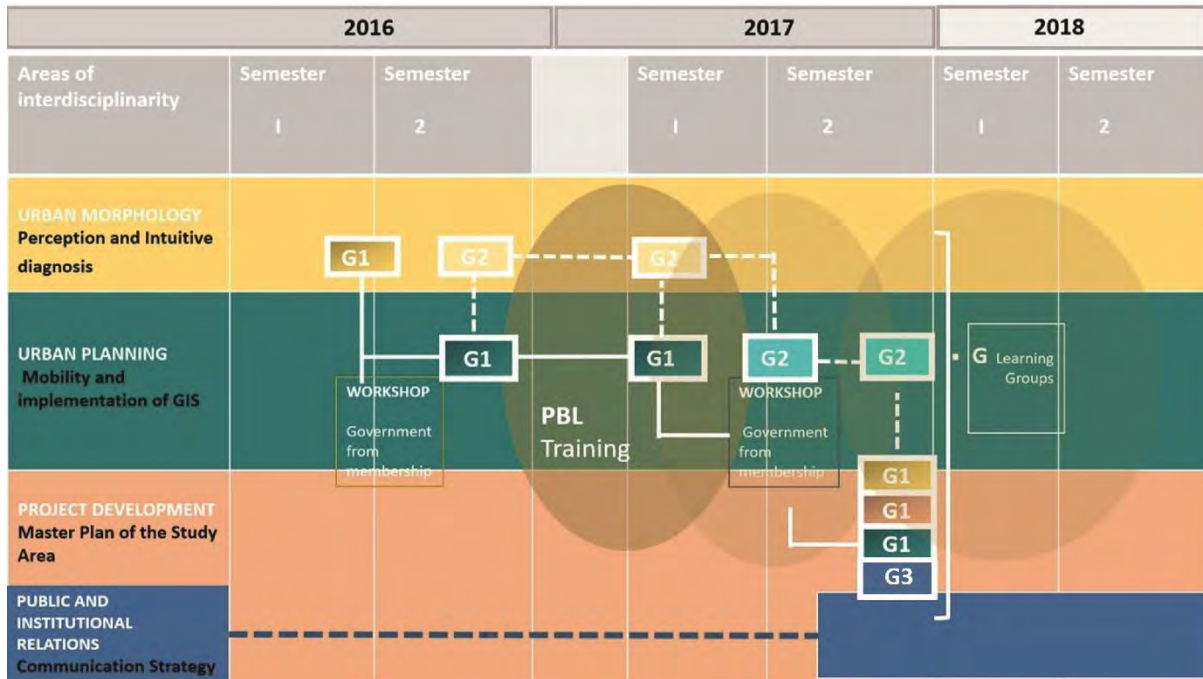


Fig.1: Scheme that details the sequence of actions according to the academic areas and the allocated time for each stage. Team staff elaboration.

First stage (year 2016) defined our contractual Erasmus+ Program Capacity Building Projects deadlines for Higher Education, with the distribution of prior tasks and role-assignment for project leader responsible to assist and participate in meetings. The teamwork integrated students and professors from the areas of Morphology, Urbanism and Final Degree Project as well as Public Relations.

In the second stage (year 2017), a staff of teachers and students organized in teams, completed Problem Based Learning Online Training Course offered by Columbus Association, to improve strategies and practical integration of this methodology into the academic areas, depending on architecture and urbanism department. At this moment we received the first external visit of stakeholders, who provided further local perspective.

In the third stage (year 2018) the team focused their pedagogical effort in a cross development of urban diagnosis, adding new technologies and communication design strategies in collaboration with stakeholders. At first, we organized the work into fifteen groups, four students each. We also improved expertise in GIS management for field survey and diagnosis. Students developed new ideas to approach BRT as an accessible, inclusive, safe, and sustainable transportation system in Buenos Aires City, as well as participatory and integrative abilities to protect the cultural and natural heritage in the study area of influence.

Communication and Digital Media II subject introduced urban morphology recognition and integration to define the city as a pragmatic dimension, while sensitive and perceptual analysis focused on the architectural dialogue between morphology and its context. The discovery of

transformable spaces, connexions, continuities, and ruptures related to functionality and uses were a consequence of the urban structure study.

Morphology area proposed to build a sensitive perception and projective morphological knowledge of urban space through 4 instances:

- Recognition of urban space
- Analysis from the perception as constructor of intuitive images
- Representation models and communication
- Capture and registration: graphics, photography and video
- Collaborative exchanges through integrative instances, World Café, talks with local government agents

On the following step, Urbanism syllabus addressed city scaled problems on mobility and sustainable transport. In this scenario we introduced the benefits of space thinking through GIS with:

- Improved cartography, better access, and effective thematic mapping
- Access to open data platforms to make more efficient surveys
- Process extensive geographical information in shorter time
- Analysis exploration with qualified information
- Better communication to public and staff
- Use current tech-planning applications

Urban Planning also proposed land use, transport, housing, land development and environment contents. Activities were focused on the definition of main objectives, situational analysis; modelling; development of suitable options, with different approaches to use GIS as a spatial thinking tool.

The third stage was Final Degree Project (FDP), meaning a graduation work that integrates the three main areas of academic syllabus to obtain the degree in architecture. It is a multiple and complex project based on bibliographical study, formulation of fundamentals and conclusions, as well as on self-evaluation of project commitment in relation to the urban response, design and technical requirements linked to the constructive reality. This area of study proposed to address and go deeper in sustainability concepts, in a way that technology and standards cease to be a limitation to become natural design tools for students.

During 2018, the project also considered the application of PBL methodology for the detection of conflicts with possible solutions and proposals. To strengthen the process, some activities were planned:

- Expert and specialist visits
- Theoretical lectures as support of ideas

- Common issues, self-evaluations and evaluations of the proposals, intervention of experts and local government agents



*Fig.2: Picture of a workshop activity with the stakeholders at validation result stage*

Student work produced reports, technical project folders, partial presentations in digital formats, final presentations in panels A1, shared models of the whole area to be intervened and partial models of each project. The main characteristics of PBL that were considered for the methodological development of the subjects are the following:

- Responsibility of own learning from students
- Unstructured simulation of problems to allow free investigation
- Integrated learning from a wide range of disciplines
- Collaboration among students
- Theoretical integration
- Self-evaluation at the end of each problem

Finally, Public Relations students made a diagnosis of the situation based on information provided by Architecture course students. They used analytical tools such as problem tree showed in Figure 3. They defined the following work objectives:

- Identification of potential conflict situations (Problem Matrix)
- Problem tree
- Courses of action for each issue
- Map of audiences to work with

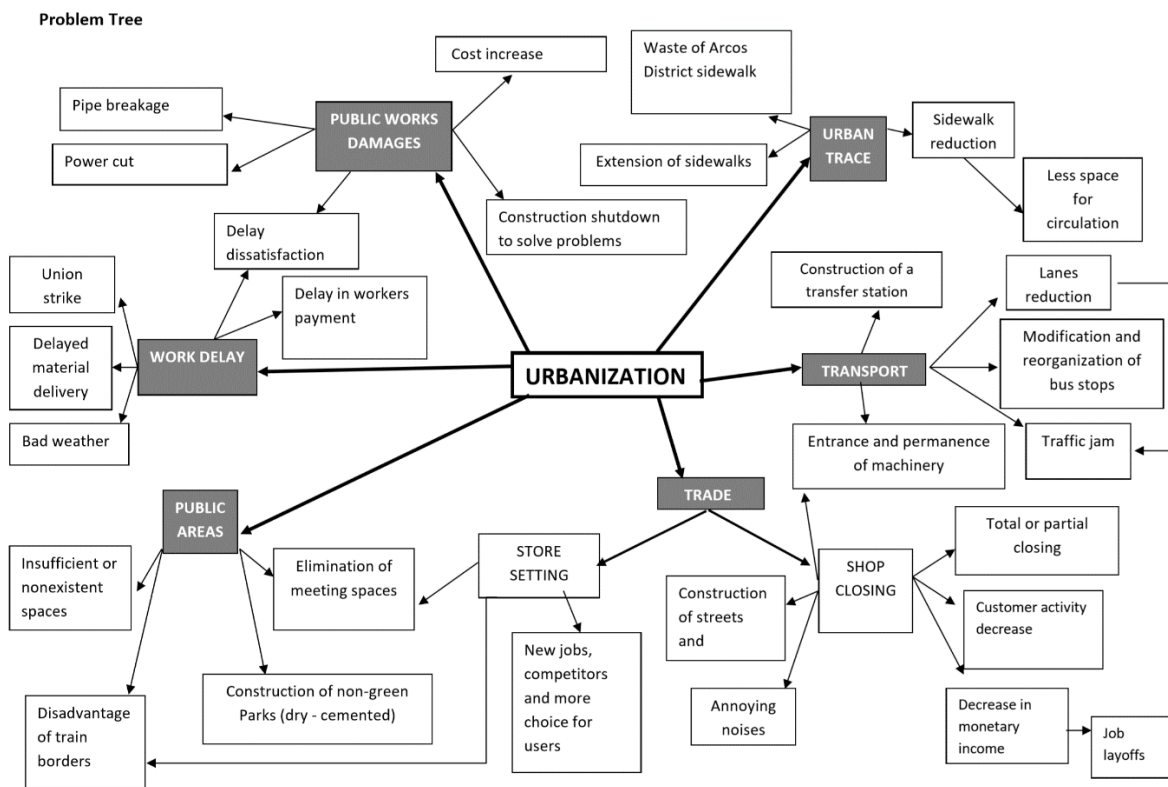


Fig.3: Problem tree produced by students of Public Relations

## ANALYSIS AND RESULTS

### 1st Stage. Urban Morphology I Perception and Intuitive diagnosis

We adopted collaborative dynamics with exchange of experiences in groups and study networks, as well as modelling programs, georeferencing, and updated interactive maps. Students used visualization software for edition, layout and design their presentations, as well as for further analysis.

PBL methodology offered an intuitive approach to enhance the dynamics of sustainable cities. The teachers staff facilitated an integrative and interdisciplinary process in teams constituted by students on their own. The aim was that each team could direct and evaluate a learning process to define the morphology problem. The teacher was a facilitator to lead a collaborative formal evaluation together with students. The groups elaborated reflection proposals and critical scenarios:

- Perceptual analysis and shared synthesis, in workshop modality based on observations on field
- Team work leading model workshop processes to define different resources to communicate the information

- Self appropriation of the total model area, and performance analysis in groups
- Proposal of models and critical reflection by each group

Students presented the objectives and relevant knowledge to develop the project. They also processed the sources of information (books, articles, interviews, observations, visual analysis) and completed a report. We proposed more freedom over student management and organization of their calendar schedule.

Students improved their sense of responsibility and definition of roles as well as critical reflection and opinion development in oral presentations. They also participated in collaborative exchange with local stakeholders, especially in the first instance of interaction at the beginning of the experience. As groups were engaged to participate in the following PBL phases, they validated the complete process with their own results, up to the finalization of the third stage. The most interesting result was to prove that having more autonomy let them develop better solutions.

### **2nd Stage. Urban planning: Mobility and implementation of GIS**

Urban and Territorial Planning and Urbanism address urban issues with emphasis on mobility and sustainable transport. In this scenario we introduced GIS as a constant and growing learning strategy. We have an international agreement with the UNIGIS Network specialized in GIS since 2012, with the Programme Support of the University of Salzburg, Austria. A main objective in this area is that students naturally introduce the relation between urban variables through geotechnologies.

“Learning GIS with PBL” was the name of our methodology plan. We provided ArcGIS software to define existing situations, decide over the best alternatives to collect, organize, analyse and represent, physical, social, and economic data of an urban area to be studied.

About the City Lab experience, PBL methodology introduced the following objectives:

- Understanding urban mobility ideas established by local stakeholders at the beginning of the process
- Working in groups, with bibliography analysis and debates
- Exchanging critical ideas in groups
- Using ArcGIS software and taking online learning experiences like MOOCs
- Defining urban analysis with structured data standards, indicators, and regulations

We perceived empowerment and motivation acceleration in the learning experience, in comparison to previous years characterised by a more conducted and traditional teaching.



GIS technology was validated by students as a method for diagnosis and communication, which gave them technological autonomy. Exchange instances such as World Cafés and workshop activities produced interdisciplinary thinking about sustainable urban impact. Their evaluation about PBL learning towards technology resulted in the following concepts:

- Technological approach facilitated and revalued perceptual diagnosis
- Technologies collaborated in communication, decision-making and data integration
- Technological processes allowed simulations of morphological solutions and more accurate verification

Students arrived at final diagnosis results with extra value to initial pedagogical objectives:

- Increasing compromise with the learning process itself
- Autonomy to find theoretical background and improve critical reports
- Empowerment of spatial science as a learning tool instead of learning GIS as an operational software
- Self-management mapping with innovative thematic outputs

The use of GIS improved graphical results with identification of local impacts.

### **3rd Stage. Project Development: Master Plan of the Study Area**

We developed design work in a polygon of the Buenos Aires map, corresponding to several sectors of Palermo neighbourhood. It is a strategic and dynamic area that links the West-East and North-South axes, reached by ongoing transformations, mostly linked to public transport systems. These actions modified the boundaries of the main node Santa Fe - Juan B. Justo, opening the possibility of new land uses, where the presence of significant green spaces with heritage value was a key factor. It was necessary to evaluate transit articulations from a pedestrian urban experience.

We proposed a diagnosis of the urban area from a perspective of interdisciplinarity and technological innovation. It included analysis of urban morphology, georeferenced databases, project practices and strategies to communicate proposals and results. To build an interdisciplinary dynamic, Public Relations career was integrated in the last phase of the project.

Intervention area:

Within the polygon of diagnosis and analysis indicated, sub-sectors were detected with respect to the Masterplan, both at the building level as well as infrastructure and landscape.

Possible programs were defined regarding:

- Responses to demands arising from the analysis of the site;

- Mixture uses to ensure a continuous animation of places to intervene;
- Commercial activities concentrated on the main transport axes;
- Situations of networks transfer of complex transport;
- Park and urban green spaces that are not contained or peripheral to the intervention areas.

Project stages:

- Analysis and diagnosis
- Detection of intervention area
- Detection of posibles programs
- Morphological proposal
- Masterplan

Some basic problems were proposed to be solved within the framework of the urban public space, which were added to other situations detected by students:

- Pragmatic, reflective and performative interaction spaces;
- Interaction programs designed to regulate and prolong the use of space;
- Actors positioning: operators, strategic observers or designers;
- Effective articulation of existing green spaces with infrastructure networks, integrating the concept of urban landscape.

The results led to the development of a Masterplan that proposed possible answers to the detected problems.

#### **4th Stage. Communication strategy and social acceptability**

Based on a problem matrix, students of Public Relations established the position that the organization should adopt, elaborated key messages and considered the audiences involved in each case.

Assessment of emerging and ongoing issues:

- Partial and total closure of commercial premises: traders will feel affected by works, with negative consequences such as a decrease in income and customers
- Vehicle congestion: residents and people who circulate in the area start to worry about the problems generated in traffic
- Modification and reorganization of bus stops: public transport companies must modify the stops in the sidewalks and streets affected by the constructions

Latent issues:

- Changes in bus stops
- Disturbing noises

- Sidewalk reduction
- Reduction of pedestrian traffic

## **FINDINGS AND EXPECTED OUTCOMES**

We organized the main conclusions and results in three groups, where different actors verified the learning process evolution and PBL methodology.

The first group was defined by:

- Pedagogical achievements in interactive planning between different study areas
- Increase of student's responsibility and self-assessment about their own learning
- Unstructured problem simulation allowed free investigation with wider analysis axes, compared with previous traditional experiences:
- Integrated learning from a wider range of disciplines, including other Schools in the same University.

Secondly, we pointed out evaluations referred to:

- Staff training with more didactical tools and a conscious methodology over practices that were taken informally in previous years
- PBL as integrated and transversal curricular sequence
- Transversal teaching processes, more horizontal than in traditional procedures, caused by the change of roles towards the idea of teachers as moderators

Finally, it was considered an evolution:

- The institutional decision to involve external actors produced a positive evolution in the whole learning process.
- The academic exchange with Local Government Agency and experts drove the experience to sustainable and realistic projects, with future application.

Figure 3 and 4 exposes the project result contribution to CityLAB Final Conference - Bogotá.

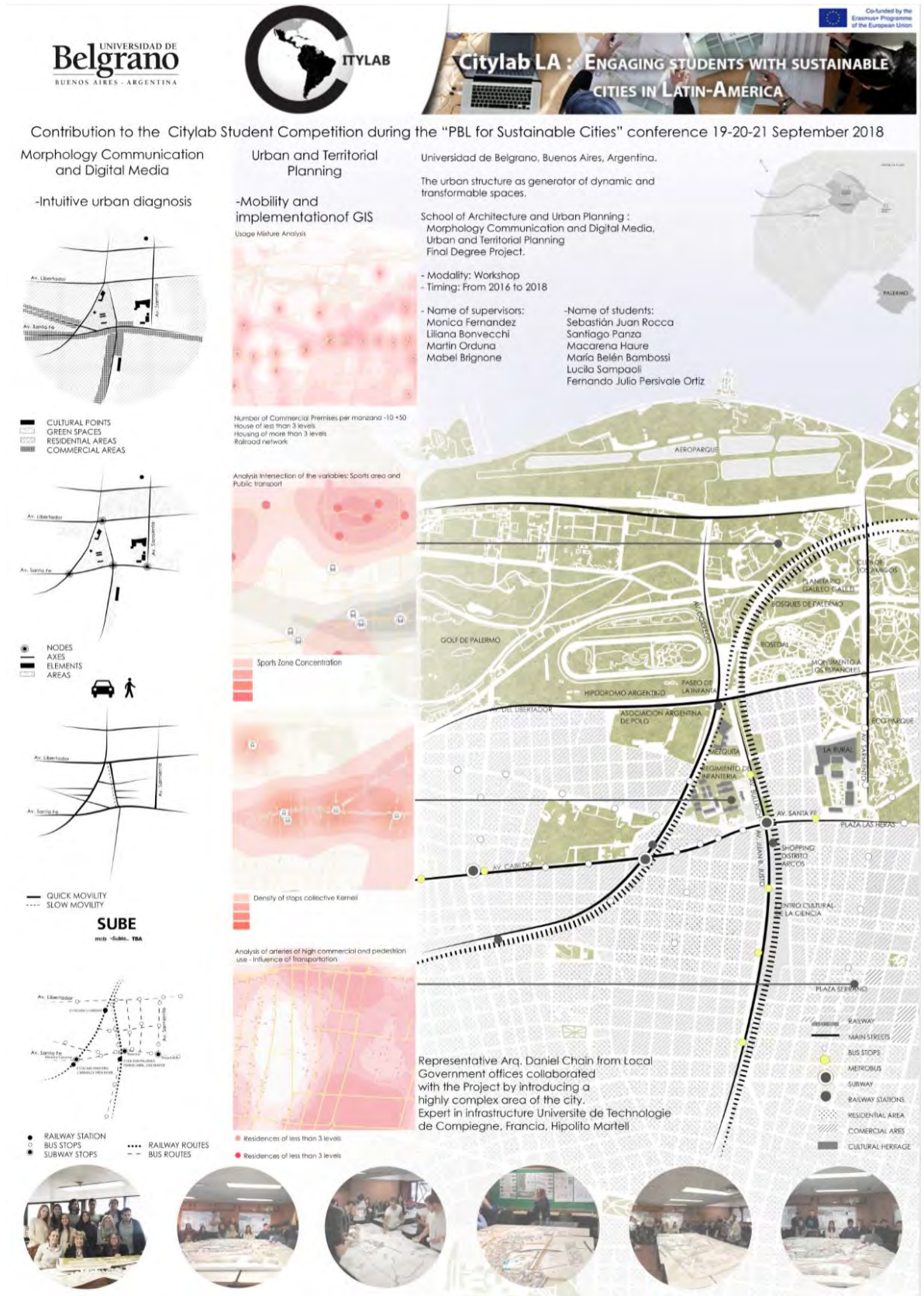


Fig.4a: Results Project elaborated by students for CityLab Final Conference contribution





Fig.4b: Results Project elaborated by students for CityLab Final Conference contribution

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